2013
FROM
POLE
TO
POLE

26th INTERNATIONAL CARTOGRAPHIC CONFERENCE

August 25 – 30, 2013 • Dresden | Germany

PROCEEDINGS

ICA
ACI

DGfK

www.icc2013.org

Edited by Manfred F. Buchroithner representing an editorial group of
Buchroithner, Manfred F.; Prechtel, Nikolas; Burghardt, Dirk; Pippig, Karsten; Schröter, Benjamin
on behalf of the International Cartographic Association. Dresden, Germany, August 2013.

Please use the search function of Acrobat Reader to find names/titles.

Imprint

This work is a compilation of contributions to the ICC Conference 2013 at Dresden. All contents of these contributions reflect the opinions and the state of knowledge of the authors. Neither the International Cartographic Association nor any other person or body, which has been involved with the compilation, production, or distribution of these proceedings to the conference participants assumes liability for the contents.

ISBN 978-1-907075-06-3

Preface

Dear colleagues from all over the world,

In 2007 Moscow hosted the 23rd International Cartographic Conference (ICC), followed by Santiago de Chile and Paris in 2009 and 2011. In two years the 27th ICC will be held in Rio de Janeiro and subsequently in 2017 in Washington DC. So, big global megacities have been and will be host to these biannual cartographic world congresses. Thus, one may be surprised that in 2013 a comparatively small place like Dresden with merely half a million inhabitants has been selected by the Executive Committee of the International Cartographic Association to organise this year's ICC.

The reasons for that may be manyfold. To begin with, the setting: Dresden boasts a significant quantity of world-class art treasures and can in this respect cope with places like Venice or Florence but also with cities like Athens, London, Paris, Moscow, Berlin, or Rome. In fact, between Italy and the Electoral Court in Dresden have always been close cultural ties. Giacomo Casanova's mother was actress at the Court Theatre, his brother Director of the Art Academy, and Casanova himself stayed many months in Dresden, finally concluding his life in a Bohemian castle near Dresden. The most famous panoramic veduta of Dresden e.g. stems from the Italian painter Bernardo Bellotto (1722–1780), called Canaletto. Dresden is also frequently referred to as “Florence of the North”.

Further, Dresden is located at the doorstep of the Saxon Switzerland National Park with its unique sandstone cliff- and-spire landscape, a natural gem that also served as the cradle of modern rock climbing which started its triumphal march from here via Yosemite Valley, California, all over the world. It attracts top rock athletes and tourists from all over the world.

Finally, the local organisers also conceive the assignment of the 26th ICC to Dresden also as a recognition of the considerable achievements in both cartographic research and academic education in Dresden. Several developments in our scientific discipline either originate from TU Dresden or have been significantly driven forth here. This is why no less a figure than Ferjan Ormeling Jr. attributed Dresden to the Great Schools of Cartography. During the 2013 ICC you might take the chance to personally verify this either in the fabulous International Congress Center Dresden at the banks of River Elbe or at the Institute for Cartography of Technische Universität Dresden.

For us from the LOC this year's International Cartographic Conference is one more gemstone in the almost 60-year long history of University Cartography in Dresden.

Welcome in Dresden! Enjoy, professionally and privately. You will be amply rewarded in both respects.

M. Buchroithner.

Manfred F. Buchroithner

Content

Content

PLENARY

Session KN-1

Web Maps, Story Maps and Trends in Underlying Geospatial Technologies

Monday, 26 August, 2013

14:00 - 14:45

KN-1 | **Web Maps, Story Maps and Trends in Underlying Geospatial Technologies** (#1502)

J. Dangermond
esri,United States

No abstract or full paper available.

ORAL

Session S1-A

Geovisual Analytics

Monday, 26 August, 2013

14:45 - 16:00

1A.1 | **Visual Analysis of Lightning Data Using Space-Time-Cube** (#966)

S. Peters[1], H. - D. Betz[2], L. Meng[1]

[1]Technical University Munich, Cartography LfK, 81371, Germany; [2]nowcast GmbH, München, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 165-176

This paper describes a framework for a visual analysis of lightning data described by 3D coordinates and the precise occurrence time. First lightning cells are detected and tracked. After that we developed a GUI (interactive graphic user interface) in order to enable the visual exploration of movement patterns and other characteristics of lightning cells. In particular we present different visual concepts for the dynamic lightning cells and tracks within a Space-Time-Cube and a 3D view. Furthermore a statistical analysis is presented. The developed GUI which aims to support decision making includes the visual and statistical representation of cell features as centroid, extension, density, size etc., within a specific temporal and spatial range of interest.

1A.2 | **Visual Discovery of Synchronization in Weather Data at Multiple Temporal Resolutions** (#1257)

X. Wu, R. Zurita-Milla, M. - J. Kraak

University of Twente, Geo-Information Processing, Enschede, Netherlands

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 247

Analyzing spatio-temporal weather patterns is fundamental to better understand the system Earth. Such patterns depend on the spatial and temporal resolution of the available data. Here, we study a particular spatio-temporal pattern, namely synchronization, and how this is affected by different temporal resolutions and temporal heterogeneity. Twenty years of daily temperature data collected in 28 Dutch meteorological stations are used as case study. Given the complexity of the analysis, we propose a geovisual analytic approach based on self-organizing maps (SOMs). This approach allows exploring the data from two perspectives: (1) station-based, in which spatially synchronous weather stations are grouped into clusters; (2) year-based, in which temporal synchronization is analyzed using a calendar year as basic unit and similar years are clustered. Clusters are identified using the SOM U-matrices and maps. Next, the spatial distribution of synchronous stations is displayed in the geographic space. Trend plots are used to illustrate trends in every cluster and the temperatures of stations and years are compared with the corresponding cluster representative values to identify anomalies in the temperature records. The analysis is repeated at daily, weekly and monthly resolutions to study the effects of different temporal resolutions on synchronization. Also daily spatial synchronization results for all years with those for groups of daily synchronous years are analyzed to study the effects of temporal heterogeneity. Results show that synchronization results are different at different temporal resolutions. Monthly results are the most stable ones both in station-based and year-based. It is also observed that spatial synchronization results are simplified when considering temporal heterogeneity.

1A.3 | **Geovisual Analytics for Maritime Surveillance: Proposing the Most Suitable Methods for the Users** (#455)

G. Vatin, A. Napoli
Mines ParisTech, CRC, Sophia Antipolis, France

A full-length version is available and can be opened here:

_extendedAbstract\247_proceeding.*

Maritime safety and security demand for a constant surveillance of the traffic state: several human actors are in charge of this control. In order to be more efficient, information systems such as Maritime Surveillance Systems are developed to provide both a general overview of the sea traffic and accurate details. This information describes the present or past states and travels of vessels. These information systems and tools intend to improve existing maritime surveillance systems by detecting abnormal behaviours at sea, and helping human operators to make decisions. Potential risks alerts, suspicious vessels and description of the situation should be managed. Actual research allows two major types of improvements: on the one hand, semi-automatic or automatic methodologies can be applied to maritime state analysis, such as data-mining, Spatial OLAP, or even the use of experts' knowledge to detect anomalies in the data; on the other hand, visualization methods can be used to include the human actors in the process of anomalies detection. The role of visualization and visual analytics has shown that these methods improve the use of surveillance systems by handling big sets of heterogeneous data and making knowledge discovery easier to human operators. Indeed, a better synthesis of the data and more effective visual tools can improve situation awareness. By including data with geographic attributes and maps, the fields of geovisualization and geovisual analytics are the main subject of our investigation. Previous works in the field of traffic surveillance and geovisual analytics, led by other laboratories, ended up in the development of visualisation interfaces to analyse data and detect abnormal behaviours. But all works had similar discussion about these prototypes: they were very specific tools for specific needs or persons, and not well adapted to all people who have a role in control. The visualization methods and the needs of controllers are very specific, according to the situation that have to face. Therefore, there cannot be a single solution for modelling, visualizing and analysing maritime data. Moreover the profile of the end user would have a major impact on how he would understand and manipulate visual analytics. An operator, a data analyst and a scientific researcher do not have the same knowledge about statistics and computer graphics: they will not feel as comfortable with visual analytics, though visualization should make their tasks easier. In order to deal with as many actors as possible and propose the most suitable visualization tools for their needs and their knowledge, we propose a methodology for guiding the selection of (geo-)visual analytics methods. Two modules have to be distinguished: (1) a knowledge base for geovisual analytics, modelling the contribution of several methods in data exploration or communication; (2) a knowledge base for risk management explaining what is the information to look for, the analysis to lead and the needs of each actors. According to the current situation, the available data and the user's profile, an expert system composed of the two previous knowledge bases would propose the most suitable solution for visualisation and visual analytics to the user. An interactive interface would be used to respect the principles of simplicity of use and complementarity between maps, graphs and tables.

1A.4 | **Detail and Integrated Representation of Spatial Relations** (#957)

<u>C. Wu</u>, X. Chen
wenyuan road 1,nanjing,Nanjing Normal University, College of Geographical science, China

A full-length version is available and can be opened here:

_extendedAbstract\4_proceeding.*

ORAL

Session S1-B

Cartographic Design Process

Monday, 26 August, 2013

14:45 - 16:00

1B.1 | **Guidelines for Consistently Readable Topographic Vectors and Labels With Toggling Backgrounds** (#848)

P. Raposo, C. A. Brewer
Penn State University, Department of Geography, University Park, United States

A full-length version is available and can be opened here:

_extendedAbstract\349_proceeding.*

A typical feature of interactive maps is the ability to toggle layers on and off. This functionality is now included in United States Geological Survey (USGS) "US Topo" 1:24,000 maps served in GeoPDF format. There has been little research in cartography on how vector and label symbols visually interact with varied, toggled backgrounds, despite this being a common scenario. While one effective strategy is to use different symbols for different backgrounds, this may not always be possible (e.g., mashups with unalterable service layers) or desirable. Further, layered interactive maps such as US Topo need to be graphically robust across diverse viewing environments (e.g., print, monitor and mobile screens). We present strategies used to develop vector and label designs for US Topo that maintain readability with fixed symbology across all possible layer toggle permutations. We generalize these strategies to provide a set of guidelines for symbolization in multi-layer interactive mapping environments. Symbols may fail against backgrounds when their hues or color lightness levels match the immediately local background too closely, or when their shape is indistinguishable from shapes seen in the background. Strategies for legibility among toggling layers include i) deliberate use of simultaneous contrast, ii) multi-band text halos, iii), transparency, iv) strategic hue and lightness selection, v) strategic sequencing of the layer strata, and vi) use of classical elements such as road casings and polygon borders. While typically complicating design, simultaneous contrast can ensure vectors remain visible over base maps with high graphical variation, such as orthoimages. Our designs use this in the choice of gray value used for roads: the shade used appears darker when seen over bare white, hill shade and contours, but lighter over land cover and orthoimagery, contrasting distinctly in each case. Alternating dark and light dashes are used for unpaved roads so that, given certain backgrounds, either dash is noticed by simultaneous contrast (Figure 1). Similarly, streams use subtly alternating blues along the line to remain prominent. We use multiple thin bands of grading color to maximize the robustness and aesthetic appeal of text halos. Darkest bands are those closest to letter forms when letters are drawn in light colors, and lightest bands are closest when letters are dark (Figure 2). This ensures legibility and provides a simultaneous contrast effect allowing text to visually "blend" with modulating backgrounds, thereby minimizing a forced appearance. Transparency is used, notably on roads and hydrographic areas. This allows some perception of underlying features, such as orthoimagery, even though these may be overlaid by toggling. Transparent gray roads allow visual interaction with underlying raster land cover, where built-up areas are symbolized in colors trending toward white in a design decision reinforcing roads. Strategic hue selections and layer sequencing are essential to ensuring legibility. Contours in our design are light orange-red, a hue unused in other layers and unlikely to appear in orthoimagery. Terrain shading is included below human features (e.g., roads), but over contours, in part to ensure a combination of roads, contours and hill shading remains legible by abating the contours. Finally, traditional elements such as road casings and polygon borders make vector symbols robust against toggled backgrounds by diversifying the hues and lightness levels in the symbol, and by delineating the feature, making color and shape matches with backgrounds less likely. Readability is critical to US Topo, particularly since the maps service a diverse user base with diverse viewing environments. The guidelines discussed here have relevance to topographic maps and mashups, where unalterable layers impose constraints which can be successfully navigated with appropriate design decisions.

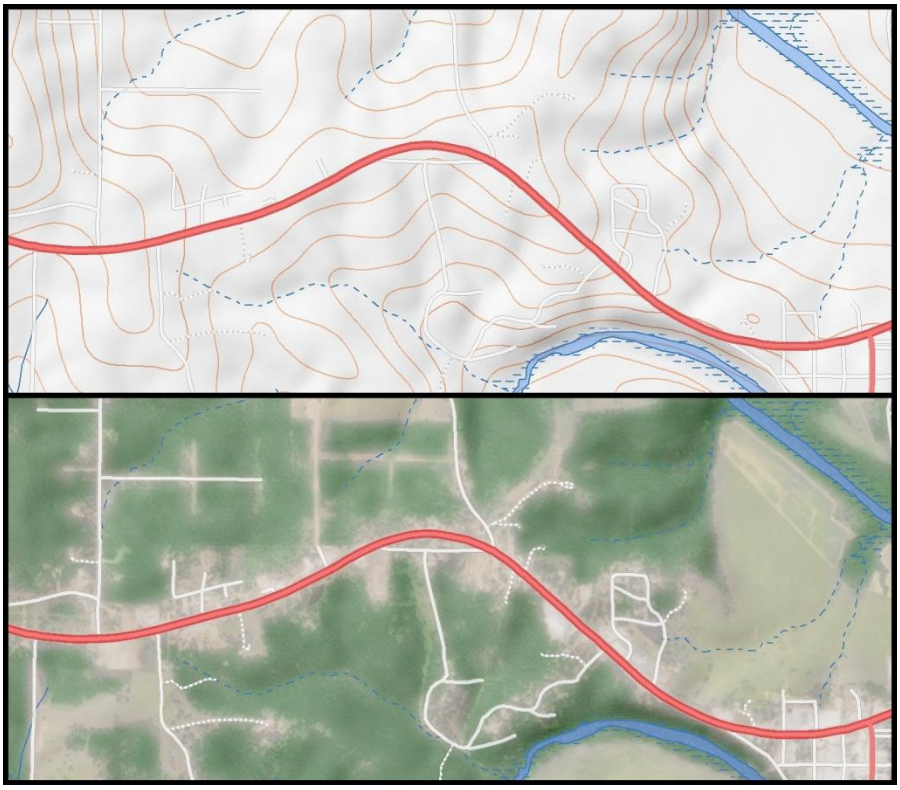


Figure 1:
Simultaneous constrast in road symbology. Road symbolization is unchanged across the two images.

Figure 2:
Multi-band text halos.

1B.2 | **Ordnance Survey's cartographic design principles: An approach to promoting good map design** (#1101)

C. Glynn, C. Wesson
Ordnance Survey, Cartographic Design & Development, Southampton, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\272_proceeding.*

As Great Britain's national mapping agency, Ordnance Survey has more than 220 years of experience in map making. We have various core skill sets and whilst many organisations and individuals rely on us to provide accurate and up-to-date geographic data, it is our cartography for which we are recognised globally as a centre of excellence. As the team responsible for cartographic design at Ordnance Survey, we have created a set of principles that we believe promote good map design at a time when cartography is arguably more important than ever. They are 'what works best for us' but are also intended as a useful guide for anybody making a map, from Ordnance Survey customers to budding neo-cartographers. It is certainly not our intention to lecture others on what is right or wrong. The purpose of this paper is to offer some useful guidelines that we believe are relevant to map design and in many cases will stimulate better cartography. Whilst a boom in the open source industry has led to a plethora of freely available geodata and supporting tools, the usage of location-based services has also grown rapidly in recent years in correspondence with the advances in web and mobile technologies. These developments combined have led to more people than ever before delving into the world of cartography as maps are widely adopted as a form of data visualisation by people who may not come from a traditional mapping background. Quite often you see a good idea that is let down by poor application of even the most basic cartographic techniques. As a community living in the open-era, we must give today's map makers the tools they need to add good cartographic design to their overall user experience. Maps come in many forms, from simple basemaps to complex aeronautical charts; our principles are designed as such that they can be applied to any. They cover the fundamental aspects of what makes a map successful in communicating its intended message. This paper will introduce our principles – which are documented and shared for the first time – and explain their importance in achieving good map design. We will also provide visual examples of each principle applied to one of our own maps. We encourage and look forward to receiving the feedback and thoughts of our fellow professionals in particular on how effective the principles are outside of Ordnance Survey.

1B.3 | **Outlier highlighting for spatio-temporal data visualization** (#447)

U. Pyysalo, J. Oksanen
Finnish Geodetic Institute, Geoinformatics and Cartography, Masala, Finland

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 165-171

This paper presents a comparison of visual highlighting methods, which are applied to spatio-temporal data to support analytical reasoning based on situation awareness maps. In our work the highlighting is seen as a method for visual analytics to draw visual attention to particular observations in a map interface without mouseover or other interaction by the user. The case study uses air traffic observations around the Baltic Sea for a 12 hour period of time. These observations are illustrated on top of the background map with three layers, namely the base map, the thematic raster layer and the symbol layer. The map design, which was produced during the study, aimed to emphasise the visual hierarchy of these layers. Some of the air traffic observations were outliers for the reason that they are flying in an unexpected location, flying at an unusual speed or elevation. In visualisation experiments they are lifted in the hierarchy by highlighting.
The detailed study objectives were to compare highlighting methods and to study whether the quality and the quantity of the outlier could be communicated by the highlighting method. The comparison of methods was carried out by setting up a user survey. The paper summarises the answers to the questionnaire and finishes with an analysis and discussion of the highlighting challenges.

1B.4 | **Partial Automation of the Cartographic Design Process** (#558)

R. Smith

Texas A&M University - Corpus Christi, School of Engineering and Computing Sciences, United States

A full-length version is available and can be opened here:

_extendedAbstract\262_proceeding.*

Over the past thirty years, a revolution, spurred by technological innovation and driven by the importance placed on spatial analysis, has prompted a paradigm shift in the mapping world. Individuals once unable to participate in the map making process find themselves with the technology, if not the cartographic knowledge, to map whatever phenomena they desire. With this democratization of mapping comes a larger community of map makers and increased production and consumption of poorly designed maps. An enlarged map making community, coupled with an increase in the consumption of maps, amplifies the possibility for the consumption of poorly designed maps and the public perception of what a well-designed map is, thus, creating a positive feedback loop reducing the quality of maps that will be created in the future. To introduce negative feedback, map makers must be educated in cartography and cartographic design; however, many barriers exist in accomplishing this. The academy is not only at fault for failing to provide education on cartographic principles. Geospatial software companies must share the burden of blame and move to remove the barriers for training users in cartographic design principles. Bad workers can blame their tools, but if the workers are cartographically ignorant, then the software companies providing the tools to the workers should take some responsibility to help train them. A software system has recently been created that automatically chooses the best symbols for a general reference map. This system relies on an expert system and data mining, to analyze and store vast amounts of information about traditional cartographic knowledge and structure of commonly used geospatial information, both of which are utilized to create a map. Without user intervention, the software markedly increases the cartographic quality of the map. This software system shows much initial promise in achieving the partial automation of the cartographic design process. With additional research, the software will be improved, including additional cartographic knowledge, development of advanced algorithms to automatically identify the theme of a data set, and deployment of this software for use by the public; thereby disrupting the positive feedback loop of decreased cartographic design.

ORAL

Session S1-C

Cartography in Art

Monday, 26 August, 2013

14:45 - 16:00

1C.1 | **Paper Maps Go Under the Knife: The Work of Three Contemporary Map Collage Artists** (#572)

J. Mersey

University of Guelph, Geography, Canada

Beginning with the Surrealism movement in the 1920s, artists have re-imagined and recycled everyday objects to express their visions and aesthetics in works of art. The use of maps in the artistic process has flourished since the 1960s and in the last decade a significant literature in the field of cartography has explored this trend. Scholars including Harmon (2009) and Wood (2010) describe the logical appeal of the map as an artistic medium; maps have an intricate graphic vocabulary and evoke an inherent authority that can be exploited by the artist. They are familiar, ubiquitous, and are designed to communicate at both the individual and collective level. Their structured representation of the world invites challenging, and artists have proved extremely resourceful in doing so. This presentation focuses on the map collage, and examines the work of three contemporary map collage artists – Matthew Cusick, Joao Machado and Nancy Goodman Lawrence. Each artist develops a unique relationship between paper maps and their art, incorporating not only the graphic lines, colors and textures of maps but also the maps' formal knowledge of place, boundaries and topography.

Matthew Cusick is a master of creating compelling images of energy and movement, perhaps most apparent in his highly detailed series of *Wave* collages. Here, the power of the map is transformed into the power of the sea. The images are over-sized, surprisingly realistic, and mesmerizing. The cartographer's original application of bathymetric tints on ocean charts is perfectly translated to the artist's rendering of massive foam-crested breakers and pounding surf. Where possible, Cusick retains original map boundaries, carefully cutting along contours, coasts and political borders to shape a new pictorial world. Trained in fine arts at The Cooper Union in New York, his works resemble paintings but with the depth, texture, and palette of the map. Born in Rio de Janeiro, Brazilian artist Joao Machado spent much of his early life in Paris, and later studied fine art in New York and Los Angeles. Machado creates in a wide range of mediums, including sculpture, woodcut and film as well as collage. His map collages feature people usually engaged in everyday activities, and his engaging narratives are told with humour and spontaneity. Machado layers map piece upon map piece to build up an image that almost appears like magic from the underlying map patterns, colours and lines. He strives to utilize maps of the same geographic region as the scene and people he is creating, never adding any paint or linework to the image. Trained in fine art at UCLA, Nancy Lawrence Goodman is an American artist who has been working in collage for over 15 years. Apart from an abstract series based on concentric circles, Goodman's map collages depict portraits of friends, family and pets. Reminiscent of Hockney paintings, the settings are candid and comfortable, and her subjects address the viewer as if posing for a photograph. Goodman's collages are, in fact, often generated from photographs. Goodman begins with a line drawing on paper and proceeds to fill in shapes of faces, carpets, tails and floorboards with bits of countries, oceans and roads, in an almost "paint-by-number" technique. All three artists have established an enthusiastic following and their works have appeared in magazines, art books, book covers, calendars and art prints. They have a significant web presence and online bloggers love these map collages. The symbiosis of art and map clearly fascinates; their viewing draws us in and promotes an active and intimate processing of place and space. We see familiar names and geography and are reminded of our own experiences and travels, yet the cartographer's representation of the world is questioned and reconfigured into a different narrative. The result invites us to explore and experience geography in a new, personal and fascinating way.

1C.2 | **Zen and the art of cartography** (#869)

K. Field, D. Demaj

Esri Inc, Redlands, United States

In answer to the question ‘what do you do’? cartographers have gone from nervously explaining that yes, there are people who make maps to reluctantly admitting “yes, it’s like Google Maps”. Cartography is now cool…but it’s not cartographers that are making it cool. Instead, cartographers continue to assert ‘principles’ and ‘traditions’ as core to effective map-making but the message is getting lost. It’s time to re-focus and re-imagine. One of the things that has bothered us over the last few years is the role of design in map-making. We see very little of what we would call good design and very few people who either have the ability or enthusiasm to value design as a key component in the map-making process. We believe this is to the detriment of the quality and usefulness of maps and this is one of the reasons that the International Cartographic Association supported the creation of a new Commission on Map Design precisely to make design explicit. In this paper we want to think a little about how we might re-imagine design and the art of (or in) cartography in a way that might be more accessible to the growing world of map-makers. We want to think a little about the juxtaposition of the art and science of cartography and the white elephant in the room…technology. Cartography is about purposeful design, combining aesthetics and visuals with an understanding of data and how people behave when viewing a map. Instead of trying to assert the importance of art as a component of cartography to map-makers unwilling to listen, maybe there is value in seeing cartography as an art in itself. Using examples of ‘great maps’ from an original survey we assert that art is not a part of cartography that we try to marry with science and technology. Science exists in tools and data that we use to make maps but art is what the artist does with these raw materials; you don’t have to be a cartographer to make a great map. Cartography is about creating something; art is in the doing and poor maps are not a function of failure to put art in cartography, they’re because the map is not treated as an artistic endeavour. The survey sought to collate a set of examplar maps that the cartographic profession could point to; that illustrated the zenith of cartographic excellence. The approach was not to construct a contrived ‘top 10’, but a set of three examples in each of thirteen different map categories. The results provided a fascinating mix of historical and contemporary examples; some obvious and some less so but we explored the design in each and explained why they exhibit high standards of cartography. The survey also revealed that the idea that excellence in cartography can only be achieved by those with a formal training is a fallacy. The democratisation of map-making is possibly not as new as we might imagine since maps have always been made by non cartographers as the survey reveals. So cartography is not Google Maps, mashing up geotagged data, rendering tiles or GIS. Cartography is an art: the art of making a map through thoughtful design, no matter how they are built or delivered or by whom they are made. Some artists produce masterpieces, some paint by numbers but every map needs a human artist and key to encouraging map-makers to value design is to re-imagine how we talk, demonstrate and teach about cartography. Further, the use of classics in cartography can go some way to demonstrating how we see our own profession and what we see as representative of our best work.

1C.3 | **A Cinematographic Cartography of the Imaginary Montreal** (#758)

C. Sébastien[1], D. Naud[2], N. - C. Taien[3], Y. Mengqian[1]

[1]Concordia University, Geography, Planning & Environment, Montreal, Canada; [2]Université de Montréal, Géographie, Canada; [3]Concordia University, Interdisciplinary Studies in Society and Culture, Montreal, Canada

A full-length version is available and can be opened here:

_extendedAbstract\307_proceeding.*

Although the recognition of the importance of films as a unique source of geographic information has grown since the 1990s, very few attempts have been made to map these cinematographic places in a systematic way. Mapping cinematographic narratives requires overcoming two major challenges. First, it calls for the transformation of complex audiovisual material into geographic data, which is a recurrent issue in geography. Once the narrative is broken down into geographic pieces, these pieces need to be mapped properly. The second major challenge faced by narrative cartography is how to represent this often amorphous geographic data in relevant ways. In this paper we first present a methodology that has been developed over the years to extract geographic data from movies. Secondly we present a geoweb application that has been designed to map the different dimensions associated with cinematographic narratives. Both the methodology and the geoweb application have been applied to map the cinematographic structure of a selection of 15 films taking place in the city of Montreal (Canada). The emerging cinematographic structure of Montreal is then presented and discussed in the third part of the paper. Finally, we conclude by arguing that mapping narratives can have multiple applications to help better understand the geographic structure of a wide variety of domains that range from fictional stories to more personal and collective memories.

1C.4 | **Beck to the Future: time to leave it alone** (#371)

W. Cartwright[1], K. Field[2]

[1]RMIT University, Mathematical and Geospatial Sciences, Melbourne, Australia; [2]Esri Inc., Redlands, United States

A full-length version is available and can be opened here:

_extendedAbstract\439_proceeding.*

When one thinks of a map depicting London, generally the image that appears is of that of the map designed by Henry (Harry) Beck. It has become a design icon despite the fact that it eschews topography (other than the River Thames) and focuses on the simplified depiction of the topology of the Underground rail network. Beck's map, designed in 1931, and first made available to London commuters in 1933, has become the image of the geography of London and, generally, the mental map that defines how London 'works'. Station names have become synonymous with the aboveground landscape and the network is such that most of London's landmarks can be readily located through the map. Navigating between them is a simple process and while the city above is a socioeconomic and cultural soup, the simplicity of the map brings a sense of order, structure and sensibility. It is a perfect counterpoint to the chaos at street level. In cartographic terms, as a communication tool, Beck's map does work. It is an effective communicator of the London Underground train network and the distribution of stations and connections between one line and others. Whilst it is acknowledged that the geography of London is distorted, it still retains the status of 'the' map of London. The symbols are clear and well crafted; the composition and layout, though somewhat challenged by network changes since 1933, remains beautifully balanced; and the design has remained relatively unchanged over the last 80 years which creates stability in appearance and breeds confidence in its use. However, this paper asserts that Beck's map is over-used in myriad ways beyond the reason for its invention. The effect of such abuse has been to dilute its own place in cartographic history. There have been many official iterations that have not always successfully married Beck's design ideas with network changes; other metro maps have often tried to imitate but with mediocre success; and the map is perpetually used as a template for mimics and alternatives. The map has become a model for parody. We begin by providing a brief background of Beck and his London Underground map followed by an outline of the three principle ways in which Beck's ideas have been used. We then consider if, as previously stated, this map is a design icon or classic design and review the attributes that appear to make it cartographically functional. Once these elements have been established the paper further reviews how, even if the geography is depicted in a way that distorts the true geography of London, users really don't care, and they consume the map as a tool for moving about London, underground as they navigate between their overground destinations. We then specifically address the use and mis-use of Beck's design and focus on those who mimic and transform Beck's design as a vehicle for their own 'new' design. Through these mechanizations and manipulations of the 'pure' elements of Beck's design by others, it has suffered years of abuse and that has diluted its own place in cartography and design. Finally, we report on an online survey that was conducted to gauge the success of Beck-esque maps and diagrams. The results of the analysis of this survey, and the consideration of whether these contemporary 'new' designs, when compared to Beck's design, do provide a better representation of the London Underground and thus a better planning and navigation tool.

ORAL

Session S1-D

Earthquakes and Landslides

Monday, 26 August, 2013

14:45 - 16:00

1D.1 | **Finding the Way and Obtaining the Route Map Information to Go Back Home during a Natural Disaster: A Case of Greater Tokyo Metropolitan Area at the Time of the Great East Japan Earthquake** (#1366)

K. Ito[1], N. Ohmori[2], S. Aono[2], Y. Niwa[1], M. Kawama[1], C. Kawamata[1]

[1]*Tokyo University of Science, Architecture, Noda-shi, Japan;* [2]*The University of Tokyo, Urban Engineering, Bunkyo-ku, Japan*

A full-length version is available and can be opened here:

_extendedAbstract\354_proceeding.*

The Greater Tokyo Metropolitan Area has about 8 million regular rail commuters, whose average commuting time is more than 90 minutes a day. It had been estimated that a vast amount of people would have difficulty to return home after a strong earthquake, and some efforts have been made such as: publication of a walking map for finding the way home after an earthquake and a network of designated shops and restaurants to support those who walk home during a natural disaster with offering drinking water, restrooms, maps etc.

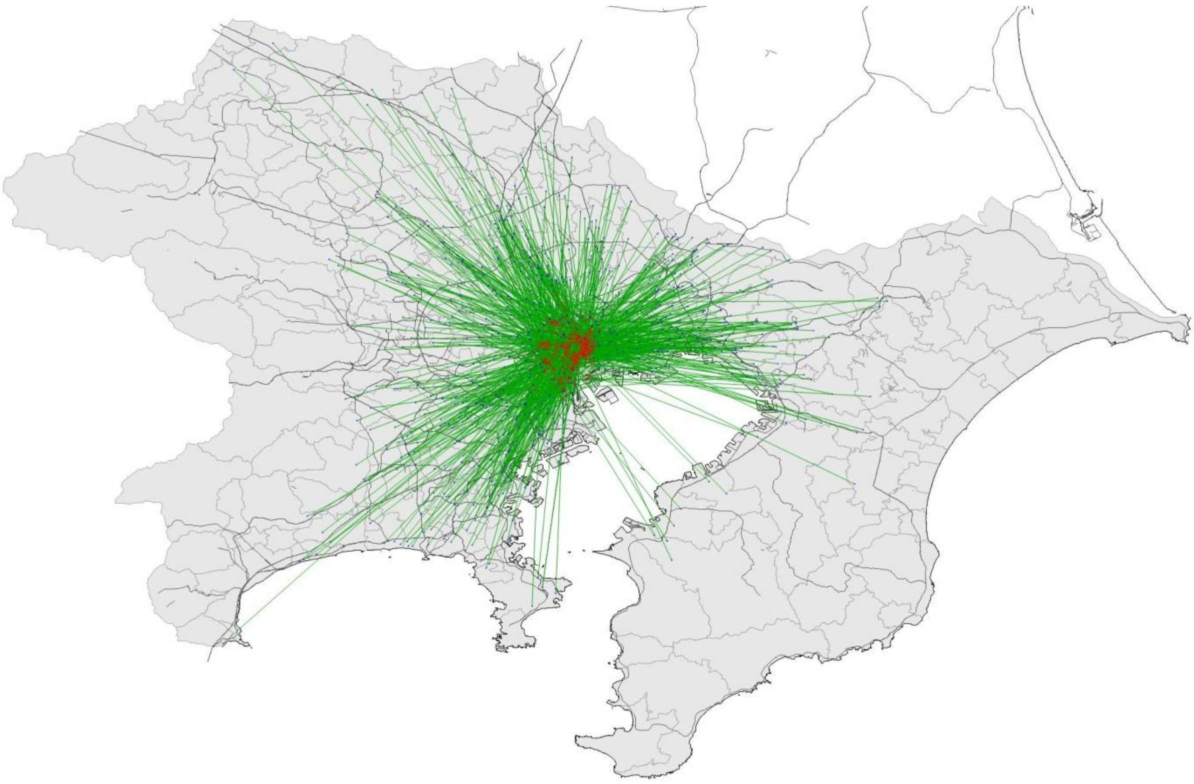
When a 9.0-magnitude earthquake hit north-east Japan at 2:46 p.m. on March 11, 2011, Tokyo also experienced strong tremors. Though human and physical damage was relatively modest, paralysis of the railway system stranded a vast amount of people actually in the Greater Tokyo Metropolitan Area.

The purpose of this study is to investigate what kind of difficulty the people have and how they obtain route map information when they go back home without regular transportation service and adequate information during a natural disaster.

This study questioned 978 individuals who were in the central area of Tokyo and away from home during the time of the earthquake. Questions consisted of each person's actions from the time of the earthquake to when they reached their home, with stop-off points en route being a primary concern.

Those who departed for home before 6 a.m. on March 12 took on average 440 minutes to go back home, while the others took on average 234 minutes. Individuals from the east part of Greater Tokyo took an especially longer time than the others. Those who spent more than 3 hours to go back home tended to obtain route map information at the visited facilities en route such as a train or subway station, a police box and a store.

Those who were in their office or school or their family or friend's home during the time of the earthquake (= individuals with a base) had relatively less difficulty than the others (= individuals without a base). Individuals without a base tended to have a stronger intention to go back home in the day, while individuals with a base tended to stay a night at their base to wait for the restoration of the public transportation service. The results of a multiple regression analysis for the individuals without a base shows that a distance between the place where they were at the time of the earthquake and their home and female significantly increase the action of obtaining route map information at visited facilities; age significantly decreases utilization of GPS and location based resources in their mobile device; and the length of time spent in going back home and female significantly increase the trouble of losing their way without map and age significantly decreases this kind of trouble. Ways of route map information delivery should be reexamined



The origin-destination:
The origin and destination of 978 individuals' going home activities after the Great East Japan Earthquake in the Greater Tokyo Metropolitan Area

1D.2 | **GIS-Based Landslide Susceptibility Mapping Using Remote Sensing Data and Machine Learning Methods** (#551)

X. Wu[1], F. Ren[2], R. Niu[1]

[1]China University of Geosciences, Institute of Geophysics and Geomatics, Wuhan, China; [2]Wuhan University, School of Resource and Environmental Science, China

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 319-334

In the Three Gorges of China, there are often landslide disasters, and the potential risk of landslides is tremendous. Thus, an efficient and accurate method of generating landslide susceptibility maps is very crucial to mitigate the loss of lives and properties caused by these landslides. This study presents a multidisciplinary approach to map landslide susceptibility on the Xietan Town of the Three Gorges, using slope units, intelligent models, geographic information system (GIS), and remote sensing data. Thirteen environmental factors, which have been extracted from 1:10,000-scale topographic maps, 1:50,000-scale geological maps, and HJ-1A satellite images with a spatial resolution of 30 m, were selected as predictor variables, including slope, aspect, curvature, slope unit altitude, engineering rock group, slope structure, distance from faults, land use, normalized difference vegetation index, reservoir water level, distance from drainage, catchment area, and catchment height. A two-class support vector machine (SVM) was trained and used to assess landslide susceptibility. Area under the curve was used to validate performance of the models. The results show that the two-class SVM outperforms the back propagation neural network in terms of both accuracy and generalization capacity, the area ratio being 0.9391 and approximately 90% of landslides were classified as high and very high landslide-prone areas.

1D.3 | **Landslide Susceptibility Mapping Along the National Road 32 of Vietnam Using GIS-Based J48 Decision Tree Classifier and Its Ensembles** (#470)

D. Tien Bui[1,2], C. T. Ho[3], I. Revhaug[1], B. Pradhan[4], D. Nguyen[2]

[1]Norwegian University of Life Sciences, Department of Mathematical Sciences and Technology, Aas, Norway; [2]Hanoi University of Mining and Geology, Faculty of Surveying and Mapping, Vietnam; [3]Vietnam Institute of Geo-sciences and Mineral Resources, Department of Tectonic and Geomorphology, Hanoi, Vietnam; [4]University Putra Malaysia, Department of Civil Engineering, Faculty of Engineering, Serdang, Malaysia

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 303-318

The main objective of this study is to compare the results of decision tree classifier and its ensembles for landslide susceptibility assessment along the National Road 32 of Vietnam. First, a landslide inventory map with 262 landslide locations was constructed using data from various sources that accounts for landslides that occurred during the last 20 years. Second, ten landslide conditioning factors (slope, aspect, relief amplitude, topographic wetness index, toposhape, distance to roads, distance to rivers, distance to faults, lithology, and rainfall) were prepared. Third, using decision tree and two ensemble techniques i.e. Bagging and AdaBoost, landslide susceptibility maps were constructed. Finally, the resultant landslide susceptibility maps were validated and compared using a validation dataset not used during the model building. The results show that the decision tree with Bagging ensemble technique have the highest prediction capability (90.6%), followed by the decision tree (87.8%) and the decision tree with AdaBoost (86.2%).

ORAL

Session S1-E

Social Mapping

Monday, 26 August, 2013

14:45 - 16:00

1E.1 | **Cultural Aspects of Cartographic Creation: Use of Mental Maps in Cross-cultural Research** (#152)

J. D. Bláha[1,2]

[1]J. E. Purkyne University in Ústí nad Labem, Department of Geography, Czech Republic; [2]Charles University in Prague, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\151_proceeding.*

In spite of the fact that the interdisciplinary theme of cultural aspects of cartographic creation was solved recently e.g. in J.B. Harley's and D. Woodward's project "History of Cartography", at present the issue has not been studied sufficiently in its complexity. The author of the paper, a cartographer and a cultural anthropologist at the same time, struggles for more complex approach. The theoretical introduction of the paper dealing with the map content, map stylistics and map language, in which maps show the greatest cultural differences. The map figures here in a role of the image of reality and visual manifestation of culture. Beside the language, as determinants of the human spatial perception and other categories related to the map creation could be mentioned the environment, the experiences and the society, in which an individual lives. Several examples of so-called cultural map styles, especially from Australia and Oceania, are introduced as well. In the next part of the paper, especially focused on the methodology, a method of cognitive maps, respectively mental maps of map users and map makers is discussed. Just these maps are suitable to explore the cultural particularities of cartographic creation. The final part of the paper presents the results of field research of mental maps of pupils, those from Czechia, from the countries of Western Europe (France, Switzerland etc.) and from the village Yawan (in Papua New Guinea). The paper brings an interesting mutual comparison of the map language as well as the map content of these maps. The issue of the cultural aspects of cartographic creation is a long-term author's interest of the user-participated perspective of cartography, in which a user of cartographic piece and his/her characteristics, the cultural origin including, plays an important role. Thank to the consideration of these user's specifics, the cartographers will be able to create such pieces that will be utilizable, not only of high-quality from the perspective of generally distinguished criteria.

1E.2 | **Participatory mapping as a tool for community empowerment – a case study of community engagement in Koffiekraal, South Africa.** (#969)

J. Pánek[1,2], A. C. Vlok[2]

[1]Palacky University in Olomouc, Department of Development Studies, Czech Republic; [2]University of South Africa, Department of Geography, Johannesburg, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\969_abstract.*

1E.3 | **Challenges in Mapping Traditional Knowledge in Canada's North** (#248)

D. R. F. Taylor

Carleton University, Geomatics & Cartographic Research Centre, Department of Geography and Environmental Studies, Ottawa, Canada

A multidisciplinary research team involving a number of disciplines including anthropology, sociology, music, English literature, geography, computer science, psychology, law and community members and organizations from a number of settlements in Canada's north is involved in creating cybercartographic atlases. These include the Atlas of Arctic Bay, The Kitkmeot Heritage Society's Place Names Atlas, the SIKU (sea ice) Atlas, the Places and Stories of the Gwich'in and others (http://gcrc.carleton.ca). This paper will describe the creation of these atlases and the challenges faced in mapping traditional knowledge. These include the technical challenges of creating input software to allow communities to become "map creators". Here, our team has created an innovative new software package called Nunaliit to facilitate input to the atlas by community members with little or no knowledge of this framework. The social processes by which the atlases are created are extremely important and are the key to ensuring sustainability over time. The paper will describe the approach we use including the important ethical and legal issues involved. These are not usually discussed in the cartographic literature.

ORAL

Session S1-F

Automated Data Quality Assessment

Monday, 26 August, 2013

14:45 - 16:00

1F.1 | **An automated geospatial datafilter to generateoptimal geographic information: a novel approach inspatial data mining** (#1327)

A. Hartmut, S. Silvija

University of Potsdam, Geoinformation Group, Department of Geography, Germany

A full-length version is available and can be opened here:

_extendedAbstract\99_proceeding.*

Geospatial information is gaining increasing importance as a valuable economic resource in the industry. This has triggered a sharp rise in demand of harmonised, uniform geographic data for a given, often interregional geographical coverage. While the amount of existing geospatial data generally exceeds the ability to access, process and use this mass data, geospatial data of a particular region, scale or quality might not readily be accessible or usable. For various reasons data acquisition for a particular application purpose is not an option. This leaves data mining the method of choice even if existing geospatial datasets for various reasons often turn out to be not good enough for a particular application. This problem can be solved by the development of a procedure that generates new optimally suited datasets for a given application from a number of existing suboptimal datasets of identical geographical coverage, topic and scale. This paper deals with the development, implementation and sample application of a software system for data fusion (DaFuS) that produces optimal geospatial data from existing vector datasets which can be customised to individual user and/or application requirements. It is shown that DaFuS generated datasets are superior in their geometrical and/or semantic quality to the imperfect source data making repeated data collection of identical or similar geodata for each new application unnecessary in most cases. The DaFuS systems contributes to reduce the heterogeneity and redundancy of geospatial data in massive geospatial databases and by this helps to promote costeffective geospatial data management.

1F.2 | **Variability of country names and identifiers in datasets – Reconciling practical and cultural perspectives** (#622)

L. Kostanski[1], S. - J. Farmer[2], R. Atkinson[3]

[1]Commonwealth Scientific and Industrial Research Organisation, Mathematics, Informatics and Statistics, Clayton, Australia; [2]Change Assembly, -, New York, United States; [3]Commonwealth Scientific and Industrial Research Organisation, Land and Water, Lucas Heights, Australia

There exist multiple versions and sources of country names and identifiers which are either managed as discreet indexes or embedded in other datasets. Forms of country names range from those in use by the countries themselves (endonyms) to externally used alternatives (exonyms), to various common abbreviations (e.g. USA) and codes (such as those in ISO 3166). Indexes are produced by a diversity of communities including United Nations agencies, Non-Government Organisations (NGOs- such as humanitarian relief or environmental assessment groups) and commercial enterprises (postal agencies, distribution companies). End users trying to reconcile such references include data scientists looking for trends across datasets; country analysts looking to compare their metrics against each other; companies trading in countries; communities trying to improve their development prospects; responders building indicator metrics as they go into a disaster zone; and, open data coders building humanitarian-focused applications. The most commonly encountered problems from the end-user perspective are the different mandates governing the creation of the indexes and associated Spatial Identifier Reference Datasets (SIRDs- datasets which either explicitly or implicitly contain place names or spatial identifiers for features); maintenance; and, the temporal natures of the available country name and associated second (and beyond) administrative level name SIRDs. The availability of unambiguous, ubiquitous country names for these stakeholders is important on many levels. Essentially, data availability is increasing rapidly and therefore handling is becoming more automated – where information is unable to be machine-matched more time is required for human processing- which in some cases where 'big data' is the focus, the original analysis task can become impossible to do in a manageable time. This paper explores two aspects of the propagation of country name SIRDs: development (cultural/qualitative) and usage (data management/quantitative). From a *development* perspective the fundamental question is asked of why , when country names can be considered one of the highest-order administrative categories for geospatial organization, there is a proliferation of 'official' country name SIRDs. Within the domain of *usage* the authors query how, in a digital age of 'big data' analytics and Spatial Data Infrastructures (SDIs), newly emerging technologies such as the Spatial Identifier Reference Framework (SIRF) can assist in reducing the ambiguity associated with multiple, heterogeneous country name SIRDs. Until now the preference of many agencies has been to homogenize geospatial information for 'ease of use' purposes- either through aggregating and de-duplicating existing SIDs or by disregarding competing information. SIRF is a system being developed by CSIRO using Linked Data mechanisms to support interoperability between heterogeneous geospatial information datasets and systems. SIRF harmonises disparate SIRDs through cross-walking and data linking methods, the benefits of which are outlined in detail by the authors. The framework system brings to the geospatial data management world, for the first time, the capability to streamline information integration processes whilst acknowledging the reality of multiple, competing SIRDs. This paper draws together both qualitative and quantitative understandings of why and how multiple country name forms exist. The authors propose methodologies for acknowledging the important cultural imperatives associated with country names whilst supporting machine processes for integration of data using alternate forms of country names.

1F.3 | **Large Scale Map Data Contents and End User Needs: Do they meet? – Case: City of Helsinki** (#301)

K. Ingberg
City of Helsinki, City Survey Department, Finland

A full-length version is available and can be opened here:

_extendedAbstract\301_abstract.*

1F.4 | **A Framework for the Automatic Geometric Repair of CityGML Models**

(#1433)

Z. Junqiao[1,2], J. Stoter[1], L. Hugo[1]

[1]Delft University of Technology, Department of GIS Technology, OTB Research Institute, Netherlands; [2]Tongji University, College of Surveying and Geo-Information, 200092, China

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 187-202

Three-dimensional (3D) city models based on the OGC CityGML standard have become increasingly available in the past few years. Although GIS applications call for standardized and geometric-topological rigorous 3D models, many existing visually convincing 3D city datasets show weak or invalid geometry. These defects prohibit the downstream applications of such models. As a result, intensive manual work of model repair has to be conducted which is complex and labour-intensive. Although model repair is already a popular research topic for CAD models and is becoming important in GIS, existing research either focuses on certain defects or on a particular geometric primitive. Therefore a framework that explores the full set of validation requirements and provides ways to repair a CityGML model according to these requirements is needed and proposed in this paper. First, the validity criterion of CityGML geometric model is defined, which guarantees both the rigorous geometry for analytical use and the flexible representation of geographic features. Then, a recursive repair framework aiming at obtaining a valid CityGML geometric model is presented. The geometric terms adopted in this paper are compliant with the ISO19107 standard. Future work will further implement the framework.

ORAL

Session S1-G

Eye Movement Analysis

Monday, 26 August, 2013

14:45 - 16:00

1G.1 | **Investigating dynamic variables with eye movement analysis** (#329)

V. Krassanakis, A. Lelli, I. - E. Lokka, V. Filippakopoulou, B. Nakos
National Technical University of Athens, Rural and Surveying Engineering, Zographos, Greece

A full-length version is available and can be opened here:

_extendedAbstract\130_proceeding.*

Cartographic symbolization is considered to be the most appropriate way to portray the geographical space on a spatial representation with a considerable level of abstraction. At the stage of map design cartographers have to choose the most efficient symbols from a huge variety of alternative options. The essential design elements for this process are the visual and dynamic variables in order to create either static or dynamic maps. The evaluation of these fundamental variables has a great impact on designing options. Moreover, the evaluation of their effectiveness is extremely important for map design. Experimental studies in cartographic research about the variables for map design bare many similarities to psychological experimentation related to visual search. In psychological experimentation studies, subjects are asked to search for a designated target in a visual scene with a specific feature among different distractors or to execute other tasks such as object counting and texture segregation. Visual search experimentation also examines the case of free viewing observation without specific task. The findings from psychological and human vision research can be of great influence in cartography. The application of said findings, however, requires the examination of actual map tasks' performance. The visual search can be measured with the use of two different methodologies. The first one is based on the speed and the accuracy of subject in identifying symbols; the second one measures eye movement recordings. In recent years, the use of the second above-mentioned methodology (also called eye tracking) has attracted interest in cartographic research and experimentation. It has so far been observed that fundamental metrics from eye movement measurements can reveal crucial results about the cognitive processes during map reading. The indication of places where map readers are most fixated offers cartographers the opportunity of an expedient design evaluation. The aim of the present study is to examine the joint function of the dynamic variables of duration and rate of change. In particular, the study focuses on the investigation of the optimal range of values in the dynamic variable of rate of change while the magnitude of changes is held constant and the variable of duration changes. 'Rate of change' is defined as the ratio of the magnitude of changes in locations or attributes to the duration of the scene. Therefore, changing the duration of the scene with a standard number of changes helps establish the optimal perceived values for rate of change. The experiment is designed based on eye movement analysis. The reaction of subjects is tested through eye movement recordings during free viewing conditions. Cartographic backgrounds with different levels of abstraction compose the visual scenes which become the stimuli of the experiment. In each stimulus only one change in location is depicted. Hence, the subjects perceive the map items which change location in map as moving objects. Literature on visual search establishes that the moving objects of a visual scene are detected immediately in a primary stage of vision. Accepting this fact as a starting point, the present study provides additional findings for the design of dynamic and interactive displays. Furthermore, enriched results from eye movement analysis demonstrate the importance of the performed methodology in cartographic experimentation.

1G.2 | **Commonalities and Differences in Eye Movement Behavior When Exploring Aerial and Terrestrial Scenesnes** (#1411)

S. Pannasch[1], J. Helmert[1], B. Hansen[2], A. Larson[3], L. Loschky[3]

[1]Technische Universitaet Dresden, Department of Psychology, Germany; [2]Colgate University, Department of Psychology, Hamilton, United States; [3]Kansas State University, Department of Psychology, Manhattan, United States

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 421-430

Eye movements can provide fast and precise insights into ongoing mechanisms of attention and information processing. In free exploration of natural scenes it has often been found that fixation durations increase over time, while saccade amplitudes decrease. This gaze behavior has been explained as a shift from ambient (global) to focal (local) processing as a means to efficiently understand different environments. In the present study, we analyzed eye movement behavior during the inspection of terrestrial and aerial views of real-world scene images. Our results show that the ambient to focal strategy is preserved across both perspectives. However, there are several perspective related differences: For aerial views, the first fixation duration is prolonged. Furthermore, fixation durations and saccade amplitudes are longer throughout the overall time of scene exploration. The temporal and spatial scanning of aerial views is less similar between observers as for terrestrial scenes. The observed differences in eye movement behavior when inspecting terrestrial and aerial views suggest an increased processing effort for visual information that deviates from our everyday experiences.

1G.3 | **Uncertainty Visualization: An Eye-Tracking study on spatial data quality**

(#813)

J. Brus, S. Popelka

Palacky University in Olomouc, Department of Geoinformatics, Czech Republic

A large number of visualization techniques lack results that would quantify their impact on decision-making processes. For this reason, individual visualization methods must be tested and their influence on decision-making processes quantified. Paper present an eye tracking study focused on uncertainty visualization. The whole experiment is framed from typology and techniques for visualisation of different categories of spatial data quality. We present a user study that evaluates the perception of uncertainty visualisation based on most commonly used techniques for displaying uncertainty in spatial data. The study uses data that were designed to represent the uncertainty connected with space, time and attribute components. Experiment was focused on intuitiveness of several visualisation techniques and also based on user preferences. Eye-tracking device records a position of an eye with sample frequency of 120Hz. From this dataset, number of eye-tracking metrics can be computed. From analyses of these metrics, and their relationship to predefined Areas of Interest (AOI), qualitative and quantitative evaluation of users strategy can be derived. Eye-tracking methods can help to provide information and data to assess effectiveness a deeper understanding of scanning strategies of the users. The principal objective of this work is the empirical study of theoretical concept of the uncertainty visualization regarding spatial data quality in the context of map-making processes within environmental studies. The results include description and an analysis of the observed eye-tracking data. Observed results may help to the development of rules for evaluation and the preparation of instructions for final presentation of the uncertainty factor in the form of a cartographic output and proof already accepted techniques empirically. Understanding and creating the empirically proved concept of correct uncertainty visualization provides a tool which contributes to better insights into the reality being visualized.

1G.4 | **Gestalt aspects for differentiating the representation of landmarks in virtual navigation** (#202)

M. Schmidt[1], L. Delazari[2]

[1]Universidade Federal de Uberlândia, Faculdade de Engenharia Civil, Brazil; [2]Universidade Federal do Paraná, Programa de PósGraduação em Ciências Geodésicas, Curitiba, Brazil

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 159-164

A current research area in cartography is the application of nonimmersive virtual reality (VR) to create riches cartographic representations in 3D. But the cartographic knowledge needed to build these representations is lacking and the consequences of this include misconceptions in map design that can inhibit or even impair the understanding of the representation. A common task in cartographic VR is virtual navigation supported by 3D topographical maps. This geographical task gathers different knowledge schema based on the selection of some features to work as landmarks. In VR there is a need for adaptation of cartographic representations to improve the cartographic communication. Therefore the strategy adopted in this research uses aspects of Gestalt to direct the user's selective attention to some features which will act as landmarks. To evaluate this proposition we compare the sketch maps from 3D and conventional 2D topographic maps made by 43 volunteers, and identify which features can be used as landmarks and how they were drawn in the sketch maps. The assessment of the number of landmarks identified by the user, their topology and orientation and how the symbols were drawn highlights the success of this proposal for 3D topographical maps for virtual navigation.

ORAL

Session S1-H

EuroSDR/COST/ ICA

Monday, 26 August, 2013

14:45 - 16:00

1H.1 | **Mapping and the Citizen Sensor: COST Action TD1202** (#1479)

G. Foody

University of Nottingham, Geographical Information Science, Great Britain

No abstract or full paper available.

1H.2 | **Managing and Acquiring Volunteered Geographic Information** (#1480)

L. See

International Institute for Applied Systems Analysis, Ecosystems Services and Management, Laxenburg, Austria

No abstract or full paper available.

1H.3 | ***Mapping and the Citizen Sensor* – Understanding and Influencing Contributors** (#1481)

N. Kerle

University of Twente, International Institute for Geo-Information Science and Earth Observation, Netherlands

Mapping, in its many shapes and forms, is increasingly benefiting from the contributions of volunteers. While the roots of citizen science and volunteered geographic information go back many decades, only more recently have such contributions been recognized as valuable in mapping efforts traditionally dominated by professional organizations. This has resulted in intensive research predominantly on issues of information and map accuracy. The COST Action *Mapping and the Citizen Sensor* aims at a more comprehensive evaluation, including the understanding and influencing of volunteer contributors (addressed by one of 4 working groups). A review currently being done by this group covers a range of questions, including (i) what distinct groups of volunteers exist, and what characterizes them, (ii) how those volunteers are recruited, instructed, and their contributions screened, validated and used in the map product, (iii) how a specific behavior to maximize map quality and accuracy can be fostered, (iv) how contributions can be sustained for long-term and routine mapping efforts, including the effectiveness of incentive and reward schemes to attract and retain contributors, and (v) ethical and legal issues of working with volunteers. One example being evaluated more closely relates to collaborative post-disaster damage mapping based on remote sensing imagery. While recruiting and motivating contributors after disaster events has been less of an issue, in particular problems relating to appropriate instruction of the volunteers and use of their contributions persist. In particular insights from the cognitive psychology community on how best to engage with diverse volunteers appear relevant and are seen as a useful means to arriving at a more robust and reliable mapping setup. The aim of this contribution is to provide a detailed overview of the ongoing review effort.

1H.4 | **Map Production** (#1482)

G. Hart

Ordnancesurvey Great Britain, Southampton, Great Britain

No abstract or full paper available.

1H.5 | **Map Evaluation** (#1483)

C. Fonte

Universidade de Coimbra, Departamento de Matemática, Portugal

No abstract or full paper available.

Session S1-I

Business Meeting of the Commissions on Cartography and Children, Maps and Graphics for Blind and Partially Sighted People, Education and Training, Planetary Cartography

Monday, 26 August, 2013

14:45 - 16:00

ORAL

Session S2-A

Mapping Emotions

Monday, 26 August, 2013

16:30 - 17:45

2A.1 | **Acquisition and Cartographic Applications of Subjective Geodata** (#652)

S. Klettner, H. Huang, M. Schmidt, G. Gartner
Vienna University of Technology, Department of Geodesy and Geoinformation, Austria

A full-length version is available and can be opened here:

_extendedAbstract\177_proceeding.*

Most geospatial applications provide services based on objective, physical features. However, humans interpret locations subjectively. By doing so, subjective spatial relations towards space are developed, which in turn, affect decision-making and behavior in space (e.g. fearful places are avoided, attractive places are explored). In other words, humans do not only perceive the environment but they also respond to it. Most geospatial applications however, rely on objective geospatial data to provide services and decision support to its users. In order to attain user-centered services, geospatial applications must include subjective information. This paper reports on results of a research project, which aims at acquiring people's subjective relations to space, as well as at incorporating subjective data into geospatial applications. We will discuss crowd-sourcing as an effective approach to gather subjective relations to space, and introduce applications of subjective geospatial data:

A. **Subjective data acquisition.** Subjective information about space can be assessed through various approaches, such as self reports, physiological recordings, or field observations. Due to the ubiquity of smartphones and increasing interests in Web 2.0, subjective geodata was collected via crowd-sourcing. With this approach we are able to acquire subjective data directly from the users – without further retrospective interpretation needed -, reported in a high granularity in space, and automatically linked to the physical environment. With this method we aim at a direct, efficient, real-time collection of data, evoked by realistic scenarios, leading to high ecological valid results.
B. **Data Applications.** Subjective spatial ratings collected in this project, are point-based data, distributed at different parts of the street network. In this paper, we illustrate two applications of these data:

1. ***Data analysis and visualization.*** The subjective data will be analyzed according to the users' socio-demographic information (e.g. age, gender, occupation) and context of contribution (e.g. time of the day, day of the week, alone vs. with others). We will analyze to which extent different groups of people in different contexts rate the environment differently/similarly. Based on the data, a subjective layer of space will be created, depicting people's relation to space on individual and aggregated levels. Visualization techniques and statistical methods are employed for these purposes.
2. ***Enhancing route planning in mobile pedestrian navigation systems.*** Research has shown that pedestrians – especially when having enough time – might favor different route qualities over shortness, such as safety, attractiveness and convenience. Current algorithms often fail to provide other aspects aside from time-optimized and distance-optimized routes. We address this problem by incorporating subjective relations to space. The basic idea is to aggregate subjective spatial ratings of similar users to model/approximate current user's subjective relation to different street segments in the street network. With this, a street network, in which each segment is encoded with a collective rating, will be generated. A common routing algorithm, such as Dijkstra's algorithm is then directly applied to compute routes with different characteristics (e.g. most comfortable route, safest route). Currently, we are designing a field experiment to evaluate the routing algorithms.

Applications of subjective geodata will not be restricted to the aspects mentioned above. We expect the inclusion of a subjective layer will bring benefits to different disciplines, not only Information and Communication Technology, but also Urban Planning, Architecture, and Policy Making.

2A.2 | **Detection, Analysis and Visualisation of Georeferenced Emotions** (#1419)

E. Hauthal, D. Burghardt

Dresden University of Technology, Institute for Cartography, Germany

Location based services consider mainly objective information and collections of facts. Subjective components such as emotions and opinions can provide alternative views, e.g. for supporting decision making. Therefore research on affect analysis has been carried out by capturing and analysing georeferenced emotions from user generated content. An approach has been developed for extracting location-based emotions from the metadata of georeferenced Flickr and Panoramio photos, i.e. from their titles, descriptions and tags. This approach has been applied to the study area of Dresden. The obtained emotions are documented in emotional maps of geospace as well as in valence-arousal-space originating from psychology. The valence-arousal-space reduces affective states to two dimensions. Thus each emotion can be described as a combination of different severities of those dimensions. The dimension of valence is a positive-negative-scale while the dimension of arousal represents the emotional excitement. The distribution of emotions within the valence-arousal-space represents the kinds of emotions occurring whereas the emotional maps show the geospatial distribution in Dresden. Several visualisation methods have been used for presenting the extracted emotional data in maps of geospace. Density maps in a multiple view visualisation show the geospatial distribution of emotions of a certain range of the valence-arousal-space. Furthermore the pure emotional values of the valence-arousal-space have been visualised in geospace with the help of a colour-scale for each dimension applied to chloropleth mapping with hexagons as reference areas. The analysis of the emotional data of Dresden reveals that one place is not only connected with one emotion. Reasons for that can be personal preferences, experiences or memories, but temporal aspects as well, i.e. some decades ago a place might have evoked different emotions than it does nowadays but still those former emotions are linked to the place and can be detected in the metadata of Flickr and Panoramio photos. Ongoing investigations aim at separating individual from collective emotions and explore how to extract also the temporal aspects of georeferenced emotions. The investigation results offer potential for an analysis regarding spatial-temporal patterns and their visualisation as well as the effect of georeferenced emotions on spatial applications in the field of tourism.

2A.3 | **Emotions: An undertheorized dimension of map cognition?** (#935)

A. Griffin

University of New South Wales, Canberra, School of Physical, Environmental and Mathematical Sciences, Australia

Since Arthur Robinson's (1952) *The Look of Maps*, cartographers have worked to systematize their study of maps, map use and symbol design. This systematization coincided with the widespread notion that maps should be thought of as authoritative, scientifically neutral, and objective (i.e., emotionless). While the design of beautiful maps has often been an aim of cartographers, and few cartographers would discount the value of map aesthetics entirely, cartographers who have studied map reading and map use have focused primarily upon perceptual and cognitive aspects of map reading, and have tended to ignore the emotional responses that maps may evoke among map readers, with a few exceptions, most of them quite recent (e.g., Aitken 2009; van Lammeren et al 2010; Edsall 2011; Fabrikant et al 2012; Griffin and McQuoid 2012; Field and Demaj 2012; Muehlenhaus 2012). The failure to consider emotional responses to maps as an area worthy of scholarly attention is particularly interesting in light of the fact that affect (the experience / feeling of emotion), behavior, and cognition are sometimes called the "ABCs" of psychology, underlining the importance that discipline gives to emotion's role in understanding human behavior. Moreover, psychologists have identified numerous links between cognition and affect (e.g., Damasio 1994, 2001; DeSteno et al 2004), meaning that studies of decision making with maps that ignore the role of emotion in decision making processes may not be telling the full story. This paper explores conceptualizations of emotion and assesses their relevance and implications for understanding map reading and map use. It draws upon a variety of disciplines with links to cartography: psychology, art and graphic design, and rhetoric and communication. Aitken, S.C., 2009, The emotional life of maps, *24th International Cartographic Conference*, Santiago, Chile. Available from: http://icaci.org/files/documents/ICC_proceedings/ICC2009/html/refer/27_2.pdf [15 November 2012]. Damasio, A., 1994, *Descartes' Error: Emotion, Reason and the Human Brain*, Putnam Press, New York. Damasio, A., 2001, Emotion and the Human Brain, *Annals of the New York Academy of Sciences*, 935, 101-106. DeSteno, D., Petty, R.E., Rucker, D.D., Wegener, D.T. & Braverman, J., 2004, Discrete emotions and persuasion: the role of emotion-induced expectancies, *Journal of Personality and Social Psychology; Journal of Personality and Social Psychology*, 86(1), 43-56. Edsall, R., 2011, Sounds dangerous: Emotion, geovisual analytics and music, *25th International Cartographic Conference*, A. Ruas (ed.), International Cartography Association, Paris, France. Available from: http://icaci.org/files/documents/ICC_proceedings/ICC2011/Poster%20Presentations%20PDF/POSTERS%20SESSION%202/P-105.pdf [15 November 2012]. Fabrikant, S.I., Christophe, S., Papastefanou, G., & Maggi, S., 2012, Emotional Response to Map Design Aesthetics, Proceedings of GIScience 2012, Columbus, OH, 18-21 September Available from: http://www.giscience.org/proceedings/abstracts/giscience2012_paper_64.pdf [15 November 2012]. Field, K. & Demaj, D., 2012, Reasserting Design Relevance in Cartography: Some Concepts, *The Cartographic Journal,* 49(1), 70-76. Griffin, A. L. & McQuoid, J., 2012, At the Intersection of Maps and Emotion: The Challenge of Spatially Representing Experience, *Kartographische Nachrichten*, 06/12, in press. Muehlenhaus, I., 2012, If Looks Could Kill: The Impact of Different Rhetorical Styles on Persuasive Geocommunication, *The Cartographic Journal,* 49(4), in press. Robinson, A.R., 1952, *The Look of Maps,* Madison, University of Wisconsin Press. van Lammeren, R., Houtkamp, J., Colijn, S., Hilferink, M. & Bouwman, A., 2010, Affective appraisal of 3D land use visualization, *Computers, Environment and Urban Systems*, 34(6), 465-475.

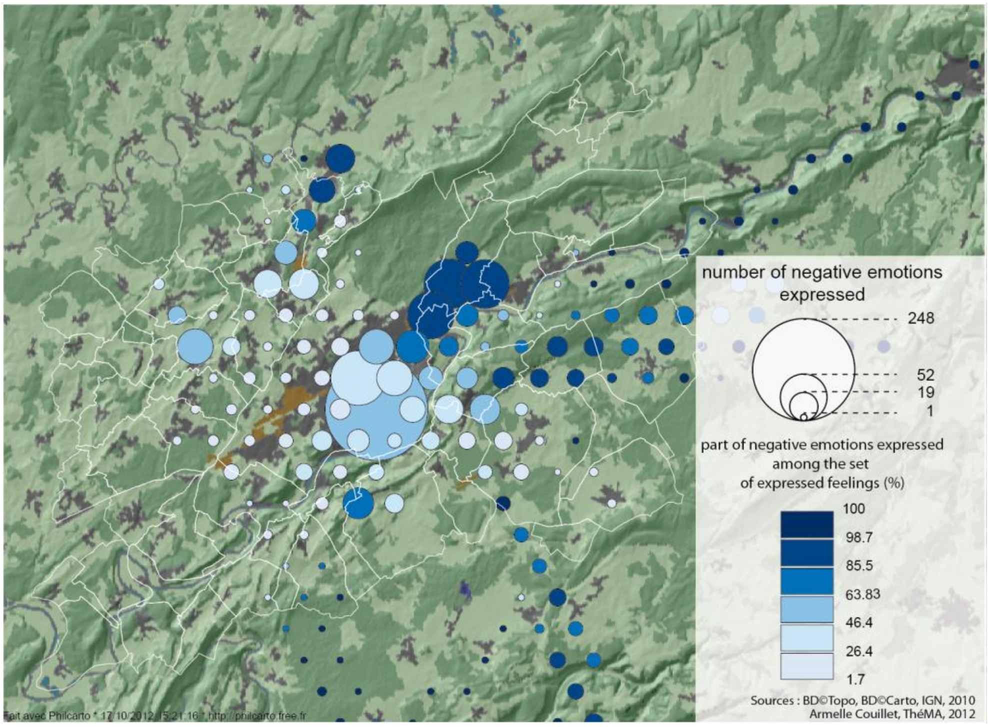
2A.4 | **Applying Visual Analytics Methods for mapping emotions felt along daily trips** (#567)

A. Couillet
TheMA Laboratory-UFR SLHS-University of Franche-Comté, Doubs, Besançon cedex, France

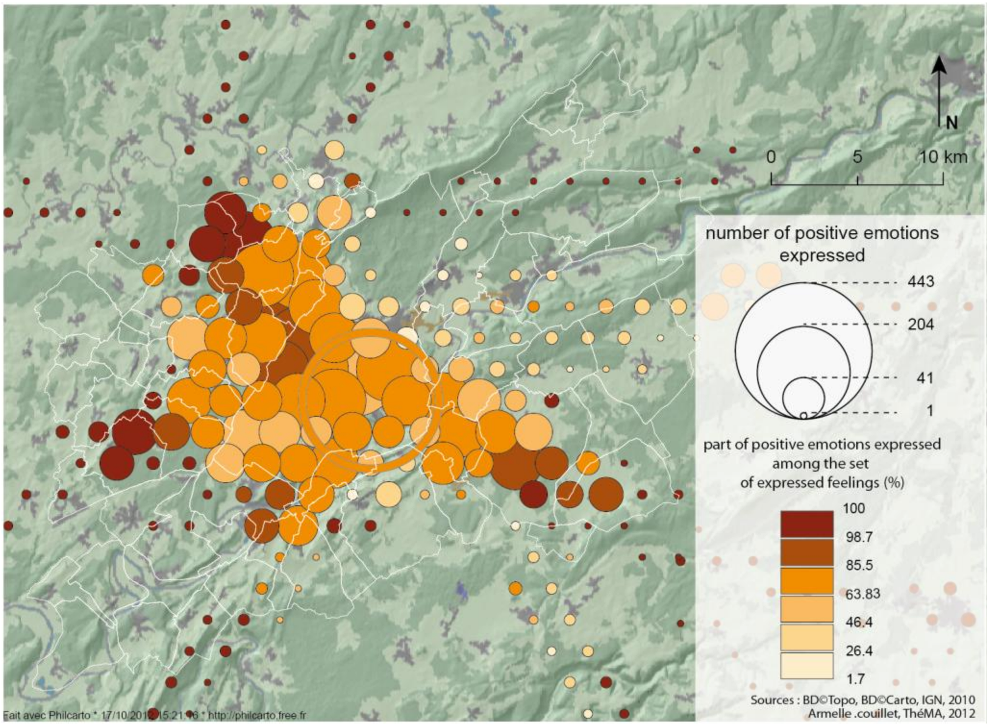
A full-length version is available and can be opened here:

_extendedAbstract\251_proceeding.*

Visual analytics are tools and methods allowing the visual analysis of large sets of movement data. We here use these methods to analyze intra-urban daily trips of individuals as well as the emotion felt by the individuals along their trip. The interdisciplinary research project ECDESUP (Evaluation, Choice and Decision in the use of Urban and Peri-Urban Spaces, www.**ecdesup**.org/*)* allowed to obtain the required data via a survey done in the town of Besançon (East of France). The persons investigated had to inform, during seven days, each of their movement according to various criteria (day of the week, hour of departure, hour of arriving, goal of the trip, mean of transportation). They also had to express their feelings according to a series of terms proposed by the psychologists of the research project (finally, emotions were classified as rather positive or rather negative). The first objective was to determine if some places in the city concentrate a specific type of emotions (either positive or negative) with respect to the day in the week and/or the moment/time in the day. The second objective was to try to explain the differences observed: are they explained by the places of origin or destination, the goal of the trip, or either the time at which the trip occurred? To reach these objectives, we opted for an alternative methodology in the representation of the movements, in another form than flow maps. We were inspired by visual proceedings developed by Natalia and Gennady Andrienko (2010): after having located each movement as a line in a GIS (the line connect the point of origin to the point of destination of the trip) we overlapped a vector hexagonal grid on the whole studied space. Every cells of the grid were considered as a polygon, which the limits were used to cut the lines, they also were used to count the obtained sections inside. In cells, we have recorded sections in relation with criteria listed above; in fact we have produced new information by using and combining the three basic types of aggregation (Fredrikson et al. 1999): spatial aggregation (S), temporal aggregation (T) and attributive aggregation (A). The values obtained have been represented with graduated symbols or/with gradation of color in the cells (depending on the nature of the data) and we realized several maps: maps of location of positive *vs* negative emotions for the whole period, maps of the same information with respect to the day of the week, with respect to the moment in the day (Figure 1, Figure 2). First results obtained, show spatial differentiation in the location of the emotions felt. Graphics of particular sectors have also suggested that neither the goal of the trip nor the time in the day can univocally explain those spatial differentiations. Further analyses are in progress to understand what are the criteria which influence most the type of emotion felt. Having compared the place of residence of the persons investigated with the distributions spatial of the feelings we suppose that all the individual movements are widely influenced by the place of house.



Map of negative emotions:
The East of the studied area is characterized by feelings rather negative



Map of positive emotions:
The West of the studied area concentrate the positive emotions

ORAL

Session S2-B

Neocartography

Monday, 26 August, 2013

16:30 - 17:45

2B.1 | **Is there a new cartography?** (#246)

S. Chilton, S. Chilton

Middlesex University, Centre for Learning and Teaching Enhancement, London, Great Britain

Many examples of new and innovative mapping are being produced outside the normal orbit of existing cartographers or map producers. The term neocartographers is being used to describe map makers who may not have come from traditional mapping backgrounds and are frequently using open data and open source mapping tools. Another difference is in the blurring of boundaries between map producers and map consumers. The availability of data and tools allows neocartographers to make their own maps, show what they want, and often be the intended audience as well – that is to say they may make the maps for themselves, just because they can. There is a real need for formal research to engage with this essentially undisciplined field of neocartography, and to this end, this paper offers some background to its development, while attempting to stimulate and synthesise activity and on-going research in this area. The overall aim is to encourage a more active engagement between cartographers and other individuals (or groups) engaging in these new, and often ephemeral, mapping activities. Good and bad examples of recent cartographywill be shown and their wider context discussed to establish whether they constitute 'new cartography'. This includes maps produced by non-cartographers and those whose production has been influenced by the availability of open data (such as transport timetable information), a burgeoning field. The paper will also highlight the issue of map design for rapid turnaround mapping, where output attracts criticism from many commentators. It will also summarise and comment on the influence of both the crowd and the cloud – for (crowd)sourcing data and for (cloud)hosting of data and their application. Finally, the paper will set out the author's vision for a new cartography and will illustrate how new cartographers are offering a very valuable contribution to the discipline. Incorporating a summary of the work of the ICA Commission on Neocartography, it will suggest why (and how) traditional cartographers should encompass this trend and engage in discussion with, and potentially influence, the protagonists.

2B.2 | **Neocartography and the Social Web** (#1218)

A. Turner
Esri, DC R&D Center, Arlington, United States

Lives are captured and published in near-realtime by people all over the world, resulting in a living and recorded memory tapestry of our experiences, thoughts, feelings and intentions. The data of the internet is not merely quantitative but represents a deep qualitative aspect that provides deeper insight and potential for understanding of society. This Social Web now constitutes a global conversation where a multitude are perceiving, ingesting, and replying to the posts of their friends, neighbors, and fellow citizens. We are just beginning to tap into this streaming web of emotional and networked data to learn about events, sentiment, and culture. Geography proves to be a defining attribute of the data as these social messages reflect local demographics, real-world networks, movement, and environment. In addition, geography grows as a tool leveraged by the ephemeral social web to create real-world impact and engagement through collaboration and shared perspectives. This neogeography, where people apply geographic technology for very personal uses, creates a new opportunity for interactive exploration. Cartographically most visualizations apply traditional techniques of place marking these social messages, or performing limited aggregate visualization or perhaps temporal animation. These techniques attempt simplistic quantitative or binary existence of data that are much richer and provide the components for intriguing and insightful study through multiple dimensions. Playfully referred to as "Neocartography", new techniques are required to effectively display this information that allows users to understand, explore, and share new information. By leveraging digital mediums such as web browsers, mobile devices, and even physical hardware, the cartography of the social web is an evolution of traditional cartography that is native to these new data and interfaces.

2B.3 | **Mobile Crowd Mapping** (#680)

J. Krisp[1], A. Cheung[2]

[1]*Technical University Munich (TUM), Cartography, Germany;* [2]*University of Auckland, School of Environment, New Zealand*

A full-length version is available and can be opened here:

_extendedAbstract\106_proceeding.*

Within this paper we investigate the computation and communication of crowd information within a lecture hall. Individuals sitting in a lecture hall (or classroom) form specific distribution patterns. We investigate a tool to recognize these distributions and to provide an interface that can be used in a mobile phone (Android app) to detect and visualize the densities within a lecture hall crowd. Visual mobile displays and interactive techniques are combined with computational processing, which enable the analysis of larger crowds. That would not be possible with purely visual methods and without the help of computational methods. As a basis for this "mobile crowd mapper", we use an app-tool that helps us to count the number of students within a classroom. This tool has been implemented within the working group on Location Based Services (LBS) at the Department of Cartography at the Technical University Munich (TUM). This tool uses common face-detection algorithms to count the number of faces in a classroom environment. Within this paper we document the extension to the "crowd-counter" functionalities to mapping of spatial densities within a crowd. The densities are based on the proximities of the different recognized faces. To effectively show the density we impose a density overlay onto the photo taken with a phone camera, taking into account the ever changing viewing perspective. This challenge of a changing field of depth can be solved by using the geometry of the clusters of detected faces, in our case the size of the detected faces of individuals in the classroom or lecture hall. The density calculation is based on the kernel density function (KDE) with a bandwidth based on the average distances between individuals sitting in the lecture room. This bandwidth can be interactively changed to study the distribution of the crowd from the location of individuals to a generalized map that provides an overview for high and low densities. The temporal domain can be realized also by taking multiple photos of the same setting. The resulting density maps efficiently communicate varying distribution patterns. A user test within a lecture room environment documents the clustering of students in the back rows or near entrances. The density information can be processed further to investigate temporal changes or the plan usage of lecture halls and classrooms. Results acquired can possibly be used to extend and enhance the algorithms and mapping functionalities to be used in outdoor settings and in "more chaotic" environments than lecture halls or classrooms.

2B.4 | **The Visitors: A Collective Methodology for Encountering and Documenting an Unfamiliar Cityscape** (#6)

L. Vaughan

RMIT University, Media and Communication, Melbourne, Australia

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 357-368

From the Dadaist and Situationist walking interventions, to contemporary locative media events and gaming, multimodal mapping methods have been used to extend vernacular methods for knowing and experiencing place, typically cities. In June 2012 a collective of artists, designers and filmmakers converged at ETH Zurich to participate in the *Cartography and Narrative* Workshop: we named ourselves *The Visitors*. This was an interdisciplinary initiative of the Art and Cartography Commission of the International Cartographic Association. Within the context of the Workshop activities, this collective were drawn together out of a shared interest in the 'unknowness' of unfamiliar cities, and a desire to map place through encounter; mapping through walking in particular. The outcome of this collective 'derive' is a film – *The Visitors* - a time based digital map, that embraces the ambiguities of subjective mapping and place-making.

ORAL

Session S2-C

Maps and the Internet: General Tasks 1

Monday, 26 August, 2013

16:30 - 17:45

2C.1 | **Taking Cartography into the Cloud** (#294)

M. Peterson

University of Nebraska at Omaha, Geography/Geology, United States

A full-length version of this contribution has been published in: KN (Kartographische Nachrichten), Vol. 63, Number 4 (Summer 2013), Pages 191-195

The Internet has become the major medium for maps but few resources exist that effectively brings cartography into the cloud. In making this transition, the theory of cartography must be closely integrated with a practical knowledge of the Internet including web hosting, scripting, programming, Application Programmer Interfaces (APIs), and online databases. In addition to knowing the principles of Internet mapping, the modern cartographer should feel comfortable with the entire set of tools that constitute the online environment. A set of inter-connected concepts and online resources are used to introduce the making of maps using cloud resources. The method alternates between theoretical and practical considerations. The theoretical component includes such topics as the development of maps and the Internet and the role of cartographic communication. Practical aspects include HTML, JavaScript, PHP, SQL and the use of various APIs.

2C.2 | **A process for assessing emergent web mapping technologies** (#1355)

R. Roth, R. Donohue, C. Sack, T. Wallace, T. Buckingham
UW-Madison, Geography, United States

A full-length version is available and can be opened here:

_extendedAbstract\380_proceeding.*

BACKGROUND: The current pace of innovation in Web Cartography is spectacular, with new releases of or substantial updates to web mapping technologies occurring almost daily. However, the ever-evolving nature of technology results in a fundamental tension for cartographers. On one hand, the increasing flexibility and interoperability of web mapping technologies open new opportunities for web maps; cartographers can do more now than ever. On the other, as technology evolves, so does the solution space from which cartographers can draw; it is increasingly difficult to establish and maintain one's bearings with this increasingly complex array of technologies. **OBJECTIVE:** The research reported here addresses this technological tension by proposing a process to assess emergent web mapping technologies. Our motivation for this work was the need to refresh the University of Wisconsin-Madison Cartography curriculum in response to a broader shift in web mapping away from standalone, proprietary technologies (e.g., Adobe Flash) and towards open technologies that leverage HTML5/CSS3 web standards and JavaScript. We designed the process to be generic to allow for application by other university programs, government agencies, and cartography firms grappling with similar issues in technology transition. Further, we designed the process for repeated application, allowing for maintenance of the UW curriculum as web mapping technology changes. **METHODS:** We first conducted a content analysis of available web mapping technologies and an online survey gathering opinions about these technologies. We used the results of these studies to narrow the complete array of web mapping technologies to four candidate technologies: D3, the Google Maps API, Leaflet, and OpenLayers. We then conducted a diary study—a variant on participant observation—in which four participants were asked to complete the same web mapping scenario, each using a different candidate technology; for reliability, a fifth participant completed the same mapping scenario using all four candidate technologies (n=8 diaries). Participants were required to log a diary entry every hour for 40 hours, mimicking constraints of an average work week. In the diary entry, participants described the scenario requirements they accomplished, key frustrations/breakthroughs, and their current feelings about the experience using a list of emotions. We administered an exit survey after the 40 hour time period to elicit additional feedback about their assigned technology and the process itself. **RESULTS:** On average, participants completed the most scenario requirements using the Google Maps API, with Leaflet a close second (Figure 1a); interestingly, there was substantial variation in the final maps by individual requirement, with the choropleth map and dynamic classification the only features implemented in all web maps and the interaction operators filter and search implemented in no web map (Figure 1b). Experiences with Leaflet were deemed more satisfying and less frustrating than the others (Figure 1c), with the diaries and exit survey suggesting several aspects of web mapping that make for a positive experience. The exit survey also provided substantial feedback on the process itself, suggesting a more streamlined variant for future use, as well as recommendations for teaching web mapping in the classroom. **CONCLUSION:** The work presented here is our initial effort to identify and evaluate a process for keeping pace with emerging web mapping technologies. As a result of the process, we began using Leaflet in Fall 2012 as the base JavaScript library for the UW-Madison Cartography Program, providing advanced labs that use pieces of D3 and the Google Maps API. The process will be administered regularly—with the laboratory curriculum revised accordingly—to ensure that the UW-Madison Cartography Program continues to evolve along with emergent web mapping technologies.

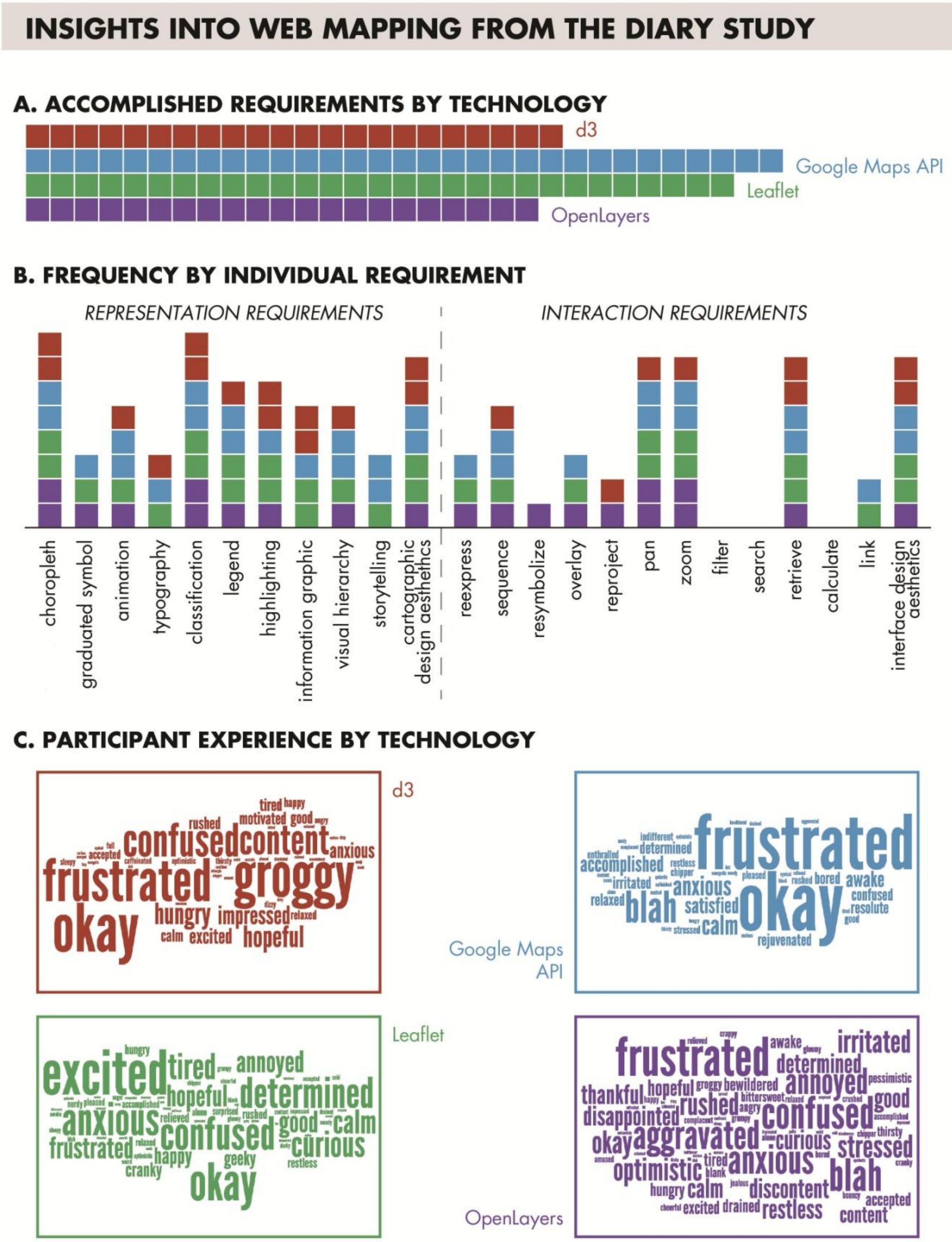


Figure 1:
Figure 1: Results from the diary study.

2C.3 | **TileServer: Extremely fast, free and open-source OGC WMTS server for pre-rendered tiles** (#951)

P. Pridal
Klokan Technologies GmbH, 6340, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\353_proceeding.*

OpenGIS Web Map Tiling Service (WMTS) is becoming the standard used for distributing raster maps to the web and mobile applications, cell-phones, tablets as well as desktop software. Practically all popular desktop GIS products now support this standard as well, including ESRI ArcGIS for Desktop, open-source Quantum GIS (qgis) and uDig, etc.

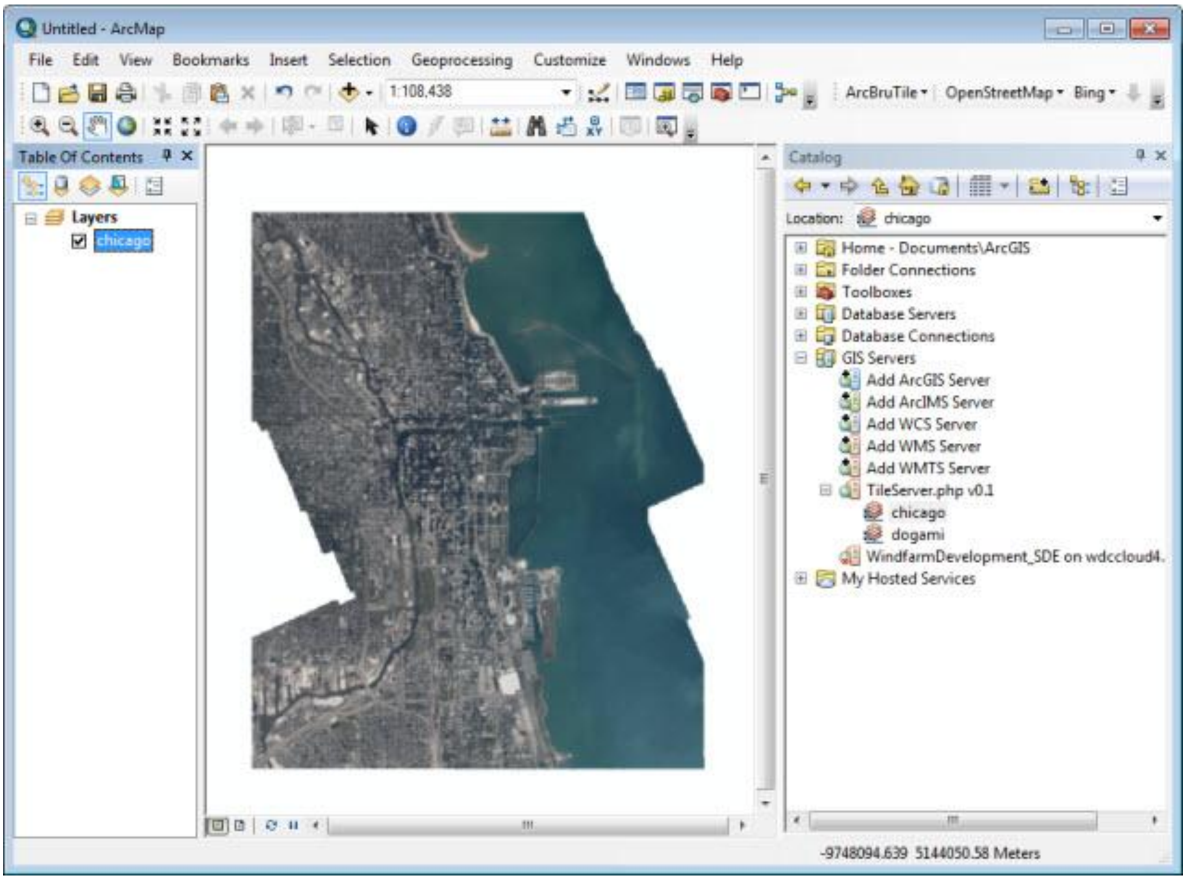
The TileServer, a new open-source software project, is going to be demonstrated. It is able to serve maps from an ordinary web-hosting and provide an efficient OGC WMTS compliant map tile service for maps pre-rendered with MapTiler, MapTiler Cluster, GDAL2Tiles, TileMill or available in MBTiles format.
The presentation will demonstrate compatibility with ArcGIS client and other desktop GIS software, with popular web APIs (such as Google Maps, MapBox, OpenLayers, Leaflet) and with mobile SDKs. We will show a complete workflow from a GeoTIFF file with custom spatial reference coordinate system to the online service (OGC WMTS) provided from a standard web-hosting.

The software has been originally developed by Klokan Technologies GmbH (Switzerland) in cooperation with NOAA (The National Oceanic and Atmospheric Administration, USA) and it has been successfully used to expose detailed aerial photos during disaster relief actions, for example on the crisis response for Hurricane Sandy and Hurricane Isaac in 2012. The software was able to handle large demand from an ordinary in-house web server without any issues. The geodata were displayed in a web application for general public and provided to GIS clients for professional use - thanks to compatibility with ArcIMS.

It can easily serve base maps, aerial photos or any other raster geodata. It is very easy to apply - just copy the project files to a PHP-enabled directory along with your map data containing metadata.json file. The online service can be also protected with password or burned-in watermarks made during the geodata rendering.

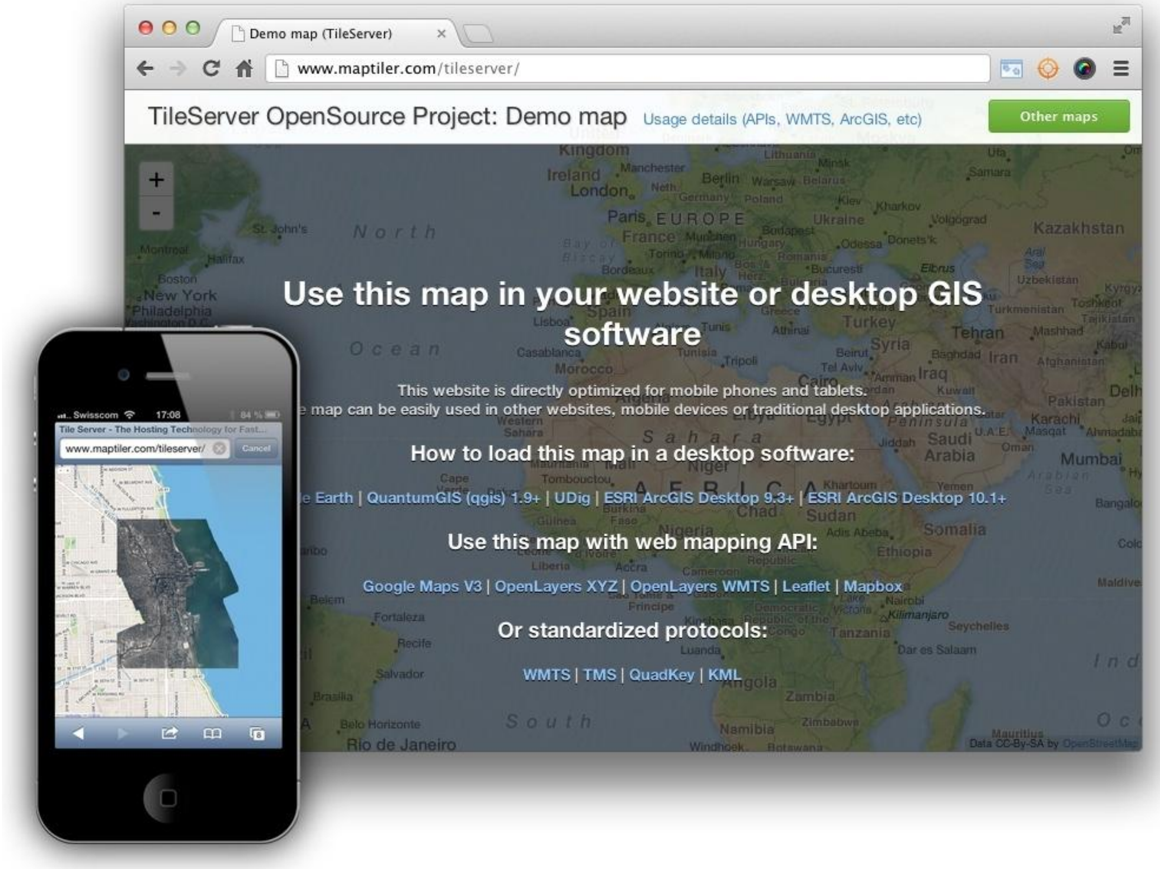
Tiles are served directly by Apache web server with mod_rewrite rules as static files and therefore are very fast and with correct HTTP caching headers. The web interface and XML metadata are delivered via PHP, because it allows deployment on large number of existing web servers including variety of free web hosting providers. There is no need to install any additional software on the webserver.

The mapping data can be available in the standardized format from in-house web servers, or from practically any standard web-hosting provider (the cheap unlimited tariffs are applicable too), and from a private cloud. The same principles can be applied on an external content distribution network (such as the Akamai's CDN with over 100.000 servers in 78 countries) to serve the geodata with higher speed and reliability by automatically caching it geographically closer to your online visitors, while still paying only a few cents per transferred gigabyte.


Untitled - ArcMap
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:108,438
ArcBruTile OpenStreetMap Bing
Table Of Contents
Layers
chicago
Catalog
Location: chicago
Home - Documents\ArcGIS
Folder Connections
Toolboxes
Database Servers
Database Connections
GIS Servers
Add ArcGIS Server
Add ArcIMS Server
Add WCS Server
Add WMS Server
Add WMTS Server
TileServer.php v0.1
chicago
dogami
WindfarmDevelopment_SDE on wdccloud4.
My Hosted Services
-9748094.639 5144050.58 Meters

ArcGIS with WMTS Service :

ArcGIS for Desktop loading maps from open-source TileServer project.



TileServer Web Interface:

TileServer web interface with step-by-step tutorials for WMTS use and mobile ready preview

2C.4 | **Scalable Vector Graphics – Web Standard for Cartography** (#521)

O. Cerba

University of West Bohemia, Department of mathematics, Plzeň, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\28_proceeding.*

ORAL

Session S2-D

Generalisation of Networks 1

Monday, 26 August, 2013

16:30 - 17:45

2D.1 | **Integration Metrics for Cartographic Generalization: Assessment of 1:1,000,000 Scale Hydrography and Terrain** (#817)

L. V. Stanislawski[1], B. Buttenfield[2], C. A. Brewer[3]

[1]*USGS, CEGIS, Rolla, United States;* [2]*University of Colorado-Boulder, Geography, United States;* [3]*Penn State University, Geography, University Park, United States*

A full-length version is available and can be opened here:

_extendedAbstract\382_proceeding.*

Cartographic generalization reduces map content and detail in a manner that legibly portrays desired features and conditions, often at a reduced scale. Contextual generalization considers objects within their environment and surrounding features from possibly multiple themes, as compared to independent generalization that only involves an individual object (Lecordix and Lemarie 2007). A variety of operations have been employed to maintain legibility and logical integration among feature themes (Ruas and Duchene 2007, Lecordix and Lemarie 2007). For instance, when generalizing roads and buildings, graphic conflicts caused by enlarged symbols may be resolved through amalgamation, displacement, or typification (Ware and Jones 1998, Regnauld 2001) Generalized hydrography or terrain may be deformed to better integrate these two layers (Gaffuri 2007). This paper presents methods to metrically evaluate how well a generalized, small scale stream network conforms to an associated elevation dataset. The United States Geological Survey recently generalized the 1:100,000-scale National Hydrography Dataset (NHD) to form a 1:1,000,000-scale (1M) hydrography layer for the National Atlas of the United States® (Gary et al. 2010). This paper evaluates how well the 1M stream network conforms to associated National Atlas 100-meter resolution terrain data. For a sample of adjacent watersheds in the central United States that span a range of physiographic conditions, elevation-derived channels are extracted from the terrain model at a density similar to the 1M stream network. Horizontal displacement, content, and density distribution of the 1M linear stream network are metrically compared to the elevation-derived channels using the coefficient of line correspondence and density-difference grids (Stanislawski et al. 2012). The 1M and elevation-derived stream networks are also compared with a more accurate stream network generalized from the high-resolution (1:24,000 or larger) NHD (Buttenfield et al. 2013) to discern if either theme requires adjustment. Results from this research will help refine generalization processing and enhance integration among National Atlas themes, as well as between the National Atlas and the more detailed National Map data. **References** Buttenfield B P, Stanislawski L V, Anderson-Tarver C, and Gleason M J (2013 submitted) Automatic Enrichment of Hydrographic Stream Networks with Primary Paths for the United States National Atlas. 26th International Cartographic Conference, Dresden, Germany Gaffuri J (2007) Outflow Preservation of the Hydrographic Network on the Relief in Map Generalisation. 23rd International Cartographic Conference, Moscow, Russia Gary R H, Wilson Z D, Archuleta C-A M, Thompson F E, and Vrabel J (2010) Production of a National 1:1,000,000-Scale Hydrography Dataset for the United States—Feature Selection, Simplification, and Refinement. Scientific Investigation Report 2009-5202, U.S. Department of Interior Lecordix F, Lemarié C (2007) Managing Generalisation Updates in IGN Map Production. In W.A. Mackaness, A. Ruas, L.T. Sarjakoski (eds.), *Generalization of Geographic Information: Cartographic Modeling and Applications*, Elsevier for International Cartographic Association, 285-300 Regnauld N (2001) Contextual Building Typification in Automated Map Generalization, *Algorithmica*, 30: 312-333 Ruas A, Duchêne C (2007) A Prototype Generalisation System Based on the Multi-Agent System Paridigm. In W.A. Mackaness, A. Ruas, L.T. Sarjakoski (eds.), *Generalization of Geographic Information: Cartographic Modeling and Applications*, Elsevier, 269-284 Stanislawski L V, Doumbouya A T, Miller-Corbett C D, Buttenfield B P, and Arundel S T (2012) Scaling Stream Densities for Hydrologic Generalization. 7th International Conference on Geographic Information Science, Columbus, Ohio Ware J M, Jones B J (1998) Conflict Reduction in Map Generalization Using Iterative Improvement, *GeoInformatica*, 2, 4: 383-407

2D.2 | **Fuzzy Generalization Inference System - the example of selection parameterization for roads and hydrographic network** (#937)

A. Fiedukowicz
Warsaw University of Technology, Department of Cartography, Poland

A full-length version is available and can be opened here:

_extendedAbstract\339_proceeding.*

The geographic information generalization process is considered as one of the greatest challenges in contemporary cartography. During the current studies and implementation tests number of algorithms were developed, which all are able to realize certain generalization algorithms (like selection, simplification, object shifting). However, there still remains the problem of building the complex system, which would be able to decide about the need and sequence of particular generalization operators at each object, as well as about the specific parameters of those operators. Choosing the proper generalization operator, algorithm and their parameters depends on number of factors, among which scale (for analog data) or level of detail (for spatial databases) are crucial ones. Subjective character of generalization process is difficult to be mimed by the popular algorithms and inference systems based on the classical two-valued logic, while it does not include e.g. the contextual character of generalization process. Executed studies are to prelude building the comprehensive system for generalization of geographic information based on the non-classical logics (fuzzy and rough). The research was established using the Fuzzy Logic ToolBox. The goal was to develop the knowledge base containing the fuzzy rules for selection operator (within the FIS – Fuzzy Inference System) for two selected feature classes (road network and hydrological network) for the chosen test area. Data source for both of them (road networks and hydrographic network) was TBD (Topographical Database) which is the basic reference database in Poland at the level of detail 1: 10 000. Data were prepared by adding extra attributes to the already existing in each database. New attributes were to represent the geometric and topographic features of objects, which are available by objects geometry in spatial databases but can not be directly processed by MatLab. Additionally the quantitative attributes were downgraded to the qualitative, linguistic form in order to be suited to the fuzzy inference system. Using Matlab Toolbox, by heuristic method was used for testing of different variants of decision rules, using diverse attributes sets. Results were evaluated by visual assessment and by comparison with the existing maps at smaller scales. Established analysis allow for elimination of certain attributes as insignificant for the decision about selection of object given class. Using only significant attributes the final, simplified rules were created for the fuzzy interference generalization system. The need of elimination attributes from the decision process seem to think about using rough sets theory at this level of generalization process. Selection of attributes significant for creation of the generalization rules is even more important taking into account that some of the attributes does not exist in the databases by default. That means that they acquisition requires either extension of the existing database structure or their computation (using spatial analysis) preceding generalization process. That is why the problem of attributes selection, with the utilizing rough sets theory, will be investigated in author's further researches. The established research has a test character and is to be the base for creation the comprehensive geographic information generalization system, which will cover also other feature classes and generalization operators. In further step it will also allow for embedding into generalization process the interaction between features of the same and different classes. At the following stage it is planned to extend the decision process, realized by the fuzzy system, to be able not only to decide if the generalization operator should be used in the generalization process, but also to answer the question about generalization operator parameters at the chosen level of detail.

2D.3 | **Deriving Products from a Multi Resolution Database using Automated Generalisation at Ordnance Survey** (#757)

N. Regnauld[1], S. Lessware[2], M. Plews[2]
[1]*Ordnance Survey, Research, Southampton, Great Britain;* [2]*1Spatial, Cambridge, Great Britain*

A full-length version is available and can be opened here:

_extendedAbstract\288_proceeding.*

Ordnance Survey is Great Britain's National Mapping Agency and recently completed the implementation of its new 'Geospatial Data Management System' (GDMS), which allows the continuous updating, under transactional control, of a national topographic database of over 500 million features. To take full advantage of the GDMS, Ordnance Survey is now undertaking the 'Multi-Resolution Data Programme' (MRDP) to upgrade its map production capabilities. The aim of MRDP is to build a system for creating new products that can be easily adapted to specific customer requirements. In addition to this increased flexibility, the system will also have to deliver efficiency gains and better consistency between derived products. MRDP's approach is therefore to implement a system that allows the reusability of data and software components, and also supports incremental updating. Its architecture is based on a multi-resolution database (MRDB), which holds representations of the world at different resolutions. These generalised resolutions are all derived from the large scale base data held in GDMS. End-user products are then derived from the appropriate MRDB resolution using a mix of automated and manual processes. The majority of the required generalisation processes are being developed in MRDP using 1Spatial's Radius Studio and Radius Clarity technologies:

- Radius Studio is a rules engine that allows data quality and processing rules and actions to be defined and automatically applied to spatial data. It is very well suited to undertaking model, geometric and many types of cartographic generalisation, where all the features of a class are usually processed in a similar fashion. Radius Studio is highly scalable and allows processes to be deployed over a grid to provide high availability and increased performance. It can be operated as a standalone application or, through a web services API, can be deployed as a service within an Enterprise architecture.

- For certain cartographic generalisation tasks, Radius Clarity can be used where the choice of generalisation actions to apply to a particular feature (or group of features, e.g. roads/buildings) is dependent on their geographic context (e.g. the surrounding features). To provide this capability, Radius Clarity includes an optimisation engine based on Multi-Agent principles.

However, as Radius Clarity is a stand-alone application, providing its capabilities within MRDP's BPEL-controlled service orientated architecture has required the integration of Clarity's Agent technology into Radius Studio; the latter being controllable through its web services interface. This integration was implemented under MRDP in early 2012. An initial version of the MRDP system is now being used to produce OS VectorMap® District (VMD). This is a national backdrop map product available for free download both in vector and raster format. The VMD derivation process is fully automatic, with no manual editing required. Manual editing using ArcGIS, however, will be used for finishing and maintaining other OS map products that require more emphasis on their cartographic quality. Enlarging on the above, this paper is structured as follows:

- Section One: Discussion on the context and objectives of the MRDP, with a review of similar ventures in other National Mapping Agencies.
- Section Two: Presentation of the MRDP architecture and the multi-resolution database that underpins it.

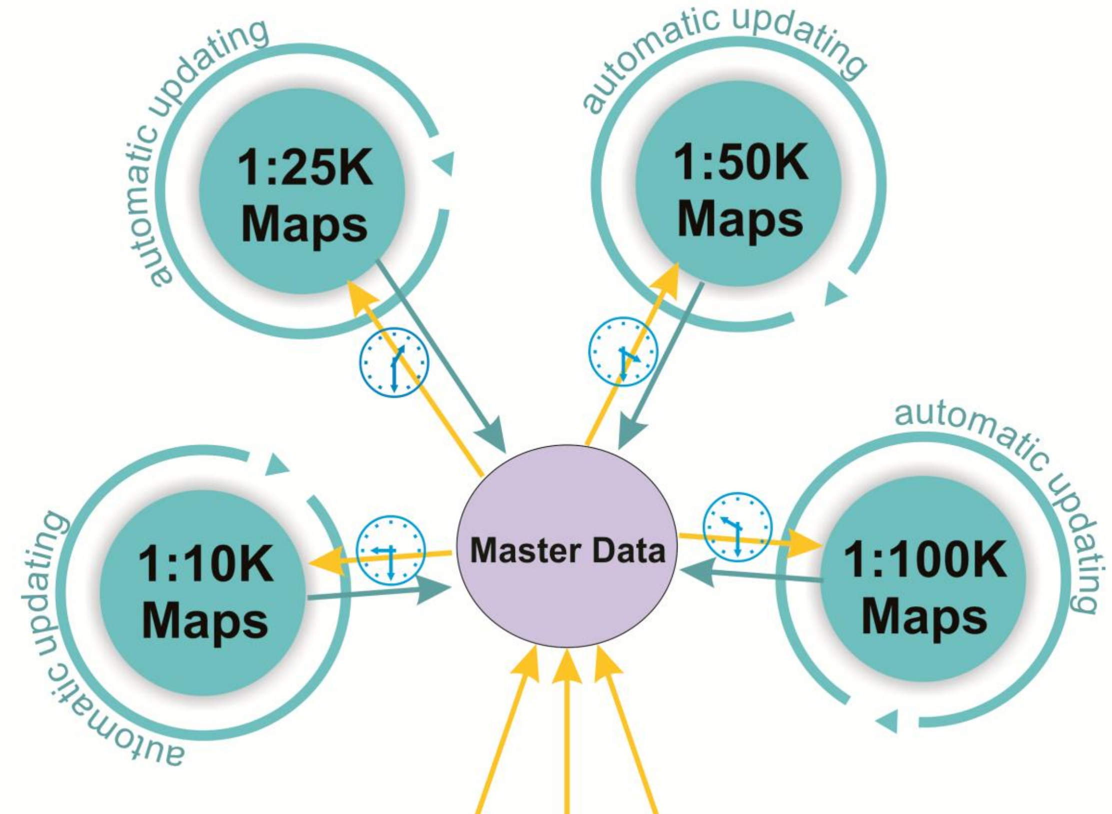
- Section Three: Description of the 1Spatial generalisation technologies that are been used, and their integration into the overall MRDP Enterprise architecture.
- Section Four: Overview of the OS VMD product, and the key MRDP generalisation processes that have been developed using Radius Studio/Clarity to derive it from the GDMS base data.
- Section Five: Describes the planned incremental change-only update process, which will be introduced into MRDP 2013 to replace the current method based on refreshing whole 10km square tiles.

2D.4 | **Automatic Production and Updating of Topographic Maps - A Case Study Using the German AAA Data Model** (#151)

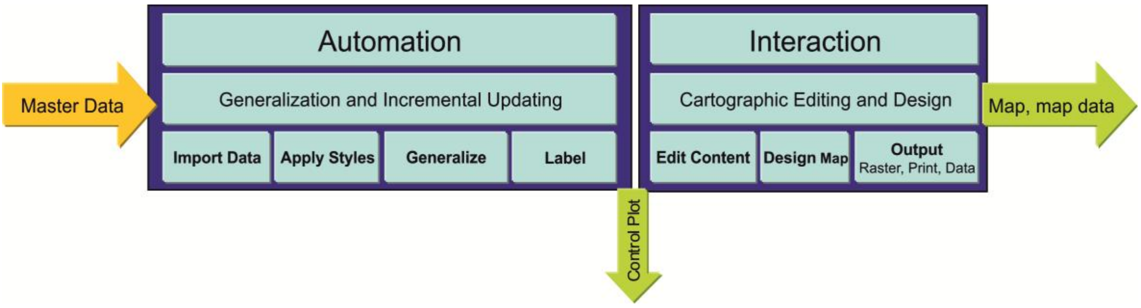
A. Mathur

Mary Lou von Wyl, Stans, Switzerland

During a time of dwindling financial and human resources, the most important reason to strive towards automation is to guarantee timely and consistent production and updating cycles that maintain the high quality of maps. Although automatic generalization and updating depend on a number of well-functioning algorithms, the main challenge is imitating the steps that a cartographer takes to produce readable maps. This can only be done with a system logic that allows for the high-quality, economical automation of the generalization and updating processes. We will present a case study from Germany about the automatic production and updating of topographic maps in the scales 1:10K, 1:25K, 1:50K and 1:100K, where the data comes from various master data sources, including the primary AAA-ATKIS data source. This case study will document the enormous and continuous time and cost reduction based on real numbers from the production field.



All scales:
Same master data source for all scales



Automation Components:
Components for the automatic production and updating workflow

ORAL

Session S2-E

Map Projections 1

Monday, 26 August, 2013

16:30 - 17:45

2E.1 | **THE USE OF MAP MASHUPS IN MAP PROJECTION EDUCATION** (#323)

&. O. Bildirici[1], O. S. Kirtiloglu[1], N. Uluğtekin[2]

[1]Selcuk University, Geomatics Engineering, Konya, Turkey; [2]Istanbul Technical University, Geomatics Engineering, Turkey

A full-length version is available and can be opened here:

_extendedAbstract\29_proceeding.*

The term mashup is used for integrating different web resources and information within a web site. Mashups are becoming popular with Web2.0, which represents a variety of innovative resources, and ways of interacting with, or combining web content. Mashups are based on Application Programming Interfaces (APIs) that are online libraries of functions. Most of the APIs are free to use by web developers. Most common mashup applications are used in web mapping or web cartography. There is a variety of API providers for map mashups, including Google, Yahoo, Bing Maps and etc. The functionality of available APIs is similar, but Google's data content is richer. With Google Maps API, web site developers can add dynamic maps to their pages, and can overlay their own point, line and polygon data on to the maps. Map mashups created by Google Maps API are used in many web sites, ranging from hotel booking to selling second hand cars. In this study, the use of map mashups in cartography education, especially in map projection education, is handled. In order to help students to understand the properties of great circles and rhumb lines, a web page, named cartographic calculator, is created. Students can do some calculations –direct solution and inverse solution on the sphere- with this web page, and see the points used on the map. Great circles and rhumb lines connecting two points can also be shown on the map. Beside the map views, a virtual globe view is provided, if the Google Earth plug is installed. Great circles and rhumb lines look different in map and virtual globe views. Since the projection of the Google Map is Mercator Projection, rhumb lines appear as straight lines. With help of calculation and visualization possibilities students can understand better the properties of great circles and rhumb lines. To evaluate the efficiency of the cartographic calculator, two groups of students taking the course cartography at Selcuk University are formed. One group includes students who use the web page frequently, the other group rarely. A poll is applied to both groups, and the answers of both groups are compared.

2E.2 | **Jacobi Conformal Projection of the Triaxial Ellipsoid: New Projection for Mapping of Small Celestial Bodies** (#277)

M. Nyrtsov[1], M. Fleis[2], M. Borisov[3], P. Stooke[4]

[1]*Moscow State University of Geodesy and Cartography (MIIGAiK), Department of Geography, Russia;*
[2]*Institute of Geography, Russian Academy of Sciences, GIS Research Laboratory, Moscow, Russia;*
[3]*Institute of Geography, Russian Academy of Sciences, GIS Research Laboratory, Moscow, Russia;*
[4]*The University of Western Ontario, Department of Geography, London, Canada*

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 235-246

In this paper a new technique for recalculating geographic coordinates of a triaxial ellipsoid to elliptical and then to rectangular coordinates of the Jacobi conformal projection is considered. Coordinate lines of the elliptical system and the cartographical grid with the parallels passing through the circular points on the Jacobi projection are shown. This new technique allows us to achieve the conformal mapping of small celestial bodies. A map of asteroid 25143 Itokawa in the Jacobi conformal projection, the first ever published, and a map of asteroid 433 Eros created by the authors in the transverse conformal cylindrical projection of a triaxial ellipsoid are presented for comparison. Asteroids 25143 Itokawa and 433 Eros are near-Earth objects.

2E.3 | **Rendering Vector Geometry with Adaptive Composite Map Projections**

(#1373)

B. Jenny, B. □avrič

Oregon State University, College of Earth, Ocean, and Atmospheric Sciences CEAOS, Corvallis, United States

A full-length version is available and can be opened here:

_extendedAbstract\115_proceeding.*

Adaptive Composite Map Projections are an alternative to the static web Mercator projection used by all current web mapping services. An Adaptive Composite Map Projection seamlessly combines selected projections as the user changes scale or the area shown on the map. Different projections are combined, depending on the height-to-width aspect ratio of the map, the map's scale, and the central latitude of the visible area. Poles can be rotated to the center of the map, and the central meridian arbitrarily selected. Vector data are streamed to the Web client in geographic coordinates and then projected and rasterized in real time on the Web browser. Data are projected and rasterized each time the user changes the map scale or the extent of the visible geographic area. These operations are computationally expensive and must be optimized for achieving interactive frame rates. This contribution will document various issues and solutions that are specific to the projecting and rendering pipeline for web maps using Adaptive Composite Map Projections. The underlying vector data model has three conceptual tiers. The first tier consists of the original geographic coordinates in the equidistant projection. The second tier uses a spherical coordinate system and is created by rotating geographic coordinates of the first tier, such that the central longitude and central latitude will appear at the center of the final map. The third tier contains projected Cartesian coordinates, derived from the second tier, which are rasterized to create the map image. When creating the third tier, vector geometry is intersected along the meridians bounding the map's graticule. It will be documented how intersections can be found, taking nested topological relations (i.e. nested islands and holes) and circumferential polygons into account. Circumferential polygons, such as a polygon delimiting the landmass of Antarctica, require special consideration, as they are bounded by a single line that is intersected in the first tier of the data model along the bounding meridians at +/-180 degrees, but consist of a single line enclosing one of the poles in the second tier. The transformation from spherical coordinates of the second tier to Cartesian coordinates of the third tier consists in both a map projection and a vector geometry densification. The densification is required to avoid lines with an edgy appearance at locations where the graticule is warped considerably. Line segments are densified based on their deviation in Cartesian map coordinates, but intermediate points are added along great circles computed on the sphere. Azimuthal projections require an additional treatment for polygons lying along the rim of the graticule. If the antipode of the projection center is inside a polygon in spherical coordinates, an additional circular outline has to be added to the polygon to construct a closed ring. The added circular outline has the same diameter as the graticule of the azimuthal projection. The resulting doughnut-shaped polygon has a regular circle outer border and an irregular inner limit. It will be illustrated how necessary point-in-polygon tests can be added to the projecting pipeline.

ORAL

Session S2-F

Web and 3D Atlases

Monday, 26 August, 2013

16:30 - 17:45

2F.1 | **Evaluating the suitability of Web 2.0 technologies for online atlas access interfaces** (#427)

E. Özerdem, F. Ortag, G. Gartner

Vienna University of Technology, Department of Geoinformation and Cartography, Austria

A full-length version is available and can be opened here:

_extendedAbstract\211_proceeding.*

Since the first online atlas, there have been many developments in Web technologies. One of the most obvious developments is the transition to Web 2.0 which enables users to participate and communicate in a collaborative manner. The vast majority of currently existing online atlases do not include functions of Web 2.0 which could let users to participate and to communicate. Some of these Web 2.0 functions, which could be adapted in online atlases, are recommendations, user comments, tag clouds, blogs and RSS feeds. Before implementing these functions in an online atlas, it is essential to know how users could react to them and how useful they might be for an online atlas. This research focuses on evaluating the suitability of these functions, especially recommendations and user comments, in an online atlas and finds answers to questions such as: How do the recommendations effect the time users spend on an online atlas website? Do the users of online atlases take editors' advices into account? Do the users of online atlases take other users' activities into consideration? Do the comments of other users change the users' own activities? In order to answer these questions, a usability testing is carried out with 25 test persons (12 female, 13 male). A prototype with different interfaces is developed for usability testing which simulates an online atlas of Austria. Some of the interfaces include Web 2.0 functions in different positions in a page and some not, for comparing behaviors of test persons with different functions and these functions in different positions. At the end of testing, it is found out that an online atlas interface with map recommendations causes %65 increase in number of maps that test persons visit, in compare to the interface without map recommendations. In an interface with map recommendations, further maps that are visited by using recommendations constitutes %80 of whole further map visits. Test persons take recommendations into consideration which are generated both from editor's advices and other users' activities. The ratio of used recommendations which are generated according to other users' activities is %68 in whole used recommendations. User comments had an impact on %23 of the test persons by changing their behaviors. %60 of the test persons used the tag cloud at least once, %44 of them visited the Blog page and only %12 of them visited the RSS feed page. According to these results, recommendations are useful for online atlases which cause users to spend more time in the website and visit more maps they might be interested in. Instead of not having such a significant choice of test persons within this testing, it might be still useful to separate recommendations into editors' advices and other users' activities because in a real working online atlas, recommendations from other users' activities can be calculated by using the real data of real users and this can provide more interesting recommendations for users. Other user comments' attract users' attention and have an impact on their behaviors. That is why it is also useful to have such a function where users can communicate each other. In a real working online atlas, percent of effects of other user comments on users' behaviors can be expected higher. Because in such a case, there would be real users who are interested in same maps and have similar purposes and for that reason they can leave more effective comments. It is also observed that a tag cloud can be an alternative to hierarchical list of topics and a blog can also be interesting for users. RSS feed function does not look that popular within this research but the percent of its use may also be higher than this research's with real users.

2F.2 | **Service Driven 3D Atlas Cartography** (#552)

N. Panchaud, I. Iosifescu, R. Eichenberger, R. Sieber, L. Hurni
Institute of Cartography and Geoinformation, ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\157_proceeding.*

The field of web cartography, and thus of web atlases, has been growing and changing fast due to the democratization of the digital media, the world wide web and finally the 3D technologies. Web atlases are powerful tools to display and explore geospatial data in interactive and dynamic ways and thus they should take advantages of the newest developments in the field of online visualization and web services.   In this article, we will discuss the advantages and challenges that arise in the use of service-oriented architecture and 3D visualization for web atlases. The use of service-driven solutions for web atlases offer the possibility to give access to significant amount of spatial data while avoiding any storage issues on the client side. Processing and rendering task can also happen on the server and thus allowing thin-client to access easily to spatial data and their visualization. Storage issues and processing capacity are even more important when 3D visualization is involved. 3D visualization is here understood as 3D perspective views on a 2D surface (e.g. computer screen), but that are perceived as 3D. It offers a naturalistic display and should thus be easier to interpret for non-expert, because it looks similar to the real world. Furthermore, it is more helpful for tasks related to shape understanding and orientation, which are two important features of atlases. Challenges in both service-oriented architecture and 3D visualization concern mainly interoperability issues and thus, the use of standards. Indeed, the goal is to be able to offer a 3D web atlas that does not require any plugins and can be displayed directly in the browser.   A technology review is conducted regarding available solutions for web services, architectures and 3D graphic data format to show the strengths and weaknesses of possible solutions for a web 3D atlas prototype. Furthermore, we will develop a set of requirements for 3D web atlases based on the review of existing digital atlases and geoportals, both 3D and 2D, as well as on empirical experience through the conception of a prototype. A list of functions found in digital atlas is used to organize the review process. Three groups of requirements are defined for a total of sixteen system requirements, visualization requirements and interactivity requirements.   Then, we will explain the architecture used for the prototype and its implementation and discuss their strengths and weaknesses based on the requirements. The prototype offers a panorama view and a block diagram view. For the first one, it uses a combination of a Web Map Service (WMS) and a Perspective View Service, called Globe Capture, to display a perspective view of the landscape with thematic data provided through the WMS. The second view presents a portion of the landscape as a 3D block using WebGL, while the texture is provided by WMS. We will show how web atlases can use these technologies and what are their weaknesses and strengths using concrete examples.   Finally, we will give an outlook on future trends in the area of web atlases, especially regarding the development of standards for additional web services, such as web services delivering 3D symbols, billboards or DEM on the fly.

2F.3 | **The Power of 3D Real-Time Visualization in Atlases – Concepts, Techniques, and Implementation** (#560)

R. Sieber, R. Schnürer, R. Eichenberger, L. Hurni

Institute of Cartography and Geoinformation; ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\178_proceeding.*

Visualization of geodata is experiencing an ongoing and striking public presence. Along with this geo-visualization boom, a strong trend towards 3D maps can be observed. 3D maps are not only visually pleasing and salient, 3D data and real-time display techniques are also increasingly available. From a cartographic point of view however, these 3D maps are often incomplete. The modeling process ends up with mere presentation of GIS data while omitting the final step of cartographic map creation. Yet, cartographic methods should be applied to clearly show relevant structures and processes in space and time. Cartography however still lacks in a comprehensive theory and coherent concepts for handling and displaying 3D data. Therefore, the mission of research is to explore and finally to build up such cartographic concepts for 3D visualization in real-time. 3D atlases – e.g. based on a Virtual Globe rendering engine – are well-suited platforms to apply and to prove these concepts. They unify different types of geographic data regarding thematic content, spatial and temporal resolution, and visualization variations. In this article, we suggest a *3D visualization concept* where all maps are generally treated as 3D representations. Thus, 2D maps are intrinsically just a special case of 3D maps. Vice-versa, 3D maps should also be available in a 2D viewing mode. Instead of using a Mapping Plane, 3D maps rather build up a *Mapping Space.* The Mapping Space may consist a) of mere *topographic or thematic 3D surfaces,* b) of *generic or real 3D objects* out of points, lines, areas, and volumes, or c) of a reasonable combination of both. For example, a heat map would represent the thematic surface type, whereas a prism map would stand for a generic set of extruded area objects (choropleths). Based on this map object classification, a matrix of *cartographic 3D representations* will be developed. This is achieved by varying the *degree of abstraction,* the *surface offset,* and also by using different *3D visualization techniques.* The *abstraction level* takes account of the level of detail and generalization of 3D surfaces and map objects. The *surface offset* describes their individual position in relation to a corresponding surface. This enables structuring information on different levels within the Mapping Space (e.g. by amount, time, interest, importance) when dealing with multiple themes. *3D visualization techniques* may include texture overlay and draping, billboards, floating layers and anchoring, shape extrusions and solid modeling. In order to achieve a cartographically well-designed map, we next have to apply common *visual variables* (size, color, shape, texture, transparency, etc.) to 3D map objects. On a more general level, *ambient variables* (atmospheric effects, haze, cast shadows) *and depth cues* (size gradient, occlusion, shading, etc.) have to be considered. The matrix-setup is intended to finally cover most of the 3D representation types. It can be used for a general classification but also for a suitability assessment within a 3D map or a 3D atlas. To illustrate the described techniques, we implement a set of real-time 3D visualizations by means of the Atlas of Switzerland. The next generation of the Atlas of Switzerland, currently being developed, is designed as an online 3D atlas, based on an atlas platform concept called AtlasPlatformSwitzerland (APS). The APS itself relies on a Virtual Globe as a 3D rendering engine. The Virtual Globe engine is capable to process and display a huge amount of topographic and thematic data in near real-time. This allows amongst others an interactive exploration of the data. Data sets in our tests cover various kinds of topics (e.g. flight routes, glaciers, and settlements). Thereby, the APS serves as an ideal test-bed for proving the adequacy and applicability of the proposed concept. At the same time, it demonstrates the usability and the power of 3D real-time visualizations in online maps and atlases.

2F.4 | **Web atlas technology as a tool of Czech Official Development Assistance**

(#478)

J. Pánek[1], R. Nétek[2], A. Vávra[2], V. Voženílek[2]

[1]Palacky University in Olomouc, Department of Development Studies, Czech Republic; [2]Palacky University in Olomouc, Department of Geoinformatics, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\96_proceeding.*

The Czech Republic expresses solidarity with the people in developing countries and feels their share of responsibility in addressing global problems that are largely related to poverty. Official Development Assistance (ODA) is a fully-fledged part of the foreign policy of the Czech Republic and contributes to the achievement of its objectives. The Czech Development Agency´s (CZDA) core responsibility is to ensure general public support for ODA. The web atlas of Czech ODA created by the Departments of Development Studies and Geoinformatics, both of Palacky University in Olomouc, brings the new dimensions of geotechnologies and digital cartography into the workspace of the CZDA. The Atlas of Czech Official Development Assistance (AODA) is a multimedia web atlas application for the ten priority countries receiving Official Development Assistance from the Czech Republic. Using the Atlas, all Czech institutions interested in international development cooperation as well as high-school teachers (which are the target groups) can obtain access to many thematic maps (physical, socio-economic, sectional and focused on the territorial priorities of Czech ODA). They are also able to get basic information on individual countries and relevant Czech projects funded by CZDA. In the Czech Republic the comprehensive application, which characterises priority countries and projects did not exist for many decades. Palacky University in Olomouc builds awareness of international cooperation not only in students and teachers but also in the wider public through diverse information sources and studies with an emphasis on attractive and user-friendly graphical user interfaces. The paper will outline the methodologies followed and technologies used in the process of creating the Atlas of Official Development Assistance as well as the results of teachers' involvement within the process. Secondly the paper will share best practices experienced during the implementation of ArcGIS for Flex as an example of Rich Internet Application (RIA). Thirdly, it will demonstrate how web atlas technology can be used to improve general public support for Official Development Assistance. The AODA atlas is the first web-based multimedia product aimed at awareness of, and education and support for official development assistance in the Czech Republic. Through the Atlas all target groups of users (students, teachers, the general public) can be involved, either passively by mastering knowledge about the problems of developing countries or actively by using the information gained in the planning and implementation of development projects. Although many web atlas developments have taken place, a number of challenges still remain. Exposed to the rapid developments in technology and their extensive applications in the world, the advances in visualisation still lag behind many countries. A gap still exists between research and application areas in the market. Consequently, the economic return from applications or the market is insufficient to maintain sustainable development, while there is not enough funding from organisation or foundation councils. Additionally, the knowledge divided between cartographers, computer scientists and subject experts, in this case development cooperation workers, causes the web atlas to be more technically oriented than subject oriented. Finally, the communication between map designer and atlas users needs to be strengthened because there is no good map without an understanding of what users need from an atlas.
Acknowledgement The Atlas of Czech Official Development Assistance is supported by the Ministry of Foreign Affairs of the Czech Republic and the Czech Development Agency.

ORAL

Session S2-G

Playing with Maps

Monday, 26 August, 2013

16:30 - 17:45

2I.1 | **Playful mapping: the potential of a ludic approach to cartography** (#973)

C. Perkins

University of Manchester, Geography, SED, MANCHESTER, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\121_proceeding.*

This paper draws on conceptual encounters with the literatures of STS, Visual Studies, Cartography and Game Studies, and sets these against empirical evidence, to advance an argument about maps and play. Cultural commentators argue that play is increasingly important in contemporary society (Raessens 2010; Bauman 1995), arguably the most important cultural signifier in many people's lives. It is no longer just a matter for children. Play allows different kinds of capital accumulation, when work is often unfulfilling, or unavailable. Aesthetic forms and performance of postmodern ways of being depend upon novel assemblages of technology, that themselves encourage a ludic engagement: the widespread diffusion of consumer electronic technologies (such as smart phones, media players and digital cameras) networked across society, and out of the workplace, is associated with modes of interaction such as 'being friendly, playful, pleasurable, aesthetically pleasing, expressive, fashionable, signifying cultural identity, and designed for emotional satisfaction' (Manovich 2006:1). And in the academy a focus on style, irony, and intertextuality signifies a rising interest in playing with ideas. New discipline areas such as game studies offer novel interpretive lenses, with which to appreciate these changes. This paper makes the case that *all* mapping is playful. It builds on Perkins (2009) arguments for a playful rethinking of mapping, and explores the need for a context-driven and performative understanding. Informed by Sutton Smith's (1997) focus on the ambiguity of play, it highlights some of the ways in which all mapping might be at once: progressive; random or unpredictable; powerful; a shared part of the practice of different social identities; imaginative; but also very much about individual behaviour and affect. Drawing upon Kitchin and Dodge's (2007) notion of mapping's ontogenetic potential, it explores how mapping technologies call particular playful encounters with the world into being, and explores the extent to which mapping, like play, might at once offer immutable and mobile views or the world, but also yield mutable, hybrid, relational and dynamic understandings of embodied mapping. This process entails a playful production and design of different mapping products. Examples of different kinds of conventional production exemplify the open-ended and playful nature of all map-making, but the turn towards collaborative cartography of crowd-sourced mapping projects such as OpenStreetMap is particularly appropriate. However, deploying mapping may also be profitably be understood as a quotidian, banal but taken-for granted, everyday kind of playing with maps. Instead of a fixed or mimetic view of a mapped world I argue that a performative understanding of map *use* may be analogous to a playful encounter with the image, or interface, best apprehended by novel methodologies, including ethnographic and auto-ethnographic accounts of situated mapping. In certain contexts these encounters may be particularly playful, and their forms morph as fashion drives cultural trends. The continuing growth in the popularity of mobile-based locative gaming apps, available on smart-phones, and developed in the last four years, has significantly increased mass-participation in mapping. People are literally playing *with* the map, instead of playing *on* the map as a game board, and their interaction with its navigational interface, offers a powerful new cultural form, calling forth new rhetorics, narratives, symbologies, ethics and mapping practices. The mashed up, overlain, ambiguities of augmented reality and locative gaming are arguably more meaningful to younger people, than almost all of the mapping described elsewhere in this ICC programme. It's time for cartographers to pay more attention to these playful mapping worlds, learn from STS-inflected studies of techno-scientific practices, and recognize the potential of a ludic approach to mapping!

2I.2 | **The casual turn: politics, play and mapping** (#945)

S. Hind[1], A. Gekker[2]

[1]University of Warwick, Centre for Interdisciplinary Methodologies, Coventry, Great Britain; [2]Utrecht University, Media and Culture Studies, Netherlands

A full-length version is available and can be opened here:

_extendedAbstract\137_proceeding.*

How can we re-think the political map and the art of political mapping as a casual, ludic and quotidian practice? In this paper we aim to re-examine political maps in relation to the ongoing 'ludification of culture' (Raessens 2006; Pargman and Jakobsson 2008), foregrounding the embedded nature of gaming and game-playing in habitual cartographical practices of contemporary life. The field of Cartography has a long and twisted history of theorizing the political in maps, from the 'strategic silences' of early nation-state projects (Harley 1988), and the post-colonial negotiation of native oral histories (Sparke 1998) to the tracing of secret CIA rendition flights (Paglen and Emerson 2007) and the subversion of urban surveillance networks (Institute for Applied Autonomy 2007). However, in all of these accounts we can now readily identify the political themes. For cartographers, hidden agendas, post-colonial narratives and surveillance techniques constitute a form of 'big P' Politics, usually centred on power, counter-action and radical opposition, more-or-less constituting the map as a deterministic method of political control, and thus readily amenable to academic analysis (Krygier and Wood 2009; Wood 2010). But if political agency is diffused through the interstices of everyday life – embedded in, and flowing through, digital devices and media – how can we conceive of micro-events that nevertheless retain a subtle, political edge? This paper contends that we must radically re-consider our understanding of how maps can be enrolled in everyday forms of political action and what those political forms may be. We introduce the term 'casual politicking' to help in orientating approaches to political mapping in three ways. Firstly, we allude to the ephemeral and fleeting nature of quotidian mapping practices, paying particular attention to how such practices are often folded into much larger, but nonetheless routine, banal, and repeated actions. Here, we contend that maps are rarely deployed *in vacuo* (in isolation, alone, separate) but instead *in medias res* ('in the middle of things'). Secondly, we also situate this interest in quotidian mapping practice within the 'casual turn' (Juul 2010) in new media studies. Primarily to understand how users create their very own mediated play-spaces in everyday schedules through a process of 'gamification' (Detarding et al. 2011). We theorize as to the implications of this casual turn, understanding how small, almost cursory, attempts to engage with the standardized ontic knowledges of map- and game-based applications are changing the ways in which we sense playful information and conceive of geographical phenomena (Thrift 2005). As harmless as they might seem, games and play are serious business. From the precarious nature of the labour conditions of unpaid games modifiers (Kücklich 2005), to the usage of video games for military recruitment (Nieborg 2005), or the parody personas of politicians on social networks (Wilson 2011), the materiality of game-playing is a nuanced affair. Following the rising tradition of locating (casual) play in unexpected places, we wish to shed light on its varying and often complex aspects, extending the notion of political mapping to include such ludic moments. Thus, in the final strand of this paper, we chart the rise of micro-political action that attends to our suggested notion of 'casual politicking' as a framework for theorizing the rise of ludic media, mobile mapping practices, and the digitization of everyday life.

2I.3 | **You Are Here! Playful Mapping, Haptic Navigation and a Cartography of Layers** (#947)

N. Verhoeff
Utrecht University, Departement for Media and Culture Studies, Netherlands

A full-length version is available and can be opened here:

_extendedAbstract\432_proceeding.*

This paper brings together Science and Technology Studies, Game Studies, and Media- and Performance Studies in a reflection on performativity and deixis in digital mapping practices and mobile interfaces for navigation and play. Playful mapping practices and the shift from the map as form of representation to the map as interactive, if not ludic, interface for navigation point towards the performativity of our engagement with the map as tool to *think* with, as well as tool to *do* with. In this contribution I will take up the proposals for considering mapping practices as a playful (Perkins; Lammes and Wilmott) and casual (Gekker and Hind) – trends of what has been called a “casual turn” (Juul 2010), or a ludification of culture (Raessens 2010) – and extend on my argument about navigational interfaces and navigation as a performative practice (Verhoeff 2012). I will consider how, through the centrality of these practices, the map is the interface for a subject-centred, *deictic* and haptic engagement with space. Moreover, I will suggest how the digital map as interface for time-based ludic practices, provides a *layered* cartography of space. The quintessential phrase of “you are here” is used not only in maps to provide a deictic centre (Pierce) for reading the map, by synchronizing the presence of the map-user in time and space with the virtual positioning of him/her “in” the map. The phrase also invokes the playful act of stating the presence of the player in spatial games like hide and seek, or digital equivalents in location-based games. It is a statement that relays relative (spatiotemporal) positing as well as its inclusive potential for both going and doing: the knot of *presence* and *performativity* so central in both navigation and play and which entails a *haptic engagemen*t with space. Elsewhere, I have began to conceptualize the temporality of deixis in cartographic interfaces of augmented reality and location-based gaming (Verhoeff 2012). Here, I will zoom in on the consequences of our consideration of a time-based notion of the cartographic interface, the deictic essence of play, and the performative impulse that characterizes the map as a tool for navigation. November, Camacho-Hubner and Latour (2010) evaluate digital cartography as what they call a navigational definition of the map, which includes anticipation, participation, reflexivity and feedback. This yields a differentiation between a navigational versus mimetic, interpretation of the map as representation, as well as a ludic and performative understanding of navigation. Following this ludic and navigational definition of the map, and by foregrounding the nature of performativity, the object of my approach in this paper is to conceptualize the way in which ludic practices of navigation (co-) construct a cartography of layers.

2I.4 | **Mapping the city, playing the city: Location-based apps as navigational interfaces.** (#956)

C. Wilmott[1], S. Lammes[2]

[1]The University of Manchester, School of Environment and Development, Great Britain; [2]The University of Warwick, Centre for Interdisciplinary Methodologies, Coventry, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\263_proceeding.*

In this paper we will examine how maps in location-based mobile applications (apps) are used as surfaces on which users can inscribe and play while on the move in urban environments, using their position and other local information surrounding them. We will look at different location-based apps to which maps are central as a playing surface. Our main argument will be that such cartographical location-based apps foreground the fluidity of mapping and emphasise the performative aspects of playing with maps. As such they are not representations used by players for consultation, but they produce new social spaces (Lefebvre 1991). It therefore does not suffice to conceive maps in such games as “mimetic interfaces” (Juul 2009). Instead they should be approached as what we will call navigational interfaces (cf. Verhoeff 2012). To understand them as such we will combine perspectives from game-studies with those developed in Human Geography and Science and Technology Studies (STS). With the emergence of smartphones, many highly popular applications have been developed in which digital maps are used for more purposes than just solely finding your way. Since it has become increasingly common for people to have smartphones in their pockets with GPS and Internet connections, a myriad of applications have been put on the market which invite users to engage with mapping for playful activities. Some of these applications may be called quasi-games because they do not have very well established rules and are positioned between social networking tools and games (e.g. Foursquare, SVNGR, Gowalla). Such quasi-games definitely entail play-like elements in relation to maps, but one can debate their (often promoted) status as games (cf. Glas 2011, Deterding et al. 2011), contrasted against other location-based apps that, instead, have well-established rules and game mechanics. In this paper we will analyse and compare such games and quasi-games, examining how playing and mapping are reciprocally constructed and how games and quasi-games compare in this respect. We will focus on apps that use maps of the physical environment surrounding the player as a graphical user interface. So, instead of just containing links to maps (e.g. City Secrets) or employing fantastical maps (e.g. Bounty Island), these apps contain maps that renders visible the actual location of the user is the central game-board on which players make their moves. Pivotal to our analyses of these (quasi) games will be how players interact with and give shape to these maps, how maps simultaneously function as (urban) navigational interfaces and game-boards and how the cultural meaning of maps as game-boards shifts in such location-based apps. Location-based apps that use the map as a digital game-board open up new possibilities for users to re-think and reflect on how maps generate practices that shape our understanding of spatial relations. They ask players to use their phones as navigational interfaces for hybridizing the map as game-board with their social playground. This generates a different awareness in which categories such as inside/outside, object/subject, play/non-play, map/tour, real/virtual become contested and the social production and performative character of maps is foregrounded.

ORAL

Session S2-H

EuroSDR/COST/ ICA

Monday, 26 August, 2013

16:30 - 17:45

2H.1 | **EuroSDR and Volunteered Geographic Information** (#1484)

D. Fritsch
Universität Stuttgart, Institut für Photogrammetrie, Germany

No abstract or full paper available.

2H.2 | **The Joint AGILE/EuroSDR Project on Crowd-Sourced Mapping** (#1485)

P. Mooney[1], J. Morley[2]

[1]National University of Ireland Maynooth, Computer Science, Ireland; [2]University of Nottingham, Geospatial Institute, Great Britain

No abstract or full paper available.

2H.3 | **The OSM-GB Project: Data Analysis, Data Quality and Web Service** (#1486)

J. Morley

University of Nottingham, Geospatial Institute, Great Britain

No abstract or full paper available.

2H.4 | **Understanding the activity of contributors to VGI projects. How, why, where, and when do they contribute geographic information?** (#1487)

P. Mooney

National University of Ireland Maynooth, Computer Science, Ireland

A full-length version is available and can be opened here:

_extendedAbstract\448_proceeding.*

The crowdsourced collection of geographic information (Volunteered Geographic Information VGI) has moved to the center of the research agenda in Web technologies and GIS. Much of the current VGI research is tightly coupled with issues related to the quality of the collected geodata and possible conflation or comparison with other official sources of geodata. This paper presents research which attempts to quantitatively understand the activity patterns of citizen contributors to VGI projects. We argue that the concept of a large unbounded crowd of citizen contributors is something of a misnomer and that majority of work carried out in VGI collection and management is performed by a small, potentially, unconnected 'crowd' of contributors. We attempt to analyse how, why, where , and when these contributors work with VGI projects. OpenStreetMap is used as a case-study VGI project.

2H.5 | **Conflation of National Mapping and Crowd-Sourced Data – A Comparison of Two Different Approaches** (#1488)

Z. Liu, V. Walter, D. Fritsch
Stuttgart University, Institute for Photogrammetry, Germany

A full-length version is available and can be opened here:

_extendedAbstract\450_proceeding.*

Along with the increasing power of Geographical Information Systems (GIS) there is an increasing demand for spatial data. National and private institutions collect spatial data in different data models and scales in order to meet this demand. Additionally, huge amounts of spatial data are collected in Web 2.0 mapping portals. The result is a multiple representation of the same topographic objects of the landscape. The aim of this project is to investigate the integration of such datasets. We use datasets from a National Mapping Agency (NMA) and from a Web 2.0 mapping portal. The integration will be done with conflation techniques. Conflation can be summarized as the process of integrating geographical datasets, combining multisource data, improving data quality, and updating spatial information. In this study, two programs (ifp conflation program and Radius Studio) are used to conflate ATKIS and OSM datasets in two test areas. The relative accuracy of the source datasets and the conflated datasets are evaluated by overlap analysis. A basic buffer overlap and an increment buffer overlap are calculated to examine the difference of datasets.

ORAL

Session S2-I

ESRI Plenary Session

Monday, 26 August, 2013

16:30 - 17:45

PLENARY

Session KN-2

3D Spatial Monitoring of Marine Animals: Real-time and Archival Systems

Tuesday, 27 August, 2013

08:30 - 09:15

KN-2 | **3D Spatial Monitoring of Marine Animals: Real-time and Archival Systems** (#1503)

<u>I. G. Priede</u>
Oceanlab, Newburgh, Great Britain

No abstract or full paper available

ORAL

Session S3-A

Quality Assessment and Uncertainty

Tuesday, 27 August, 2013

09:15 - 10:30

3A.1 | **Map Quality Assessment – Groundwork and Implementation Approach**

(#465)

L. Tsoulos, N. Blana

National Technical University of Athens, Surveying Engineering, Zographou, Greece

A full-length version is available and can be opened here:

_extendedAbstract\154_proceeding.*

Map quality refers to the overall characteristics of the map considered as a communication and reference medium for measurement and decision making. The better the quality of the map/chart the more efficient its utilization by the users community will be. In map quality assessment the problem lies with the definition and quantification of the quality characteristics of the map/chart which could lead to an overall quantified estimation. The definition of map quality may be constituted of different parameters, which either focus on the consequence of cartographic communication and thus provide a holistic description of the communication process quality or concentrate on specific parts like semiotics (for a selected purpose of map-use), structuring of semantic map content, primary model data-quality (as result of consistency of a database) or similar. Existing bibliography refers to a number of efforts addressing the issue of map/chart quality, which deal with certain elements of quality i.e. positional accuracy of the portrayed features, but not with an overall quantitative assessment of the map/chart. Two factors are considered important in producing a map/chart according to the relevant specifications and the users' needs: a. The utilization of spatial data of known quality, which will have been based on internationally adopted data quality standards and b. The quality control of the derived data in every phase of map composition process. Spatial data of known and acceptable quality is not by itself adequate to confer map quality therefore the quality level of the input spatial data cannot be considered as a quality measure of the resulting map. This issue arises due to the transformations performed on input spatial data in every phase of map composition process. Cartographic data quality control and assessment are the only ways to ensure that - in every phase of map composition process – input data will be transformed in a way satisfying the set specifications and will result to a product of known and acceptable quality. In spatial data production and especially in the framework of spatial data infrastructures, a constant effort in controlling data quality is in place. A typical example of this effort is the data quality model developed as a result of the ESDIN project, which is based on the ISO 19100 series of standards and the INSPIRE specifications on data quality. On the contrary, quality assessment process in map production is limited and research results have been published on quality evaluation of the derived cartographic data mainly due to generalization. Undoubtedly there is no formal approach for the development of a quality model covering the map composition process as a whole. This paper elaborates on the issue of map quality assessment and presents part of an ongoing research on the development of a map quality evaluation methodology. The formulation of the proposed method is based on two assumptions: a. The map composition process constitutes of a series of processes/phases which are performed in digital environment b. A map is composed through the compilation of data, which undergo a number of transformations/alterations in every phase of the map composition process. Map quality assessment will result implicitly through the evaluation of cartographic data quality in each and every stage of map composition process considering that the input data satisfy minimum quality criteria. The execution of the map quality model in each phase of map composition process will facilitate the evaluation of the overall map quality.

3A.2 | **Digital elevation model quality assessment with no ground control** (#354)

L. Polidori, M. El Hage, E. Simonetto

CNAM / L2G, Le Mans, France

Digital elevation model (DEM) quality assessment is often based on the distance between the data and a set of ground control points obtained through another technique. In this usual case, an error can be derived from the statistical behaviour of the discrepancies, and the quality of a DEM can be expressed with quantitative indicators such as 3D RMS errors. The spatial distribution of the discrepancies can also be used to identify systematic modelling errors or the influence of landscape characteristics such as relief or vegetation.   However, this approach has two major limitations: - The statistics of the discrepancies is meaningful only if an important set of control points is available, and they are supposed to have a much higher accuracy than the DEM, so that it may be difficult to identify responsibilities between providers of DEM and ground control points. - A high absolute accuracy of the elevation cannot guarantee the quality of shapes, which is rather based on the accuracy of elevation derivatives such as slopes, aspects or curvatures.   In order to overcome these limitations and to offer a wider range of possibilities for DEM quality assessment, an internal control can be considered. This approach consists in verifying that a number of fundamental properties of the Earth's relief, which are supposed to be true everywhere, are respected in the data. In other words, it is a control of the geomorphological realism of the DEM. Two main kinds of Earth's relief properties will be considered, namely, physical properties (such as the fact that rivers always flow down) which can be used to detect local artefacts in the DEM, and statistical properties (based of geostatistical indicators such as the histogram of terrain slopes), which can be used to reveal systematic artefacts or an overall lack of realism.   These hypotheses need to be easy to verify, but they must also be scientifically justified. Indeed, they depend of invariant factors (such as the gravity field which is approximately constant and has the same impact of the Earth's relief everywhere) but also non-uniform factors such as regional lithostructural properties. They may also depend on scale, since high resolution DEMs (with 1 to 10 meter mesh size typically) are likely to integrate vegetation and man-made structures, while medium resolution DEMs (with 10 to 100 meter mesh size) are more likely to express the natural morphology of the Earth's relief. These restrictions limit the internal limitation approach.   The relevance of these criteria and their contribution for DEM quality assessment will be discussed as well as their potential applications for operational altimetric cartography and scientific research (geophysics, planetology).

3A.3 | **The Certainty of Ladscape Degradation?** (#243)

R. Bacova, J. Jakubinsky, E. Svobodova, P. Kubicek, V. Herber

Masaryk University, Faculty of Science, Department of Geography, Brno, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\223_proceeding.*

The main reason of this paper is the tendency of users to consider computer-generated maps for correct and uniquely identifying a given phenomenon. This study has an ambition to promote the natural critical thinking and to refine the decision making by GIS applications. Especially in natural risk management the critical and spatial thinking is indispensable. The basic facts are linked to the project GeoRISK: Geo-analysis of landscape level degradation and natural risks formation. Project is trying to confirm the dependence of high level landscape degradation and propensity to natural risks emergence. This multidisciplinary approach is applied to model catchments with different natural conditions in the Czech Republic. Uncertainty is generally considered as a quantitative or a qualitative variable characteristic of the spatial, typological or temporal value of reference attribute. Its origin is evident in all stages of modelling reality. It arises in the collection, transformation, and visualization of a geodata. These causes of its formation are influenced by the using technology, the human factor, and by a visualization and communication of geographic information. The intention of this paper is promoting the concept of uncertainty and supporting the quality of decisions and interpretations models of the real landscape degradation, maps of man-made landforms in river landscape. The importance of river landscape studies is to identify the global environmental changes in the regional and local scale. The various human activities in different regions, river catchments, determine the degree of ecosystem´s interference. The hydro-morphological forms, land-use changes of risky territories have been mapped during the detailed field survey. Specifically the inventory of anthropogenic landforms and ecosystem services evaluation will be investigated there. Thus identified the most degraded regions will be compared with areas at risk of floods and landslides. By the supplementation of observed characteristics to spatial and thematic uncertainty characteristics the reliability pattern will be obtain. During the study a strategy for the identification, quantification and communication uncertainty in spatio-temporal models and geographical analysis will be developed. There will be created a method for using of uncertainty in landscape degradation. Attention will be primarily focused on the temporal and positional uncertainty, which is not yet adequate addressed in the Czech Republic. Furthermore there will be designed possible multidimensional (multiple kinds of uncertainty) representation of uncertainty.

3A.4 | **Uncertainty modeling of glacier mapping and morphology estimation, in Arctic** (#921)

X. Zhao, S. Ai, X. Pang
Wuhan University, Chinese Antarctic Center of Surveying and Mapping, China

A full-length version is available and can be opened here:

_extendedAbstract\125_proceeding.*

In the light of global climate change, glacier mapping and the determination of glacier volume become important subjects of research (Binder et al. 2009). The accuracy of surface elevetion and bedrock mapping as well as the uncertainty propagation in the volume estimation will directly influence the quality of future modeling such as in climate change, sea-level rise or montain hydrology (Fischer 2009, 2011). Does the surface elevation derived from sparse GPR(ground-penetrating radar) data have sufficient accuracy to delineate the local bedrock undulations? Do the slight volume decrease of a glacier and its terminus retreat that estimated from observations are reliable evidences for supporting the climate warming statement, rather than false alarms caused by large uncertainty embeded in the information extraction process? Bearing these questions in mind, data quality and uncertainty modeling should be placed in a crucial role in the glacier mapping activities. Previous research on glacier volume calculation and surface and rockbed DEM have been concerning the error distribution, in independent and specific applications (Ai et al. 2006; Binder et al. 2009; Fischer 2009, 2011). This study propose a framework for uncertainty modeling of glacier mapping and morphology estimation in general, by first analyzing the sources and distributions of uncertainty and then integrating them in a stochastic model-based method. The Markov chain Monte Carlo method is implemented within the statistical framework, enabling us to take account of all sources of uncertainty, their interaction and propogation to the final model output. The developed method is then applied to the mapping and volume estimation of two glaciers in Arctic, namely Austre Lovénbreen and Pedersenbreen. These two glaciers were invistigated during the April of 2009. 32 sampling transcets and more than 34000 point samples were designed (Fig. 1). At each sampling point, the position was read from GPS and the ice-thickness was derived from GPR. We analyze the error distribution of the sampls, quantify how the uncertainty distribution propagate through data processing steps such as interpolation. Finally, the surface DEM, bedrock DEM, spatial distribution of ice-thickness and their uncertainty are mapped. Moreover, tipical ice profiles derived from GPR are demonstrated, important glacier morphological parameters are estimated with quality reports, and the area needing future feild survey are identified. **References** Ai ST, E DC, Yan M, Ren JW (2006). Arctic glacier movement monitoring with GPS method on 2005. Chinese Journal of Polar Science, 17(1):61-68 Binder D, Brückl E, Roch KH, Behm M, Schöner W, Hynek B (2009) Determination of total ice volume and ice-thickness distribution of two glaciers in the Hohe Tauern region, Eastern Alps, from GPR data. Annals of Glaciology 50(51):71–79 Fischer A (2011) Comparison of direct and geodetic mass balances on a multi-annual time scale. The Cryosphere 5:107-124 Fischer A (2009) Calculation of glacier volume from sparse ice-thickness data, applied to Schaufelferner, Austria. Journal of Glaciology 55(191):453-460

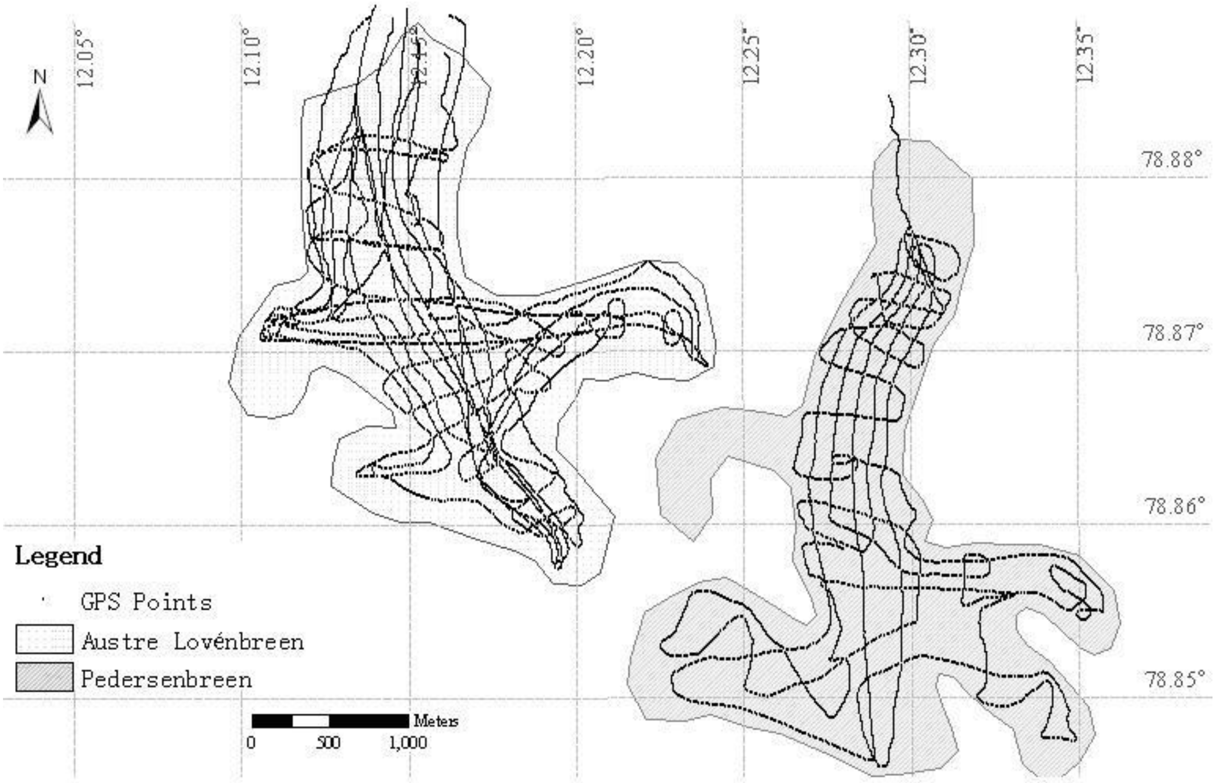


Fig.1:
Spatial distribution of sampling points on two Arctic glaciers

ORAL

Session S3-B

Maps and Security

Tuesday, 27 August, 2013

09:15 - 10:30

3B.1 | **Forensic mapping in South Africa: four examples** (#411)

P. Schmitz[1,2], C. Eloff[1], R. Talmakkies[3], C. Linnen[4], R. Lourens[5]

[1]CSIR Built Environment, Spatial Planning Support, Pretoria, South Africa; [2]University of Pretoria, Department of Geography, Geoinformatics and Meteorology, South Africa; [3]South African Police Service, Branch Commander, CID Witbank, South Africa; [4]South African Police Service, Provincial Command Centre, Cape Town, South Africa; [5]South African Police Service, Stock Theft Unit, Malmesbury, South Africa

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 238-247

Forensic mapping has been used successfully in South Africa to bring criminals to book. This paper discusses four examples of forensic mapping applications used in courts as evidence ranging from murder, kidnapping to stock theft. These four cases necessitated various approaches to display the information in court. A single map was used in the first case example. The second murder case example a storyboard approach was used to portray the events surrounding the murder. Several maps in a presentation format were used to illustrate the suspects' involvement in stock theft. The last example consisted of a report that included several maps to indicate the suspects' involvement in the crime. The conclusion is that the mapping approach must be appropriate for a specific court case to convey the evidence as clear possible to the court.

3B.2 | **An Anti-compression Fragile Watermark Scheme for Vector Geographical Data** (#886)

C. - Q. Zhu, Q. - S. Wang, N. Ren, W. Wu

Nanjing Normal University, Key Laboratory of Virtual Geographic Environment of Ministry of Education, China

A full-length version is available and can be opened here:

_extendedAbstract\886_abstract.*

3B.3 | **A Digital Watermark Algorithm for Tile Map Stored by Indexing Mechanism** (#891)

N. Ren[1], C. - Q. Zhu[1], S. - J. Ren[2], Y. - S. Zhu[1]

[1]*Nanjing Normal University, Key Laboratory of Virtual Geographic Environment of Ministry of Education, China;* [2]*Xi'an Division of Surveying and Mapping, Xi'an, China*

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 079-086

With the fast development of various applications for map service, the construction and development of the site of Google map have attracted a growing interest from the scientific and industrial communities recently. However, while dealing with tile map in web service publication, a crucial issue of copyright protection arises. The purpose of this paper is to propose a novel mapping mechanism based watermarking algorithm for tile map, in such a way that the invisible and robust watermark information could be embedded effectively. Thus, the confidential and secure communication of tile map is obtained in the network. The characteristics and requirements of tile map stored by the indexing mechanism are analyzed firstly, which could help the application of the watermark embedding. Then, the watermark generated by *m* sequence is embedded in the blue channel by using the mapping mechanism. Finally, the experimental results are given to confirm that the proposed algorithm is robust to shearing, splicing, rotating, and additive noise.

ORAL

Session S3-C

Augmented Reality and Sound

Tuesday, 27 August, 2013

09:15 - 10:30

3C.1 | **The perception of information conveyed by graphic variables building point signatures in the Augmented Reality system on mobile devices** (#802)

L. Halik

Adam Mickiewicz University in Poznań, Poland, Department of Cartography and Geomatics, Poznan, Poland

Significance of the research Research shows that over 80 percent of all information has some spatial reference. The figure shows the importance of the issue of optimizing the presentation of spatial information. In the age of the information society, quick access to clearly defined and intuitively understood data can assist communication and decision making processes **Research project objectives** The key research objective of the project undertaken is determining the impact of each graphic variable and combining them together to create a point signature in the Augmented Reality system and analyze the perception of the transferred information. Another scientific goal will be to determine the effect of different ranges of values of the graphic variable on the level of communication between the point signature and the recipient in the Augmented Reality system on mobile devices in terms of vertical (zoom level) and horizontal (number, type of display objects) presentation of cartographic content. **Research methodology** Summary of visual static variables occurring in literature (Figure 1). Analysis of the visual variables building signatures of selected analog tourist maps / topographic maps and computer navigation maps. Creating a signature sets with different parameters of the visual variables. Testing the sets of signatures on a group of 20 volunteers who received the questionnaire, and whose behaviour was video recorded. Analyzing obtained results and formulating conclusions **Conclusion/implication** The selection of the appropriate visual variables significantly affects the perception of the information carried by the signature. The study demonstrated that some of the visual variables that have so far rarely been used on traditional maps are gaining in importance when used in the Augmented Reality systems.

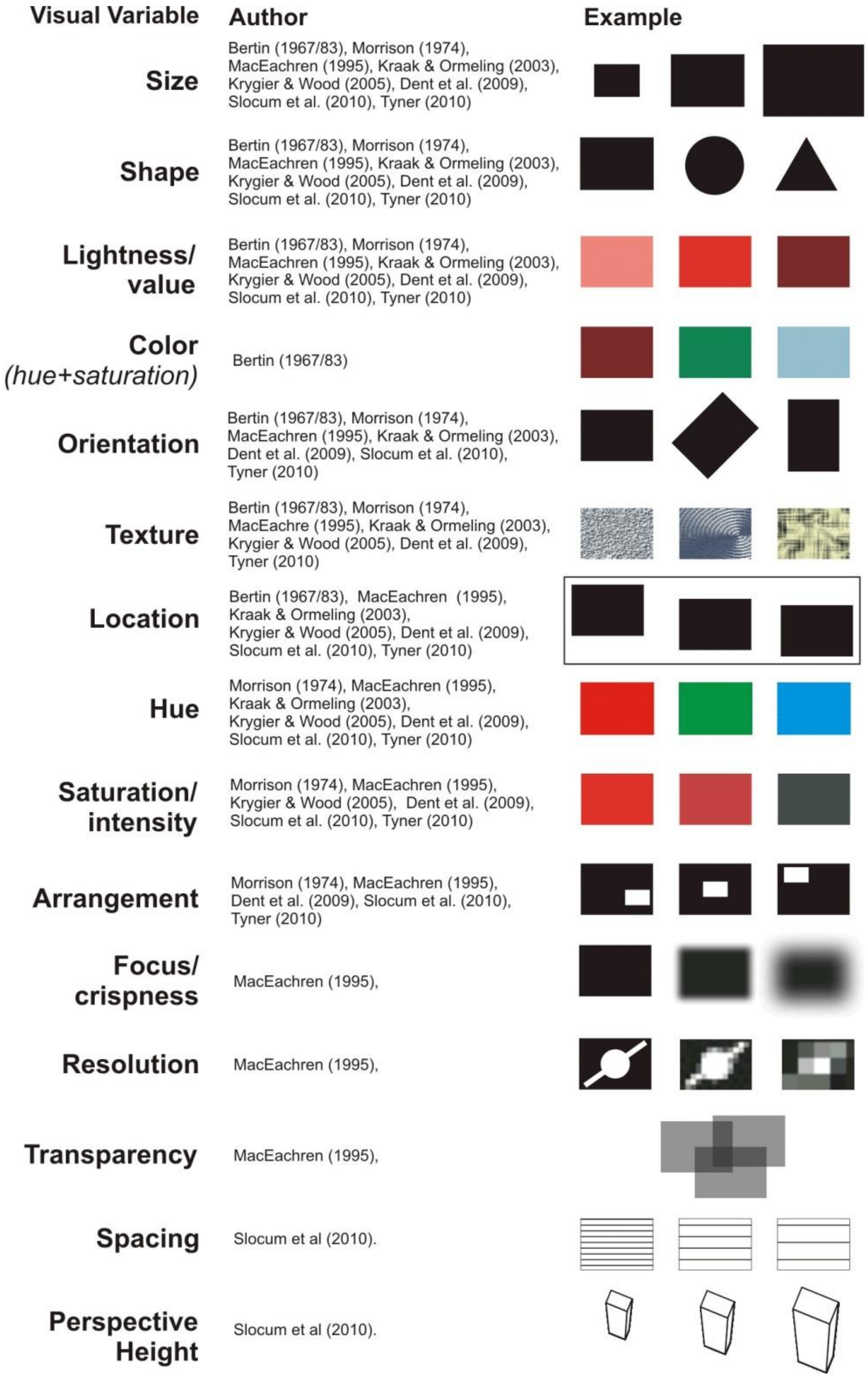


Figure 1:
Static visual variables in literature

3C.2 | **Maps with sound as the way of elevation representation** (#736)

A. Medvedev

Institute of geography of Russian Academy of Sciences, Department of cartography, Moscow, Russia

A full-length version is available and can be opened here:

_extendedAbstract\389_proceeding.*

At the present stage of development of cartography and geoinformatics the problem of organization and visualization of spatial data is one of the key problems, the object of study of many experts. In solving the problem of visualization and reporting efforts are reduced to the problem of representation in visual form of data or research results. Traditional tools in geography - maps, charts and graphs are not coping with the task of visualization, when you need to draw the object or the maximum transmit information to the human perception. Ways of elevation representation to now are the actual problem of cartography. Use of traditional methods along with modern technology gives a great tool for researchers. Modern geoinformation technologies enable high-quality and fast visualization of terrain by means of digital elevation models (DEM). All existing methods of imaging the terrain appear to us a graphical representation or model. In the concept of "Map" or DEM, topography appears to the user likes a graphics, rather than a set of coordinates and elevation levels than is actually a DEM. The study was conducted comparing the characteristics of sound waves and sound with a surface of the Earth at different test sites. Like all periodic oscillations, sounds consist of tens of sine waves of different frequencies. If the complex sound waves can be decomposed into simple components using Fourier analysis, perhaps the opposite - to build it from the individual components. Based on this method a program complex «Elevation Music» was developed, consisting of several applications to provide Earth surface by means of sound. Software system based on sound principle representation of elevation characteristics. Terrain transforms into sound waves through the following ways: - Comparing hypsometric profiles and sound waves - Areal sound representation - Streaming sound representation. To play a sound of relief , to make it “visible” one needs to modulate the relationship directly or indirectly with the sound map and the relief (digital map or DEM). Direct playback of relief with the help of sound and visualization of alignment, obviously, can be achieved only through direct interaction of sound with elevation levels. Such interaction is complex, so the implementation of the direct visualization of considerable difficulties. The advantages of this method is the ability to see and hear the audio playback and image at the same moments of time in which they occur, in other words, in real time. Indirect visualization of sound reproduction of the relief is a multi-step process and is carried out with a certain delay to the time of formation of the sound image. Unlike visualization, playback sound of relief primarily aims to play the image of the real picture for the person to hear and imagine. This is an extremely delicate operation scheme, since it is necessary to pick up very subtle sound effects to a person with poor vision for the presentation of the terrain. It should be noted that a sound method described above can be used to pass through the sound not only characteristics of relief, but other indicators of quantity and quality, and perform a number of other educational functions.

3C.3 | **«3D geovisualisation of Noise and Visual impact of a proposed wind farm development using a GIS based visual-acoustic 3D simulation»** (#612)

P. Apostolos[1], K. Themistoklis[2], C. Evangelos[3], S. Nikolaos[1]

[1]Aegean University, Geography, Mytilini, Greece; [2]Aegean University, Environmental Sciences, Mytilini, Greece; [3]Aegean University, Cultural Technology and Communication, Mytilini, Greece

A full-length version is available and can be opened here:

_extendedAbstract\246_proceeding.*

Wind energy market developments appear to be a complicated matter all over Europe. Planning, decision and implementation process often fails on the local level where social acceptance is the key issue for successful wind parks development. The location siting process of the wind park considers to be a very crucial factor on influencing the public acceptability. There are two factors that unrest both the local community and government; the first and most understandable from the public sector, is the impact of the new infrastructure in the aesthetic quality of the landscape and the second and less understandable is the noise annoyance factor. Both the above mentioned factors are correlated with the landscape morphology. They are also studied and calculated for every wind park planning and sitting process. The results of these processes are visualized using, as common way of communication with the public, the two-dimensional maps. Digital visual presentation of spatial related phenomena has been identified as an effective mean of communicating landscape related information with the public due to the new advances in computer visualisation techniques. Newly, policy makers and scientists are increasingly using of three-dimensional representations of environmental impacts as a tool of communication with the local government and local communities. 3Dgeovisualisations are emphasizing the transparency and the decoding of spatial information by extending the validity of the environmental representations in a more efficient way. The lack of the visualization tools used to improve the communication between policy makers and the local communities for wind farm facility development lead us to develop a new 3d geovisualisation approach of visual and noise impact for future wind park development. This specific research is concerned with discussing the methodology of 3Dvisualisation of digital spatial information relating to the potential visual and noise impacts of proposed wind farms development on the island of Lemnos. This paper documents an approach of constructing 3Dgeovisualisations using spatial analysis results deriving specific spatial noise and visual models. The visibility analysis of spatial models takes into consideration the land morphology combined with the real size of the wind turbines. The final results are two different maps; a binary map which shows whether or not a wind turbine is visible from every point of the island and a quantitative map showing the number of the wind turbines which are visible from each point in the study area. The developed noise spreading model is based on the International Energy Agency: Wind Turbine Noise Model and assumes that the noise spreads over the source either hemi-spherically or spherically. The noise model results in a map that shows for each point the cumulative noise caused by the wind turbines in the study area. In this approach the visual and sound spatial simulation results are used for the creation of 3D photorealistic geovisualisations with the noise emissions embedded. These 3Dgeovisualisations are created with the use of real wind turbines noise emissions. The final conclusions of this methodology are a) 3D prerendered videos with the real noise emissions as they derived from spatial analysis results and b) real time navigation in a virtual environment where the user is able to trigger specific “spatial noise items” in order to achieve the real noise emission into the virtual landscape. The results of the proposed 3D cartographic geovisualisation are compared with the 2D cartographical approach. This approach will allow scientists to represent their research results and to communicate in a more effective way with the public. Using 3D geovisualisations of noise and visual impacts of a future wind farm development is possible to achieve a better and more comprehensive communication-information tool with the public sector and the local communities in order to support local acceptance

3C.4 | **Augmented Reality Visualization of Archeological Data** (#990)

D. Eggert[1], D. Hücker[1], V. Paelke[2]

[1]Leibniz Universität Hannover, Institut für Kartographie und Geoinformatik, Germany; [2]Institut de Geomàtica, Castelldefells, Spain

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 203-216

One intention of archeology is the documentation and reconstruction of historical development of mankind. The extracted data of an archeological excavation is usually spatial referenced and visualized with the help of maps or geographical information system. Both, paper maps and digital representations have partly complementary strengths and shortcomings in their application. With Augmented Reality, both Systems can be combined and complement each other. This Work presents a concept for augmenting archeological paper maps with 3D models and additional interaction options. Besides the presentation of contents in 3D space for museum visitors, the identified examples of usage include the generation of new contents to support the archeological work on an excavation site. The mobile application *ARAC Maps* (Augmented Reality for Archeological Content) realizes this concept based on commercially available devices with the Android operation system.

ORAL

Session S3-D

Web Services and GIS

Tuesday, 27 August, 2013

09:15 - 10:30

3D.1 | **Development of a web-based system to track airborne and satellite assets to obtain imagery for emergency response** (#976)

S. E. Battersby[1], M. E. Hodgson[1], B. A. Davis[2], S. Liu[1]

[1]University of South Carolina, Department of Geography, Columbia, United States; [2]Department of Homeland Security, Science and Technology Directorate, Washington, United States

Remotely sensed imagery has been recognized as a critical need for emergency response. To be effective for use in the response phase, the imagery is needed within three days post-event. It is clear that imagery is deemed necessary by many Federal agencies and is a priority data layer for almost have of the state emergency management offices. However, it is not always easy to quickly identify sources from which a full set of imagery for disaster area of interest can be obtained within the short three day time window. To help remedy this situation and to aid decision-makers in the process of identifying imagery sources and imagery characteristics to meet the needs of the response team, we have developed a web-based tool (RESPT – the REmote Sensing Planning Tool) to aid in tracking both airborne and satellite remote sensing assets for use in emergency response. The RESPT system has been designed to facilitate identification of combinations of airborne and satellite assets for collecting imagery with the following criteria: 1) complete coverage of an area of interest, 2) collection within the time frame required by the user, and 3) meeting user-specified characteristics (e.g., spatial resolution, spectral characteristics, ability to collect imagery sufficient for identifying elements of essential information, etc.). To make the search process more accessible to users with varying levels of expertise, the system has also been designed to guide users through the selection process and to provide rankings of all combinations of the available assets in terms of their acceptability for collecting appropriate imagery for the designated area. Additionally, the RESPT can identify optimal *combinations* of assets to provide a complete set of imagery over any disaster site. In this presentation, we discuss the development of the RESPT system with specific consideration to the usability and utility of the system for aiding in emergency response.

3D.2 | **Geo Web Services for transport crisis management in alpine region**

(#1116)

E. Gálicz, M. I. Hossain, W. Reinhardt

University of the Bundeswehr Munich, Institute of Applied Computer Science, Neubiberg, Germany

A full-length version is available and can be opened here:

_extendedAbstract\160_proceeding.*

Geographic Information System (GIS) has been used in various domains of disaster management for many years and already been proved as a valuable tool for decision support and management of disaster events. Geo Web Services (GWS), which are relatively new extents of GIS, are making their headway faster than ever, allowing us to use various type of geo-data and geo-processing functionalities from different sources in a system independent environment and with low cost and resources. These remarkable features of GWS embolden the authors to build a GWS based prototype application under the framework of an Alpine Space project called TranSAFE-Alp. The present paper demonstrates the development of an application, based on Geo Web Services for transport crisis management in alpine region with a goal to improve the management of transport emergency cases. The application is built with different geo web services like Web Map Service (WMS), Web Feature Service (WFS), Transactional Web Feature Service (WFS-T) and Web Processing Service (WPS) in combination with the OpenLayers library: an open-source mapping software designed to run in the browser and is easily extendable with self-developed elements. The application provides online access to vulnerability and susceptibility maps as well as to satellite maps, which are integrated via WMS from third-party sources. The WMS approach allows the users to gather data without actually storing it on the system, and without even generating them by their own. Apart from that we have implemented some functionalities and tools that can be integrated in a decision-support system in emergency management. One of them is feature drawing functionality, which is based on WFS-T, and enables the user to indicate the area of crisis/disasters. Another function is the routing function, which is based on a WPS, and shows the shortest path between two given points. This routing function combined with the feature drawing tool offer the capability for emergency operator to calculate alternative possible transport route ignoring the one affected with a disaster. Another important WPS function developed for the application is the nearest service finder function, which enable the user to find and notify the nearest emergency units (police station, fire service, rescue service etc.) to the location of the disaster. Beyond the web services, the paper also exhibits the specialties and difficulties of visualizing the results of Web Processing Services in OpenLayer client. Moreover, the paper describes the architecture of the prototype application, and how the mentioned tools and functions are integrated in it. The authors also tried to define further elements which can be integrated in geo web service based disaster management systems.

3D.3 | **Evaluation of the adequacy of the land use in sub-basin using GIS and Remote Sensing** (#1316)

J. C. Demarchi, C. R. L. Zimback

UNESP - Univ. Estadual Paulista - School of Agronomy, Soil and Environmental Resources, Botucatu, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\298_proceeding.*

The growing negative environmental impacts in rural areas, resulting from inappropriate use and management of the land by farming activities, demand an appropriate land use planning, which must take into account the physical environment characteristics. The Land Use Capacity System of Brazil, developed by Lepsch et al. (1991), classifies the farmlands into eight classes, according to the soil erosion risk and into four subclasses according to the kind of the restriction (erosion risk, soil properties, excess water and climatic restrictions) based on limiting factors, such as soil depth, permeability, drainage, erosion, fertility, slope, slope length, flood risk, and others. The lands of class I do not present erosion risk and they are suitable for all kinds of use. The lands of class IV, intermediate, are not suitable for annual crops and the lands of class VIII are not suitable for cultivation, thus native vegetation must be preserved. The protection of Brazilian forests is regulated by the Forest Code, which establishes the permanent preservation areas (PPA), i.e. the hillsides with slopes steeper than 45º, the hilltops and the marginal strips along rivers, streams and springs and the legal reserve areas must be preserved with natural vegetation. The aim of this paper is evaluate the degree of adequacy of the use, the management and the conservation practices adopted in Ribeirão das Perobas sub-basin regarding the land use capacity and permanent preservation areas of this sub-basin, located in Santa Cruz do Rio Pardo, in São Paulo State, Brazil, by GIS and Remote Sensing techniques. The land use and conservation practices maps were elaborated in the GIS Idrisi Selva using ALOS and Landsat-5 TM satellite images. To obtain the soil map, it was used the photopedology (soil - landscape - aerial photos correlation), soil sampling, physical and chemical analyzes in laboratory and soil profiles description. The slope map was obtained from the digital elevation model (DEM) of the study area. The land use capacity map was obtained by analysis and cross-tabulation among land use limiting factors, soil map and slope map. The land use capacity classes were individualized and associated with land use and with conservation practices, then it was evaluated the degree of adequacy regarding the soil conservation. The PPA's were obtained through buffer technique over the drainage network and by the reclassification of the areas with slopes steeper than 45º, then they were associated with the land use map to identify areas with conflicting land use. It was observed in the land use analysis that the use is below the land use capacity in 11.6% of the sub-basin area, represented by pasture, eucalyptus and permanent crops over erosion low-risk areas. The land use is appropriate in 48.19% of the sub-basin, in areas where farming occupation complies with the tolerable limits for soil conservation and in 32.7% of the sub-basin is above the potential use (land use capacity), corresponding the areas with bare soil, annual crops in areas with very low fertility and steep slopes, with pasture without management and others. The class VIs (limitation of soil fertility) concentrates 69.49% of the area whose use is above the potential in the sub-basin. Native forest and dams occupy 7.1% of the sub-basin area, which is below the rate recommended by the Forest Code. Regarding conservation practices, the land use is appropriate, in relation to the land use capacity, in 83.64% of the sub-basin, corresponding to contour tillage areas associated with terracing. The native vegetation (semideciduous rainforest) occupies 61.07% of the permanent preservation areas and the main conflicting land uses are: pasture, soybean and sugarcane. The use of satellite imagery and GIS techniques allowed rapid integration of spatial data and the development of an accurate diagnosis of the current land use and management regarding soil degradation risk.

3D.4 | **Assessment of Risk and Hazard of Technological Emergencies with GIS (on the Example Vinnytsia Region)** (#259)

V. Putrenko
Institute of Geography, National Academy of Science of Ukraine, cartography, Kyiv, Ukraine

A full-length version is available and can be opened here:

_extendedAbstract\259_abstract.*

ORAL

Session S3-E

Special Issues in SDI

Tuesday, 27 August, 2013

09:15 - 10:30

3E.1 | **Advances in Intelligent Processing of Topographic Map Image** (#907)

Y. Yang, X. An
State Key Laboratory of Geo-Information Engineering, Xi'an, China

A full-length version is available and can be opened here:

_extendedAbstract\21_proceeding.*

Geographic information is the core component of national spatial data infrastructure. As one of the main techniques of quickly acquiring geographic information, intelligent processing of topographic map image gets more and more attention. The states of art of the theories and applications of intelligent processing of topographic map image are summarized, and the recent advances in some key techniques of color image segmentation, map symbol recognition, text extraction, and linear feature vectorization are analyzed. Several main problems and further challenges are pointed out.

3E.2 | **Imagery Becomes Knowledge - Image Analysis Services in the Enterprise**

(#133)

T. Bahr

Senior Consultant, Exelis Visual Information Solutions GmbH, Gilching, Germany

A full-length version is available and can be opened here:

_extendedAbstract\66_proceeding.*

Geospatial software users are looking for tools to quickly and easily get answers from imagery anywhere, anytime. As organizations grow and more users employ image analysis in their decision making process, these organizations have a need to centrally deploy and manage applications, tools and data. Additionally, as users are located in a variety of environments, there is a need for a range of geospatial client applications including desktop, web browser, and mobile apps.

The ENVI Services Engine is a cloud based deployment of image analysis functionality that integrates into geospatial platforms. The ENVI Services Engine is comprised of a RESTful API that allows access to ENVI's imagery exploitation capabilities, as well as the necessary components to publish and deploy these consumable web services into any enterprise environment. By offering on-line, on-demand image analysis, geospatial users have access to information derived from remotely sensed data from any location at any time. The ENVI Services Engine incorporates open source standards, and as a result, supports integration into many different types of systems. By running ENVI algorithms and routines as enterprise services, users can access any of the image analysis components they need for data exploitation. ENVI solutions combine spectral image processing and image analysis technology to get detailed information from geospatial imagery. Data gathered from today's satellite and airborne sensors, including panchromatic, multispectral, hyperspectral, radar, thermal, and LiDAR, is supported. ENVI ingests, reads, and extracts information from these various sources, and can fuse multiple data modalities to exploit the strengths of each data type. It works with any size data set and has automated tools to prepare big and small geospatial imagery for viewing or further analysis. The underlying development language IDL allows to extend or customize ENVI features and functionality to fit both image analysis requirements and specific project needs. The ENVI Services Engine runs ENVI or IDL algorithms routines as enterprise services, all through a standard HTTP RESTful interface, allowing users to provide basic user interfaces to complex analysis tasks via lightweight clients. The ENVI Services Engine deploys ENVI functionality as a service for consumption by remote end users, other applications, or other services running in the enterprise. Results can be saved and displayed in a variety of clients, including online, desktop, and mobile clients, depending on the user's implementation. These image analysis applications and components can be integrated into a cloud environment, independent of any existing middleware configuration. The ENVI Services Engine is therefore a flexible and easy to use framework that functions within the user's existing infrastructure. As well as offering on-demand, online access to ENVI functionality, the ENVI Services Engine can be used to develop and expose unique analytics, allowing organizations to create their own enterprise image analysis workflows. Using existing ENVI functionality in a cloud environment will help to save time and resources, as the user can develop an algorithm once and deploy it to multiple locations. Additionally, the user can release new applications and functionality as mission needs change and evolve. One of the largest benefits of deploying image analytics in the cloud is the ability to run complex, resource-intensive analysis on extremely large datasets from thin or mobile clients. By having both the data and analysis components on the web, lightweight applications can be used to call the analysis functions, making the analysis workflow more efficient for users and moving image exploitation closer to the end user.

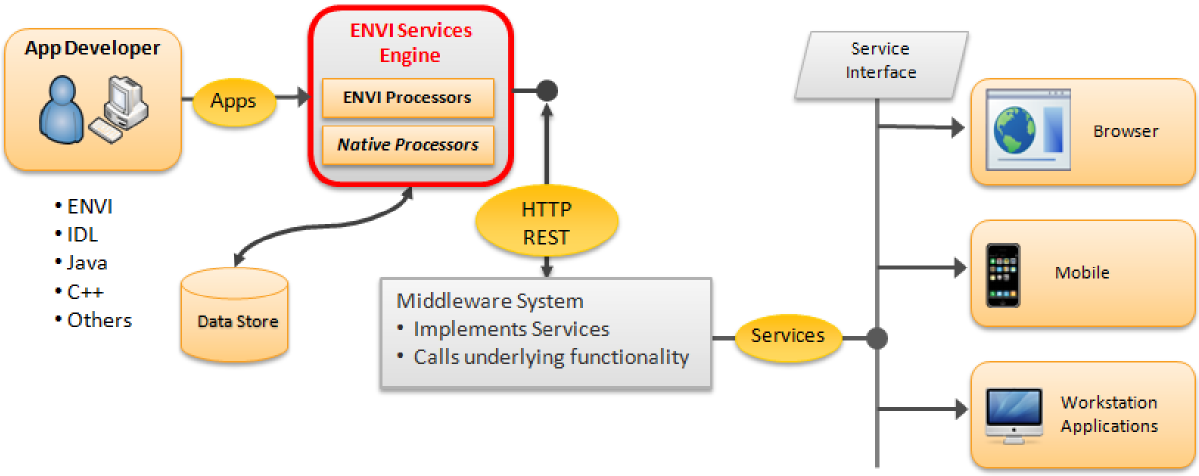


Figure 1::
Deployment of the ENVI Services Engine in the Enterprise

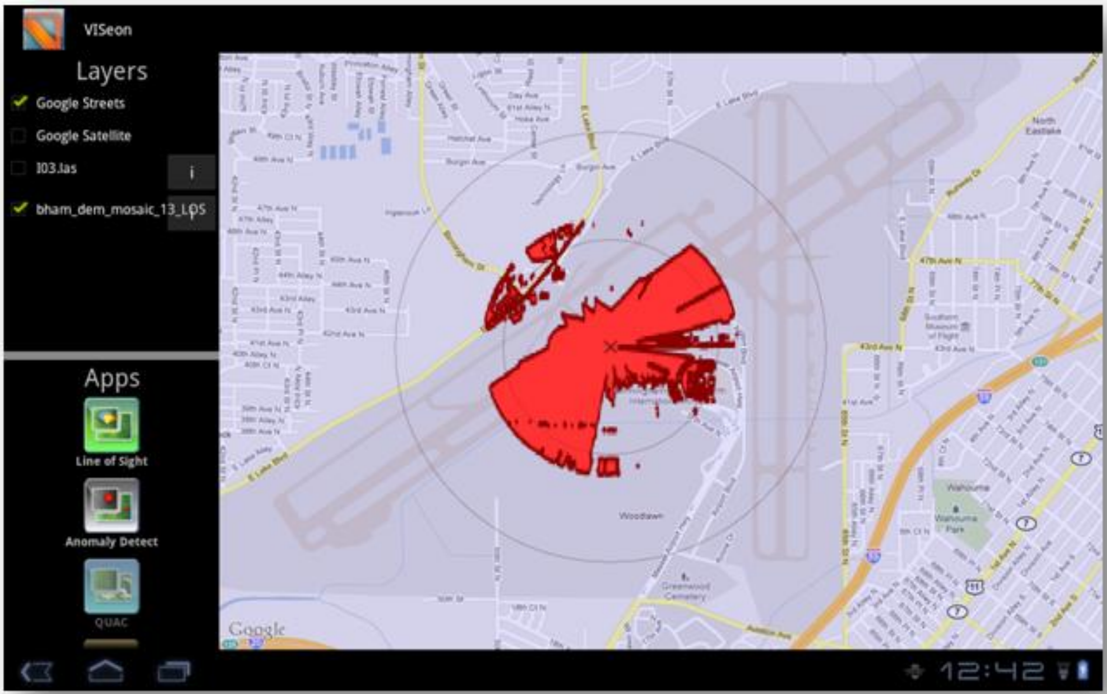


Figure 2::
Line of Sight App launched from Native Android Client

3E.3 | **Spatial data discovery using general purpose web search engines** (#1263)

S. Katumba[1,2], S. Coetzee[1]

[1]*University of Pretoria, Geography, Geoinformatics and Meteorology, South Africa;* [2]*University of Pretoria, Geography, Geoinformatics and Meteorology, South Africa*

A full-length version is available and can be opened here:

_extendedAbstract\191_proceeding.*

3E.4 | **Exploring the Impact of a Spatial Data Infrastructure on Value-Added Resellers and Vice Versa** (#1034)

A. K. Cooper[1,2], S. Coetzee[2], P. Rapant[3,4], D. Laurent[5], D. M. Danko[6], A. Iwaniak[7], A. Peled[8], H. Moellering[9], U. Düren[10]

[1]CSIR, Built Environment, Pretoria, South Africa; [2]University of Pretoria, Centre for Geoinformation Science, South Africa; [3]VSB-Technical University of Ostrava, IT4Innovations, Ostrava-Poruba, Czech Republic; [4]VSB-Technical University of Ostrava, Institute of Geoinfomatics, Ostrava-Poruba, Czech Republic; [5]Institut Géographique National, Saint Mandé, France; [6]ESRI, Vienna, United States; [7]Wrocław University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, Poland; [8]University of Haifa, Department of Geography and Environmental Studies, Israel; [9]Ohio State University, 8Department of Geography, Columbus, United States; [10]Bezirksregierung Köln, Bonn, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 395-404

A spatial data infrastructure (SDI) is an evolving concept for facilitating, coordinating and monitoring the exchange and sharing of geospatial data and services. In earlier work, we developed a formal model for an SDI from the Enterprise, Information and Computational Viewpoints of the Reference Model for Open Distributed Processing. Within the Enterprise Viewpoint, we identified six stakeholders, including a *Valueadded Reseller (VAR)*, a stakeholder who adds value to an existing product or group of products, and then makes it available as a new product. A VAR is particularly important because they extend the usefulness of SDI products: high quality and useful VAR products help ensure continued funding by governments of publicly provided data.

We engaged with various types of VAR around the world, to understand what encourages or inhibits VARs in an SDI, and the contributions VARs can make to an SDI. The results are described here.

121

ORAL

Session S3-F

Cartography for Children

Tuesday, 27 August, 2013

09:15 - 10:30

3F.1 | **Smartphone-based school atlases?** (#360)

J. J. Reyes Nunez

Eotvos Lorand University, Department of Cartography and Geoinformatics, Budapest, Hungary

A full-length version of this contribution has been published in: Cartographica, Vol. 48, Number 2 (Summer 2013, Title:"Selected Papers from the 26th International Cartographic Conference, Dresden, Aug., 25-30: The Challenges of Visualization"), Pages 126-133

The use of the newest mobile devices not only by adults but mainly by young people and children is constantly growing in a considerable number of countries. Youngest generations consider the use of smartphones and tablets as a kind of “natural tool” to help them in the daily activities. The wider and wider use of these devices is determined by the increasing presence of LBS-based and Web 2.0-based applications. The vast majority of the map-based applications developed for smartphones are LBS-based applications planned to help the users when they are orienteering or seeking for thematic (e.g. touristic) information in a given environment. This study presents the possibilities of using smartphones in school cartography, more specifically in displaying school atlases. After a brief background to the use of smartphones by children and young people in different countries, digital atlases are presented in general as a short introduction to the recommendations for the adaptation of school atlases for these devices. Next are described the two initial aspects of the process of adaptation of these atlases for smartphones: the adaptation of the content and of (carto)graphic solutions. Finally, another important theme is discussed: weather the mobile devices-based school atlases can be improved combining the solutions used in PC atlases with the new solutions developed especially for mobile devices, such as LBS technology or 3D technology-based representations.

3F.2 | **Geospatial learning treshold overpassed with digital maps and mobile serious games on the terrain** (#1319)

Y. Ferland

Université Laval, Sciences géomatiques, Québec, Canada

The potentially positive impacts of new digital technologies on various mobile or portable devices are questioned in terms of elementary education objectives that have to be met for the development of some geospatial competencies at school. The role and effects of using both digital maps and “serious games” in educational context should be considered together, in order to take advantage of (the supposed) children’s easiness and abilities with such technologies. The scientific problem and the educational concern are both about the apparent threshold or stage in the development in the geospatial competencies and representations of the child that, if not reached by the end of elementary school programme, will “regress” in capability and interest and be difficult to address further in high school; that impedes seriously geospatial behaviours and attitudes toward maps, location, and orientation at the adult age. A comparison must be done between different technology devices (e.g., from pen-and-paper to kind of smartphone) in order to verify if that really modifies or enhances (i.e. makes a difference) in learning geography at this specific developmental stage (generally about 10-12 years old) and at the corresponding level in the educational programme (about grades 5 to 7). For experimentation, two different software games dedicated to learning outdoor, in fieldtrips on site, were tested respectively in rural village and in urban neighbourhood, both with teachers and small groups of children. Adapted “serious games” have been prepared and documented, with rules and description files as for a “geocaching” play, for observation and collect of data (taking location notes by tagging on digital maps), with the support of GPS and augmented reality (AR) capacities. Based on a conceptual frame that considers both particular cognitive learning styles and socio-constructivist method, within the GeoEduc3D research project, these semi-formal activities took place within the” social universe” curriculum, which encompasses geography, history, and economics, to which one can associate architecture or forestry. As for many digital applications in educational context, the danger to elude is to look too heavily at the child’s funny adaptation to the mobile gadgets and contingent capabilities of reaction to the game (involving transferable psychomotor skills) instead of the substantial learning of some disciplinary matter (geospatial awareness and onsite map reading competencies). But even serious and for learning purposes, a game must be played as such and not just as a metaphor. Results show that behavioural aspects of the game (competition, cooperation, attention, reaction, interaction) appears more efficient in multi-modal realities (both concrete and virtual) to capture, analyze and synthesize geospatial information, but only if followed in the classroom by consolidation activities recalling the the information gathered on the terrain.

3F.3 | **Mapping my Mangrove: New Technologies applied to cartography to support environmental education in the teaching of Geography** (#456)

I. Sousa
State University of Rio de Janeiro, Geography Post Graduation Program, São Gonçalo, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\456_abstract.*

3F.4 | **GLOBAL WARMING TEACHING THROUGH MAPS AND DIAGRAMS TOUCH** (#836)

W. Ribeiro[1], A. Coll[2]

[1]Universidad de Sao Paulo, Geografía, Brazil; [2]Universidad Tecnológica Metropolitana, Centro de Cartografía Táctil, Santiago, Chile

A full-length version is available and can be opened here:

_extendedAbstract\420_proceeding.*

Researchers from Argentina, Brazil, Chile and Peru come together in front of a research project led by Chile and supported by the American Institute of Geography and History (PAIGH-OAS), to develop the proposal for teaching blind and deaf students, through tactile maps and plates, the issue of global warming and its impact on natural events. The team of international and interdisciplinary work has been developing the project for the past four years, with the main purpose of children with visual and hearing disabilities understand, through the teaching of geography, the problem of global warming Through the map and didactic diagrams touch, strengthening observation and collection of environment from a sensory standpoint through images, text and speech decoding mapping. To develop the different topics and Print tactile maps were studied program content that students must meet in their respective countries, so as to enable them to use the material in the classroom and learn in a different way the matters treated by teachers. The process of integration touch products has been one of the most laborious and time-consuming steps to address, especially as it is to work with complex textures and reliefs that replace the traditional visual and graphic design, on an issue as complex as "global warming". Therefore, when it is invested more in the evaluation time of the material and subsequent optimization of same, which has generated at least three new versions of tactile material, enabling students to achieve 85% of understanding information represented.

ORAL

Session S3-G

Map Projections 2

Tuesday, 27 August, 2013

09:15 - 10:30

3G.1 | **Atlas of Map Projections: the technology of creation on the basis of program-analytical complex** (#654)

G. Zagrebin

Moscow State University of Geodesy and Cartography, Science and Education Center of Geoinformation Mapping, Russia

A full-length version is available and can be opened here:

_extendedAbstract\189_proceeding.*

A methodology of automated selection and construction of elements for mathematical basis of maps was developed in the Moscow State University of Geodesy and Cartography under the scientific supervision of prof., doctor of technical science Ivanov A.G. The steps of this methodology were brought into effect in a special software complex created by the author. This complex provides automation of the processes of all the mathematical basis elements creation. The complex allows to define the scale of mapping, to choose the optimal map projection, to carry out its calculation, to construct a graticule and a layout, as well as it provides a comprehensive characterization of the projection in any point of the map (geographical, spherical polar and rectangular coordinates, the magnitude of distortion of all kinds). The program complex works with vector and raster graphics and allows interacting with all basic geographic information systems (GIS) (MapInfo, GIS «Map 2011», ArcGIS) and graphics programs. «The Atlas of map projections for the main regions of the Russian Federation» (federal and military districts) was created on the basis of the developed program. The relevance of the Atlas is caused by the transformation of the administrative-territorial division of Russia: federal districts were allocated, military districts were reformed. The Atlas consists of two parts. In the first part, the methodology of automated choice of map projection is described. According to this method, the optimal cartographic projections, which meet the requirements for minimum distortion of mapping territories, were selected for eight federal districts and four military districts. In the second part, the name of each projection and its parameters are indicated on a separate page for all considered regions; also a brief explanation and a graticule are given as well as the distortion of areas and the maximum distortion of the corners. The Atlas can be used as a library of map projections, where each mapping territory has a corresponding map projection and its parameters. The Atlas is presented both as a hard copy (printed) and in a digital form. Each entry in the library of map projections (Atlas page) contains the name of the territory and an optimal projection specially selected for this territory, or a projection traditionally used for the considered territory. All the projections considered in the Atlas are implemented in modern GISs. Projections' parameters can be easily installed by using the corresponding text line describing the coordinate system from the Atlas. «The Atlas of map projections for the main regions of the Russian Federation» will allow optimizing maps making process for both state and private cartographic companies. The Atlas is made for certain regions of the Russian Federation, but the program-analytical complex allows you to create atlases of projections for any area of the globe.

3G.2 | **Extending Adaptive Composite Map Projections with Wagner's Transformation Method** (#1340)

B. Šavrič[1], B. Jenny[2]

[1]Oregon State University, College of Earth, Ocean, and Atmospheric Sciences, Corvallis, United States; [2]Oregon State University, College of Earth, Ocean, and Atmospheric Sciences, Corvallis, United States

A full-length version is available and can be opened here:

_extendedAbstract\47_proceeding.*

The majority of web maps today use the Web Mercator projection. While this projection has advantages for maps at larges scales, it is not well suited for small-scale mapping because it shows areas close to poles with enormous areal distortion. There are many alternative projections available for small-scale world maps that can be used instead of the Web Mercator projection. Hence, for an interactive scalable map, different projections should be used at different map scales. This approach requires smooth blending between projections that preserves distortion characteristics of the blended projections. A simple approach would consist in blending projections using interpolation with a weighted mean, but this blending would not retain distortion characteristics. For example, when linearly interpolating two equal-area projections, the resulting projection is generally not equal-area. Moreover, interpolation could result in curvy and folded graticules. Recently, the adaptive composite map projections have been presented as an alternative to solve these issues. In this composite of map projections, different projections are selected according to the scale of the map and location of the mapped area. With the proper choice and combination of projections, web maps can be equal-area for any map scale. However, the number of possible equal-area projections for very small scales is currently limited to the Hammer and the Quartic Authalic projections. These two projections have the property of being convertible into Lambert's azimuthal projection, the medium-scale projection used in the adaptive composite map projection. The German cartographer Karl Heinrich Wagner, in 1932, suggested a transformation technique for the development of new map projections also known by its German name "Umbeziffern", meaning renumbering. This method first maps the longitude and latitude values using two parameters onto a smaller segment of the globe, and then projects the geographic coordinates using an existing projection. After projection, a part of the graticule is enlarged to the parent projection's scale with a parameter that adjusts the graticule to the preferred equator and central meridian ratio. The result is a new map projection. Wagner presented three methods, with one maintaining the area distortion characteristics of the parent projection. With this method, different equal-area projections with straight or curved parallels can be created. For example, Wagner derived the Wagner VII projection from Lambert's Azimuthal Equal-area projection using this method. This powerful mechanism by Wagner can be applied to extend adaptive composite map projections. It enables smooth and equal-area blending between two related projections by changing the values of one ratio parameter and two parameters defining the range of the longitude and latitude. In the context of adaptive composite map projections, these parameters change with map scale. The extension of adaptive composite map projections with Wagner's transformation method makes it possible to enlarge the set of small-scale map projections. We will demonstrate the inclusion of the Wagner VII, the cylindrical equal-area projection, and a variety of other equal-area projections. In addition, this presentation will examine which of the existing equivalent projections are connected with the Lambert Azimuthal projection via the equal-area Wagner transformation.

3G.3 | **Developing PAMS – A Paleolocation Mapping Service** (#1305)

T. Urban[1,2], F. Hardisty[2,3]

[1]*Texas Advanced Computing Center, University of Texas at Austin, United States;* [2]*Pennsylvania State University, Geography, University Park, United States;* [3]*Pennsylvania State University, Dutton e-Education Institute, University Park, United States*

A full-length version is available and can be opened here:

_extendedAbstract\308_proceeding.*

We describe the development of a web mapping service called PAMS – A Paleolocation Mapping Service. PAMS generates and maps the paleographic location of any given point on the earth's surface, given location and a geologic age. PAMS is freely available at paleolocation.org. PAMS represents an advance on previous paleographic mapping software for two reasons: the use of a previously unavailable, high-quality plate reconstruction database, and the presentation of the mapping service as a web service, with greater ease of use for both end users and web developers. Understanding how PAMS was developed, and why it takes the form it does requires an understanding of issues that are particular to paleolocation, as well as more general web mapping concerns. Particular to paleolocation, we describe previous efforts in the area of paleographic mapping, the particular paleographic plate data we are using, and the coordinate rotation methods that are necessary. More generally, we describe our software implementation including the database schema, what kinds of scientific and educational applications are foreseen for this service, and suggestions for future work. We hope that PAMS can serve as an example of how geospatial mapping services should be developed in the service of scientific research and education in the geosciences.

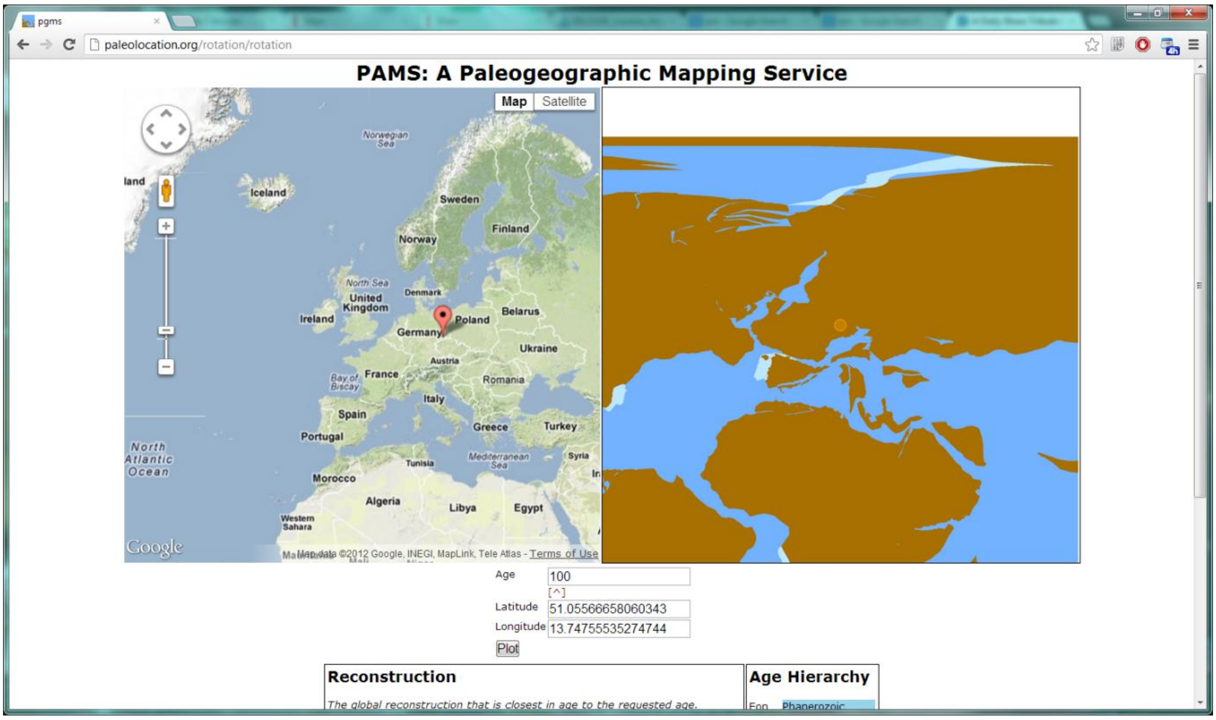


Figure 1:
The PAMS user interface, showing a reconstruction of the plates around Dresden as of 100 million years ago.

3G.4 | **HEALPix Mapping Technique and Cartographical Application** (#173)

O. Esen[1], V. Tongur[2], I. B. Gundogdu[3]

[1]Selcuk University, Construction Offices Presidency, Konya, Turkey; [2]Necmettin Erbakan University, Computer, Konya, Turkey; [3]Selcuk University, Geomatics, Konya, Turkey

A full-length version is available and can be opened here:

_extendedAbstract\80_proceeding.*

Hierarchical Equal Area isoLatitude Pixelization (HEALPix) system is defined as a layer which is used in modern astronomy for using pixelised data, which are required by developed detectors, for a fast true and proper scientific comment of calculation algoritms on spherical maps. HEALPix system is developed by experiments which are generally used in astronomy and called as Cosmic Microwave Background (CMB). HEALPix system reminds fragment of a sphere into 12 equal equilateral diamonds. In this study aims to make a litetature study for mapping of the world by mathematical equations of HEALPix celling system and calculating and examining deformation values by Gauss Fundamental Equations. So, although HEALPix system is known as equal area until now, it is shown that this celling system do not provide equal area cartographically.

Session S3-H

Business Meeting of the Commission on Atlases

Tuesday, 27 August, 2013

09:15 - 10:30

Session S3-I

Business Meeting of the Commissions on Map Design, Neocartography

Tuesday, 27 August, 2013

09:15 - 10:30

ORAL

Session S4-A

Environmental Monitoring

Tuesday, 27 August, 2013

11:00 - 12:15

4A.1 | **Assessing local variations of deforestation processes in Mexico using geographically weighted regression** (#596)

M. Jean-Francois[1], C. Gabriela[1], G. Frida[1], A. R. Araceli[1,2]

[1]*Universidad Nacional Autónoma de México (UNAM), Centro de Investigaciones en Geografía Ambiental, Morelia, Mexico;* [2]*Centro de Investigación en Alimentación y Desarrollo - CIAD, Hermosillo, Mexico*

A full-length version is available and can be opened here:

_extendedAbstract\385_proceeding.*

This study identifies drivers of deforestation in Mexico, by applying geographically weighted regression (GWR) models to cartographic and statistical data. As part of the model, it was first developed a wall-to-wall multitemporal GIS database incorporating digital land use/land cover maps at scale 1:250,000, using data from the National Institute of Geography, Statistics and Informatics (INEGI for its Spanish acronym), for three different dates (1993, 2002 and 2007), along with ancillary data (road network, settlements, topography and socio-economical parameters). The database analysis helped quantifying and assessing forest spatial distribution, and deforestation at the municipal level during two studied periods (1993-2002; 2002-2007). Findings suggest that although deforestation rates have decreased during the last studied period, deforestation still represents a serious threat to conservation and environmental sustainability in Mexico. For instance, rates of deforestation of primary temperate forest were estimated about 0.74% and 0.41% per year, for the 1993-2002 and 2002-2007 periods respectively. The statistical analysis was based on data from municipalities with a forested area covering at least 500 ha and 30% of the municipality. More than 2300 municipalities out of 2443 fulfilled these conditions, representing more than 96% of the country forest and scrub-land area. The GWR model results were compared to a global model. The use of GWR increased the strength in the relationship in terms of the goodness-of-fit (adjusted R^2) from 0.40 (global model) to 0.73 (average R^2 of GWR local models), with individual GWR models ranging from 0.39 to 0.90. The GWR model highlighted the spatial variation of the relationship between the percentage of deforested land and its drivers. Factors identified as having a major impact on deforestation were related to: topography (slope), accessibility (road density), land tenure, ranching activities (cattle and goat density), human population density and marginalization. Results also indicate that the most important drivers explaining deforestation vary over space, and that the same driver can exhibit opposite effects depending on the region. Based on local regression model parameters, cluster analysis allowed the aggregation of municipalities with similar patterns of deforestation into homogeneous regions. A deforestation model for the entire country will be further developed, using these regions to divide the model procedures into sub-regions with specific deforestation rates and drivers.

4A.2 | **GPU-accelerated spatial interpolation rendering for web-based environmental monitoring** (#366)

C. Lienert[1], H. Bär[2], L. Hurni[2]

[1]Canton of Aargau, Dept. Construction, Traffic and Environment, Aarau, Switzerland; [2]ETH Zurich, Institute of Cartography and Geoinformation, Zürich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\276_proceeding.*

Environmental monitoring, early warning or decision support systems manage and visualize environmental data online and in real-time. First, the software-architecture of such systems is often based on a thin client - thick server concept, with most processing tasks performed on the server and results sent to, and visualized on, the clients. Second, real-time cartographic visualization in such systems is frequently limited to point symbolization, representing various point measurement sites. Area representations or temporal animations are often lacking. Critical performance issues arise when the first aspect is considered, particularly when a considerable number of users are requesting data and computation power simultaneously from the server. Connected with this is the second issue, when more complex visualization is required. Spatial interpolation and modelling between measuring sites is, for a number of environmental parameters (e.g., temperature, precipitation, groundwater) more meaningful. Yet, spatial real-time interpolation is resource-intensive and earlier studies have shown that server-side interpolation based on commodity server hardware is lagging behind. The paper presents a new method to contribute to the problem solving of high numbers of parallel access to resource-intensive, server-side spatial interpolation procedures. We propose a parallel-computing workflow based on a thin server - thick client concept, using the new WebGL standard, a standard associated with the GP-GPU (General-purpose computing on graphics processing units) technique. Preliminary results show that the rendering process is considerably faster spatial interpolation, and even allows to directly generate temporal animations.

4A.3 | **HydroProg: a novel system for hydrological forecasting and flood risk mapping** (#181)

T. Niedzielski[1], B. Mizinski[1], M. Kryza[1], M. Wieczorek[1], P. Migon[1], M. Kasprzak[1], P. Netzel[1], M. Szymanowski[1], W. Kosek[2], M. Witek[1], J. Jeziorska[1]

[1]University of Wroclaw, Poland; [2]Kraków University of Agriculture, Krakow, Poland

Recent hydrological phenomena are difficult to forecast, however in order to successfully perform a prediction exercise it is necessary to integrate the real-time monitoring activities with prediction systems and services. The latter also work in real time and provide both site-specific prognoses corresponding to particular gauges and the spatially continuous information represented by extent of a flood. In December 2011, at the University of Wroclaw, Poland, a new project commenced, and its objective is to build a unique hydrologic prediction system equipped with the online mapping service. The system in question aims to serve the hydrometeorological data in real time, with various sampling intervals, to the participating institutions (call for participation is still open) that are subsequently expected to run their hydrologic models and contribute to our ensemble solution. Hence, there will be numerous prediction models generating prognoses in real time using the same data. The predictions of riverflow will be available on maps produced dynamically with the Geoserver infrastructure. Along with the forecast at gauged sites we shall anticipate the flood extent and aim at publishing such spatial data in our online service. Spatial hydrologic predictions at ungauged locations will be checked and verified using the unmanned autonomous aircraft which shall provide orthomosaic maps when the flooding occurs. The test phase of the system will commence in 2013.

4A.4 | **Exploring Distribution of Uranium in Ukraine: Geovisualization and Spatial Statistics** (#763)

M. Govorov[1], V. Putrenko[2], G. Gienko[3]

[1]Vancouver Island University, Geography Department, Nanaimo, Canada; [2]Institute of Geography of the National Academy of Sciences of Ukraine, Department of Cartography, Kyiv, Ukraine; [3]University of Alaska Anchorage, Department of Geomatics, United States

A full-length version is available and can be opened here:

_extendedAbstract\231_proceeding.*

ORAL

Session S4-B

Cartography and Literature

Tuesday, 27 August, 2013

11:00 - 12:15

4B.1 | **Dreams, Memories, Longings - Visualising Projected Spaces in Fiction**

(#674)

B. Piatti, A. - K. Reuschel, L. Hurni

ETH Zurich, Institute of Cartography and Geoinformation, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\159_proceeding.*

Background/Frame This paper builds on research carried out within the interdisciplinary project „A Literary Atlas of Europe“ (www.literaturatlas.eu) – in a close collaboration between scholars from literary studies and cartographers. The literary atlas deals with the specific geography of fiction by mapping the spatial dimension of novels, novellas, short stories etc. through a newly designed set of symbols. It aims at visibly rendering the complex overlays of real and fictional geographies. During the initial analyses of literary texts the space of fiction is broken down into different categories, among them „settings“ and „projected spaces“. **Projected Spaces in Fiction** Without any doubt projected spaces are a most fascinating category. The term means that these are spaces a fictional character thinks of, remembers, is longing for or imagines, without being physically present in (compared to settings/zones of action where the actual plot takes place). Fiction features an overwhelming abundance of projected spaces. A fine example is Arthur Phillips's novel Prague (2002): not a single sequence of action is set in Prague, as the toponymic title and the book cover of the first edition might very well indicate or even promise. As a matter of fact, all of the characters live in the Budapest of the Post-"Wende" era and remain there for the duration of the novel, while all their thoughts are quite hopelessly directed to the arcane and ghostly Prague, the Golden City. Another very impressive example is Ulrich Bechers Murmeljagd (The Groundhog Hunt), published in 1969. In this novel the protagonist Trebla, a war veteran and exiled from Austria in 1938, is seeking shelter in a Swiss alpine resort, but is restlessly haunted by his past – the trenches and the horrors he experienced as a young officer in the years 1914-1918. Against the backdrop of the peaceful, sublime alpine scenery of Engadine, he gets virtually beamed back, by overpowering memories, into the theaters of war in Rumania and Italy. What is notable is a kind of "triggering effect" – in some cases Trebla's flashbacks are released by a topographical/visual similarity between his current whereabout and the faraway places he remembers. Moreover, the picturesque shores of Silser Lake (setting) become congruent with the coastline of the Black Sea around Constanza (projected space) – a map of both regions shows an almost seamless overlay. **Mapping projected spaces** Currently, we use shades of blue on our maps in order to indicate projected spaces and networks of such spaces (while settings are depicted in red), but there must be many more options to deal cartographically and visually with this category. Questions the paper will adress and discuss along a series of map sketches are the following: - Is there a difference in the spatial density/plasticity of the two categories (is maybe one level depicted with more accuracy, while the other remains more vague)? - Can a typology concerning modes of transitions (between setting and projected space) be set up? - What kind of devices could support a visualisation of the triggering moment? - Changing function: Some projected spaces can become settings in the course of plot development (or vice versa) - How can the different subcategories of projected places be symbolised in a meaningful way – memories; dreams/daydreams/nightmares; places of longing? **Inspirations from the Movies** One direction of future experiments might be to search for impulses/inspiration in the cinematic realm: It is more than evident that a transition/ "departure" from a setting to a projected space has an inherent movie-like quality. since movies often operate with different techniques of flashbacks and since fantasies, dreams and surreal moments belong to the art of motion pictures from its very beginnings. The question remains if the triangle fiction – maps – movies is productive one, when it comes to the particular constellation of „projected spaces“.

4B.2 | **Mapping Out *Patience*: Cartography, Cinema, and W.G. Sebald** (#561)

T. Ng-Chan

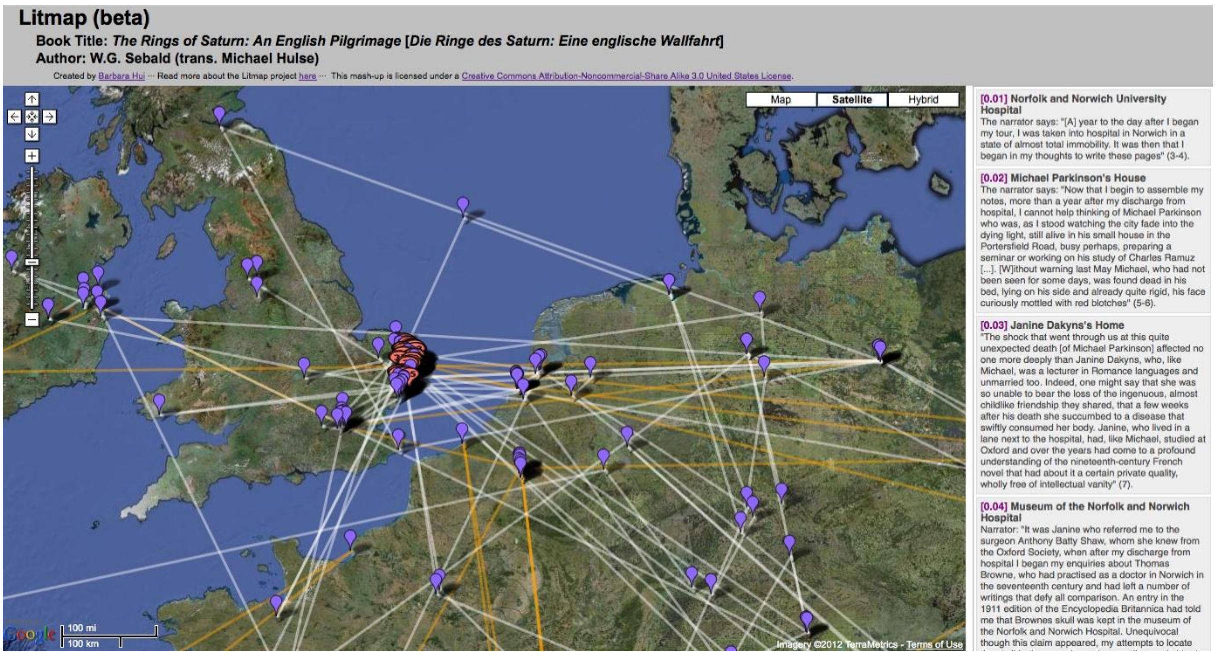
Concordia University, Centre for Interdisciplinary Studies in Society and Culture, Montreal, Canada

A full-length version is available and can be opened here:

_extendedAbstract\396_proceeding.*

In his book *The Practice of Everyday Life* (1984), Michel de Certeau describes the changing function of the map over time as moving from the marking out of itineraries ("performative indications chiefly concerning pilgrimages") to the colonization of space. He suggests that the map has now become an authority on place where there are sets of rules and plans, streets and architecture, places of interest, whereas the itinerary, which is the narrative, the context, and the human perspective, is becoming lost (120-121). One way of relating the itinerary back into the map is through cinema. A very recent film *Patience (After Sebald)* by Grant Gee (2012) uses both the map and the itinerary as frameworks for a cinematic exploration. *Patience* literally follows in the footsteps of writer W.G. Sebald, in modes of film essay / biography / landscape documentary, by tracing the same path described in Sebald's literary work *The Rings of Saturn*. Elements in *Patience* take off from narrative cartography, showing the locations of Sebald's walking tour of Suffolk, England, as plotted out on a grid map, as well as the locations mentioned in the wildly divergent narrative. Cartographic cinema, or the mapping out of space through cinematography, is also a strong theme in the film. The theme of exploration, both inner and outer, ties the literary and cinematic works together. Through an examination of *Patience (After Sebald)*, I propose to trace some of history and functions of cartographic cinema and its relation to narrative cartography, the mapping impulse, and Googlemaps. I argue that a variety of cartographic strategies, the itinerary in particular, are necessary to have an fuller understanding of the world and our place in it.

Patience (After Sebald):
Poster for the film by Grant Gee



Screenshot-Google Mashup :
Litmap Project by Barbara Hui, as featured in the film "Patience (After Sebald)" by Grant Gee

4B.3 | **Facts in Fiction: Introducing Cartography and Surveying in Martin Suter's Novel „Die Zeit, die Zeit"** (#1334)

L. Hurni
ETH Zurich, Institute of Cartography and Geoinformation, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\360_proceeding.*

In September 2012, Swiss best-selling author Martin Suter („Smallworld", „Lila, Lila", "Business Class") published his latest novel "Die Zeit, die Zeit" ("Time, time"; in German, currently no translation available). The story is set up around two main actors, Taler and Knupp, who are neighbours across the street in an average suburban town in Switzerland. Both of them have lost their spouses some years before and they are longing for them. Knupp develops a somewhat exotic theory that instead of time only changes exist. Time could therefore be turned back to a specific moment by "simply" re-establishing the spatial situation of a specific place. Taler and Knupp therefore start to re-create their houses, gardens and the street in between in the exact same manner as they were twenty years before. Of course, this imposes a major challenge not only to the two main actors, but also the author. Martin Suter therefore contacted the author of this ICC abstract in Spring 2012 in order to evaluate possible surveying and mapping methods to fulfil this demanding task. Suter set up several boundary conditions, such as the presence of old analogous Leica photography depicting the house and the garden of Knupp in its old state, or the use of an old theodolite for surveying purposes. After intensive discussion between author and consultant, it was decided to set up the following workflow: Surveying of the outside situation (garden, street) using classical surveying methods (traverse, detailed surveying); Projection of old photos onto new plan using a Camera obscura (projective transformation); overlay of old garden photos with new reconstituted photos in order to replace the current trees with new ones having the same dimensions as the trees 20 years before. These methods are crucial to fulfil the tasks and personal wishes of the two main actors. In this paper we will describe this methodology in detail and give reasons for the specific choice of methods (technical, context and literary reasons). Classical surveying methods for instance are more tangible than virtual computer-based methods and therefore better describable and interesting to the reader. We try to identify stylistic elements in Suter's writing applied for description of the surveying and mapping parts in the novel. Furthermore we will describe the literary chain of perception which comes close to a similar chain in Cartography: Idea of author, mental landscape (imagination) of author, definition of literary setting and detailed furnishing, textual implementation, reading and perception process by reader, mental map / imagined landscape of reader. We will thereby compare the original sketches of the surveying methodology and situation made by the consultant with sketches of the process and of the imagined landscapes made by readers of the novel. The presentation will be accompanied by audiobook extracts of the respective text sections.

Die Zeit, die Zeit:
Banner advertisement of Martin Suter's "Die Zeit, die Zeit"

4B.4 | **Narrating Place** (#1522)

M. Bissen[1], P. Ritchard[2], L. Vaughan[2]

[1]City University of New York, The Graduate Center, United States; [2]RMIT University, School of Media and Communication, Melbourne, Australia

The aim of Narrating Place is to explore through a series of 45 second video pieces, a diversity of ways of narrating the experience and representation of place. The phenomenon of place is a rich concept rooted in how we perceive and conceive our environment. This is a concept which deserves continual critical and exploratory work to develop ways to understand how, through spatial and subjective experience we narrate a particular place. Individuals were invited to contribute to this work based on the curatorial team's knowledge of their work and interest in the subjective representation of place. The invited participants come from the Americas, Europe and Australasia. The outcome is this rich mix will result in a unique commentary on and contribution to the affective cartographies of place (from http://narratingplace.info/).

ORAL

Session S4-C

Analysis of Rural and Urban Structures

Tuesday, 27 August, 2013

11:00 - 12:15

4C.1 | **Analysis and mapping of rural-urban interactions** (#775)

M. Gunko

student, Institute of Geography RAS, Moscow, Russia

Complex multi-level relations of small and medium-sized cities and surrounding rural areas require the creation of adequate visualization of their interaction and relationships to achieve sustainable management and spatial planning. The development of rural-urban relationships mainly in hierarchical order resulted in the concentration of population and peripherisation. Traditional settlement and communications depend on industrial and infrastructure factors. Cities have long been considered focal points of rural areas, reflecting the most specific elements of their environment: specialization of the city used to largely depend on the characteristics of natural resources on the suburban area. To identify geographic and temporal relationships we conducted the following types of mapping operations: - Interactive mapping representation of one or more attributes with different features; - Interactive classification by one or more properties of geographical elements; - Interactive selection of rural-urban relationship zones (network); - Space-time representation of rural-urban relationship indicators dynamics with the use of animation; - The construction of models based on phenomenon's distribution. For representing relationships and comparisons of individual properties of objects one can use graphs, charts and histograms. For a graphical representation of multi-dimensional relationships and their subsets were used three-dimensional charts, radar charts, and parallel coordinates. To show the relationship between objects and their classification we used directed graphs and decision trees. The combination of factors determine the strength of rural-urban interactions: some cities, naturally blend into the countryside and directly connected with the environment, others are “alien” to the surrounding urban area, their interaction with the countryside is expressed very poorly. To determine the nature of the interaction social and economic indicators are used, such as: economic specialization of cities and rural areas, labor and non-labor pendulum and seasonal migrations city-countryside, the share of resources generated in rural areas that is processed in the city, the frequency of city-countryside public transport and etc. In general, there are many different ways of rural-urban interactions in Russia but their study is constrained by numerous factors, including the lack of statistical data. The informational support of the above tasks is carried out using a variety of social and economic methods (field work, statistics analysis, social surveys), space-time geoinformational analysis and mathematical modeling of the relationship of cities and rural areas. The analysis of rural-urban interactions will improve territories' management - practical use in decision-making processes in the field of population, urbanization, zoning and regional planning.

4C.2 | **Identifying Residential Land in Rural Areas to Improve Dasymetric Mapping** (#410)

S. Leyk[1], B. Buttenfield[1], N. Nagle[2], A. Stum[1]

[1]*University of Colorado, Geography, Boulder, United States;* [2]*University of Tennessee, Geography, Knoxville, United States*

A full-length version is available and can be opened here:

_extendedAbstract\370_proceeding.*

Cartographic methods such as dasymetric modeling have been demonstrated as very useful techniques for spatial refinement of population estimates (Semenov-Tian-Shansky, 1928; Wright, 1936; Mennis, 2009). Dasymetric mapping, which can be understood as a special type of aerial interpolation, uses various types of ancillary data as limiting and related variables to generate population estimates within target zones. It is assumed that target zones are at a finer resolution than the spatial aggregates (e.g., census units) for which population estimates are publicly available. The majority of dasymetric mapping results for study areas which span urban and rural areas often demonstrate relatively higher accuracy in urban regions (Eicher and Brewer, 2001; Mennis, 2003). This is particularly true when using ancillary fine resolution information such as landcover which traditionally reflects residential areas quite reliably within city limits (Zandbergen and Ignizio, 2011). One persistent challenge in dasymetric mapping is the determination of residential locations in rural regions. These regions are problematic because census data are highly aggregated due to low population densities. At the same time, landcover is less reliable in rural areas where small farms and settlements are often misclassified. Studies that included alternative ancillary variables (e.g., road density or terrain derivatives) could not demonstrate improvements in the spatial precision of dasymetric mapping results in rural areas. As a consequence the dasymetric refinement is less effective in rural areas relative to urban areas. In this paper we focus on dasymetry in rural areas and examine the predictive power of different ancillary (related) variables to improve the spatial precision of population estimation in rural regions. The underlying statistical model can be conceptually understood as a prediction of the most probable locations of residential land. In addition to residential landcover, we will employ predictive variables such as road density, impervious surface, the area of underlying census units and terrain derivatives (i.e., slope and elevation) to build up a Generalized Linear Model (GLM) that predicts the likelihood of each rural location to be residential land. We will create composite variables from the ancillary datasets, such as combining the density of roads and administrative boundaries which is believed to carry explanatory power for residential land. To validate we will use available parcel data from Boulder County, Colorado, USA since such cadastral data provide the highest locational precision for identifying residential land and to differentiate it from other forms of land development. We will present the results of these efforts in form of probability surfaces for residential land, comparing adjacent rural and urban areas. We will incorporate these results into dasymetric maps. This modeling approach will significantly improve small area estimation and dasymetric mapping due to more reliable identification of areas where the rural population can be expected to reside. **References** Eicher, C.L. and Brewer, C.A. (2001) Dasymetric Mapping and Areal Interpolation: Implementation and Evaluation. *Cartography and Geographic Information Science* 28, 2:125-138. Mennis, J. (2003) Generating Surface Models of Population Using Dasymetric Mapping. *The Professional Geographer* 55:31–42. Mennis, J. (2009) Dasymetric Mapping for Estimating Population in Small Areas." *Geography Compass* 3, 2:727-745. Semenov-Tian-Shansky, B. (1928) Russia: Territory and Population: A Perspective on the 1926 Census. *Geographical Review* 18, 4:616-640. Wright, J.K. (1936) A Method of Mapping Densities of Population: With Cape Cod as an Example. *Geographical Review* 26, 1:103-110. Zandbergen, P.A. and Ignizio, D.A. (2010) Comparison of Dasymetric Mapping Techniques for Small-Area Population Estimates. *Cartography and Geographic Information Science* 37, 3:199-214.

4C.3 | **Automatic Delineation of Urban Blocks from Topographic Maps** (#1051)

S. Muhs[1], G. Meinel[1], D. Burghardt[2]

[1]*Leibniz Institute of Ecological Urban and Regional Development, Research Area Monitoring of Settlement and Open Space Development, Dresden, Germany;* [2]*Technical University of Dresden, Institute for Cartography, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\304_proceeding.*

Large-scale, ex-post analyses of urban dynamics on base of time series is of significant relevance for evaluating the success of settlement policy goals. Of particular interest are urban blocks, streets, and buildings representing elementary objects of urban structure. Digital data about urban structure in Germany, at the level of urban blocks, have been supplied comprehensively since 1997 by the ATKIS® Basis DLM Stage 1. However, to assure the meaning of those time series analyses, data from earlier time periods are necessary. To supply these, we present an object-based concept for an automated delineation of urban blocks from topographic maps at a scale of 1:25,000, which have been proven as an alternative for a comprehensive study of urban structure of pre-digital times at low cost, using techniques of digital image processing. Moreover, this approach corresponds with the worldwide trend to digitize knowledge that can also be observed with topographic maps. The approach has been developed using the binary base layer (black layer) of the German raster-based digital topographic map DTK25-V. It contains elementary objects of the urban structure in addition to border lines in general, symbols, fonts and digits. Following the Anglo-American definition of an urban block as smallest entity of (built up) plots bounded by street lines, the delineation of urban blocks from maps arises from the depiction of the street network. Instead of street lines, an urban block can also be enclosed by other topographic borders such as railways for trains or trams, rivers, tracks, or parcel plots. According to this definition, an urban block´s outline can be modeled geometrically as a closed polygonal line. In turn, closed polygonal lines can be transformed to polygons and therefore to area objects. In consequence, the algorithm for an automated delineation requires explicitly the separation of urban-block objects as well as the geometrically correct plotting of the blocks as closed polygonal line. However, both requirements are usually not fulfilled for the whole map. The competing use of those different content layers of the base layer can result in an overlap of information with regard to plotting. According to the cartographic model and the priority of the overlapping content compared to the urban structure layer, this can result in joining of single urban blocks or the fragmentation of one block into multiple pieces due to exemption. Therefore, it is necessary to recognize and remove joining and exempting map elements (*interfering objects*) using knowledge-based rules. The actual delineation of the urban block is achieved by a three-step algorithm. In a first step, all objects of the remaining map content are transformed to polygons using a region fill method. Then the polygons are evaluated in terms of plausibility regarding a given geometric model for urban blocks (form, size, etc.) with erroneous and unconnected fragments of the urban block structure remaining. In a second step, these are tested for the possibility of gap closing for up to two fragments followed by the block evaluation module. This way, a temporary block structure is obtained and given the urban block definition, a simplified copy of the street network can be determined by calculating the inverse of the block structure. This network, in turn, can be used to recognize and correct erroneously closed objects or to indirectly identify not yet closed blocks by a network tracking/correction module. Results of our approach are presented and discussed for three case study maps of Dresden, Hannover and Krefeld.

4C.4 | **Analysis of European Topographic Maps for Automatic Acquisition of Urban Land Use Information** (#1290)

U. Schinke[1,2], H. Herold[2], G. Meinel[2], N. Prechtel[1]

[1]Technical University of Dresden, Institute for Cartography, Germany; [2]Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

A full-length version is available and can be opened here:

_extendedAbstract\233_proceeding.*

In this study, we analyse and evaluate European topographic maps with regard to their suitability for an automated acquisition of detailed urban land use information. Digital information on recent and historical land cover and land use are of utmost importance for both urban and landscape research. However, land use change detection using historical geo-spatial information is still mostly limited to local case studies. Efforts to build national, continental (e.g. INSPIRE, SEIS), or even global (e.g. GMESS, GEOSS) environmental information and monitoring systems require harmonised and objective spatial data with a comprehensive coverage. Topographic map series are an important, low cost, and - in a historical dimension - often the only available data source for an automated extraction of the desired digital information. In the given context, we investigate the potential of topographic maps in a scale range between 1:25,000 and 1:50,000 issued by about 20 European governmental mapping agencies. Apart from nearly equal metric scale classes there exists still a substantial dissimilarity among the official topographic cartographic products within Europe. Inherent differences in the general map design and types of cartographic symbols inevitably affect the strategies for an automated extraction of spatial information and, hence, the interpretation and comparability of the derived land-use information. In spite of a frequent portrayal of Universal Transverse Mercator (UTM) grid coordinates, we found that most official mapping agencies in Europe still stick to National Reference Systems. Thus, evaluation criteria comprise projection metadata for a later operational bulk geo-referencing as well as information about the complete coverage of a map series and dates of last revisions when aiming at a comparable and comprehensive map interpretation for a large territory. The representation of urban land cover objects such as buildings, urban blocks, parcels, and transport infrastructure in both dense urban and sparsely settled rural regions evolves the main part of analysis due to the varying designs attributes as fillings, line types and layer schemes. Particular attention is paid to graphical conflicts caused by generalisation procedures in derived map scales such as displacement and simplification, as well as to all sorts of map annotations screening underlying cartographic information. The results of the study support efforts to advance in image analysis algorithms for feature extraction from topographic maps, in order to monitor land use change on a transnational basis within Europe.

ORAL

Session S4-D

Thematic Atlases

Tuesday, 27 August, 2013

11:00 - 12:15

4D.1 | **Cartographic Visualization of Phytophenological Characteristics** (#1330)

V. Voženílek, A. Vondráková, A. Vávra

Palacký University Olomouc, Department of Geoinformatics, Czech Republic

One of the most discussed scientific topics is climate change. Climate change can be monitored primarily through monitoring and mapping of climate factors. In addition to these basic methods there can be used other indirect methods which could be as accurate: one method of indirect mapping of climatic factors is phenology. Phenology deals with monitoring of vital signs or vegetation, timing of periodic vital signs and the relationships of these phenological phases on climatic and soil conditions during the growing season. The presentation of spatial distribution of phenophases in the form of maps is still relative rarity, although maps are very effective tool for the presentation of spatiotemporal variability of phenophases onset in the specific area and time. Phenological data have a spatial dimension and its relationship is released directly to a particular location. In particular, the tools of geographical information system (GIS) are very suitable for the data processing and using suitable methods of thematic cartography it is possible to make the high-quality cartographic visualization. Visualization in the set of maps can provide a complete determination of phenological conditions of the study area. Such maps can then be compared with maps of climatic characteristics and can be a good tool for climatic studies or comparisons. The research realized at the Department of Geoinformatics, Palacký University in Olomouc, addressed the question what is the most suitable method to presenting spatial distribution of phenophases onset. Because there are also plants where the analysis of spatial distribution is more difficult because of many cultivars and varieties at individual stations, it was also needed to present these data in the form of illustrative graphs. With regard to the user-friendly perception there were created new methods of graphic representation of these data – both in cartography and in graphs. These methods of phenophases onset visualization have not been presented in another research. The results of the research are presented in the publication Atlas of Phenological Conditions of Czechia. Because the atlas cartography has its own specifics, it was necessary to take into account the compactness of the atlas and continuity of individual chapters. Also there was addressed the question of synthesis, there were designed processes to make a complex and synthetic maps. To enable the comparison of historical development in phenophases ones there were created comparative maps from different historical periods. There was also realized the typization of regions having similar characteristics for the area of the Czech Republic. The research results bring new approach to the methods of cartographic visualization of phytophenological characteristics. There were defined procedures and colours schemes for the presentation of phenophases onsets and there were also created new types of graphs. The results are useful for processing any other data of the phenophases onsets. Similar approach has not been realized in such comprehensive form.

4D.2 | **Transportation Data in Maps Special Analysis for Influencing Decision Making** (#428)

O. Raz

Israeli Central Bureau of Statistics, GIS Sector, Jerusalem, Israel

A full-length version is available and can be opened here:

_extendedAbstract\27_proceeding.*

Introduction The ICBS collects and publishes data on traffic volume and road accidents with casualties on a monthly basis. This data is produced for the use of traffic engineers in planning and maintenance of roads, in accordance with traffic volume, as well as for the use of the police in law enforcement. In addition, the data is used for economic and traffic research and for the investigation of road accidents. Up until recently, the ICBS published traffic volume data in tables in hard copy publications and on the web (Table 1). Road accident data are also published in hard copy and in an interactive map, showing specific detail of singular events, but without national scope and without special analysis of the data. **New Data Analysis** As of 2012, a new initiative by the ICBS GIS sector produced new ways to introduce the data – maps on a national scope, showing specific related topics. For the first time, a national map of traffic volume counts was produced and published. This map shows road data on a line vector layer with a division into data categories (Fig. 1). In addition, a new analysis of the road accidents database produced heat maps of lethal road accidents on non-urban highways. **Comparing the Data** Finally, to demonstrate the GIS capability of providing a national analysis from a different perspective, and in order to show how one map can revive a database with thousands of entities, we produced a map combining traffic volume counts with lethal road accident heat maps (Fig. 1). The ICBS leaves it to the public to interoperate, but a look at the map shows a different perspective in regards to the basic thesis that there is a direct relation between traffic volume levels and lethal road accident density levels. **Future Benefit** The traffic volume map serves as a visual aid for future planning and for a fast and easy analysis of the data with a national perspective. This method of displaying traffic volume counts is new in Israel. There is also no public example of density analysis of road accidents in the country. A widespread dissemination of these maps will help in effective decision making and could lead to deeper study, using maps as a visual aid for understanding and analyzing our own databases. **References** Israeli Central Bureau of Statistics and the Israeli National Road Safety Authority (2012): *Road Accidents with Casualties 2011, Part II: Accidents on Non-Urban Roads*, Publication No. 1493, http://www.cbs.gov.il/reader/transport/accidents.html , Accessed 11 Nov 2012. Israeli Central Bureau of Statistics (2012):*Traffic Counting on Non-Urban Roads 2006-2011*, Publication No. 1485,http://teunot.cbs.gov.il/niturtnuaenterprise/, Accessed 11 Nov 2012. Israeli Central Bureau of Statistics (2012):*Maps Based on Data from the Statistical Abstract of Israel 2012 No. 63*, Chapter 24: Transport and Communications**,** http://www.cbs.gov.il/shnaton63/map/24_01e.pdf , Accessed 11 Nov 2012.

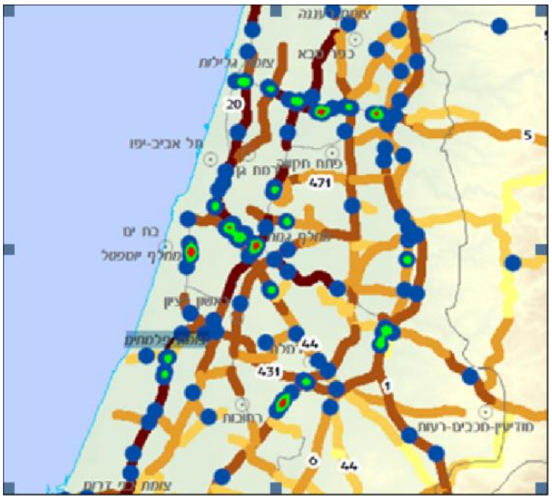


Fig. 1:

Lethal accident density hotspots combined with traffic counts. (Source: ICBS)

Traffic Volume by Road, Section and Day of Week (in Thousands)

Road	Section	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Daily Average Sun-Thu
431	6	67.4	68.2	69.3	68.3	71.3	63.5	49.9	68.9
431	6	34.2	35.2	35.6	35	37.2	33.9	26.4	35.5
431	6	33.2	32.9	33.7	33.3	34.1	29.6	23.5	33.4
431	10	62.2	62.6	64.1	63.3	65.8	57.2	45	63.6
431	10	29.7	30.4	31	30.6	32.3	28.2	22.2	30.8
431	10	32.5	32.2	33.1	32.7	33.4	28.9	22.9	32.8
431	20	47.8	47.9	49	48.2	50.1	40.7	32.9	48.6
431	20	22.3	22.9	23.2	22.9	24	18.2	14.5	23.1
431	20	25.5	25	25.8	25.3	26.1	22.5	18.4	25.6
431	30	97.1	97.3	99.4	98.5	101.9	82.5	63.3	98.9
431	30	54.3	55.2	56.1	55.8	58.3	47.6	36.6	55.9
431	30	42.8	42.1	43.3	42.7	43.6	34.9	26.8	42.9
431	40	85.1	85.3	84.3	86.1	88.1	66.2	51.7	85.8

Table 1:
Data table example for the traffic volume map. (Source: ICBS)

4D.3 | **Swiss World Atlas: Development and automated setup of a geographical name index database for cross-media atlas applications** (#481)

T. Koblet, L. Hurni

ETH Zurich, Institute for Cartography and Geoinformation, Zürich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\146_proceeding.*

The first edition of the Swiss World Atlas was released in 1910. Since then numerous enhancements und updates were realized. The first entirely digitally created edition was published in 2002. During these hundred years, the map production workflow has changed fundamentally. In contrast, the creation of the geographic atlas index is not completely different from its establishment in earlier years. Still for the 2002 edition the geographical name index was typed and amended manually with attributes like latitude, longitude, administrative area or geographical object. For the next edition of the Swiss World Atlas the workflow to create the index will be automated and simplified using GIS-Tools. In the proposed paper we present an innovative, self-developed ArcGIS Toolbox (written in Python with the ArcPy package) to build up and handle an index database. The main table of the database contains the following attributes: id, name (German, English, French, Italian), geographic object, country, subdivision, population, altitude, latitude, longitude and map in printed atlas (array with maps of the printed atlas where the entity is found). The input of the index tool is an ESRI shapefile containing point geometries that represent the entities to be written to the index. The only required attribute of the points is the name of the item. Optionally the country attribute and the geographic object attribute can be set to uniquely identify an entity. The functionality of the tool includes translation of geographical names (German, French, Italian, English), defining the location (country and administrative subdivision), calculating the coordinates and saving the entities to the new index database. The geographical names are taken from the Swiss World Atlas 2010 edition, the administrative data is taken from the Global Administrative Areas database (GADM) and the Natural Earth dataset. The benefits of continuously building up a database are manifold. Besides saving time in final stage of atlas production, a database allows the creation of a printed index based on various rules. Due to the attribute that stores the occurrences in the printed atlas it can be defined at any stage of the atlas production process if e.g. the printed index should contain the page number where an entity appears first in the atlas or if it contains the page number of the overview map that include that specific entity. Entities that appear only in large-scale maps can easily been excluded from the printed index. Furthermore an index database gets more and more important when going into cross-media publishing. When developing an interactive atlas, the database can be adapted as a search database. Using the example of the Swiss World Atlas interactive, we show in this paper that an interactive search functionality requires the same database structure and attributes as the generation of an index for a printed atlas. Hence an entity is always linked to at least one map. Whereas in a printed atlas this link is represented by writing the corresponding map(s) to each item in the index, in an interactive atlas the link between an entity and a map can be visualized by highlighting the entity on the specific map at the correct coordinates.

ORAL

Session S4-E

Web Mapping Applications

Tuesday, 27 August, 2013

11:00 - 12:15

4E.1 | **Advances in Web-Service Driven Cartography** (#361)

I. Iosifescu, C. Iosifescu, N. Panchaud, R. Eichenberger, R. Sieber, L. Hurni
Institute of Cartography and Geoinformation, ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\210_proceeding.*

Web-service driven cartography deals with the development of high-quality interactive cartographic online applications, which are based on an interworking of Web services and Web technologies. The main advantages of service driven cartography is the creation of such cartographic products directly from geospatial data, that are stored in large spatial databases, and achieving a rich cartographic output for future map content updates with hardly any human intervention. The main innovation in Web-service driven cartography are Cartographic Web Services. These are cartographically enriched but standards compatible map services, that allow, based on cartographic visualization rules, the precise cartographic representation of the geospatial data from a database. After an overview of Cartographic Web Services we will present the fundamental architectural design of cartographic applications in Web-service driven cartography and the process of cartographic symbolization using cartographic visualization rules based on the well-known OGC standards SLD and SE. Then we will focus on recent advances in the field. For this purpose we have set as use case a recreation of a national atlas, namely the Atlas of Switzerland, as an online application. We will compare not only topographic maps but also the most common types of 2D thematic maps in atlases and we will demonstrate that it is possible to create cartographic products by using Web-service driven cartography with a comparable expressivity as in established offline digital atlases. Furthermore, we will briefly explore the realm of 3D web atlas visualizations. Although Web-service driven cartography has been proved to be a viable solution for 2D cartographic products, the combination of 3D technologies with the concept of Web-service driven cartography in atlases has not yet been broadly explored. We will show how a simple workflow based on Cartographic Web Services can be used to supply cartographically symbolized textures for the production of 3D panoramas and block diagrams and we will also highlight some areas that need further research. Finally, we will review how the concepts of Web-service driven cartography can be beneficial and practical to be applied for the development of modern online Atlases.

4E.2 | **Integrating Linked Open Data into Open Source Web Mapping** (#419)

<u>W. Owusu-Banahene</u>, S. Coetzee

University of Pretoria, Centre for Geoinformation Science,Department of Geography,Geoinformatics and Meteorology, Hatfield-Pretoria, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\37_proceeding.*

4E.4 | **Web Mapping Metro Rail Services in Los Angeles County** (#29)

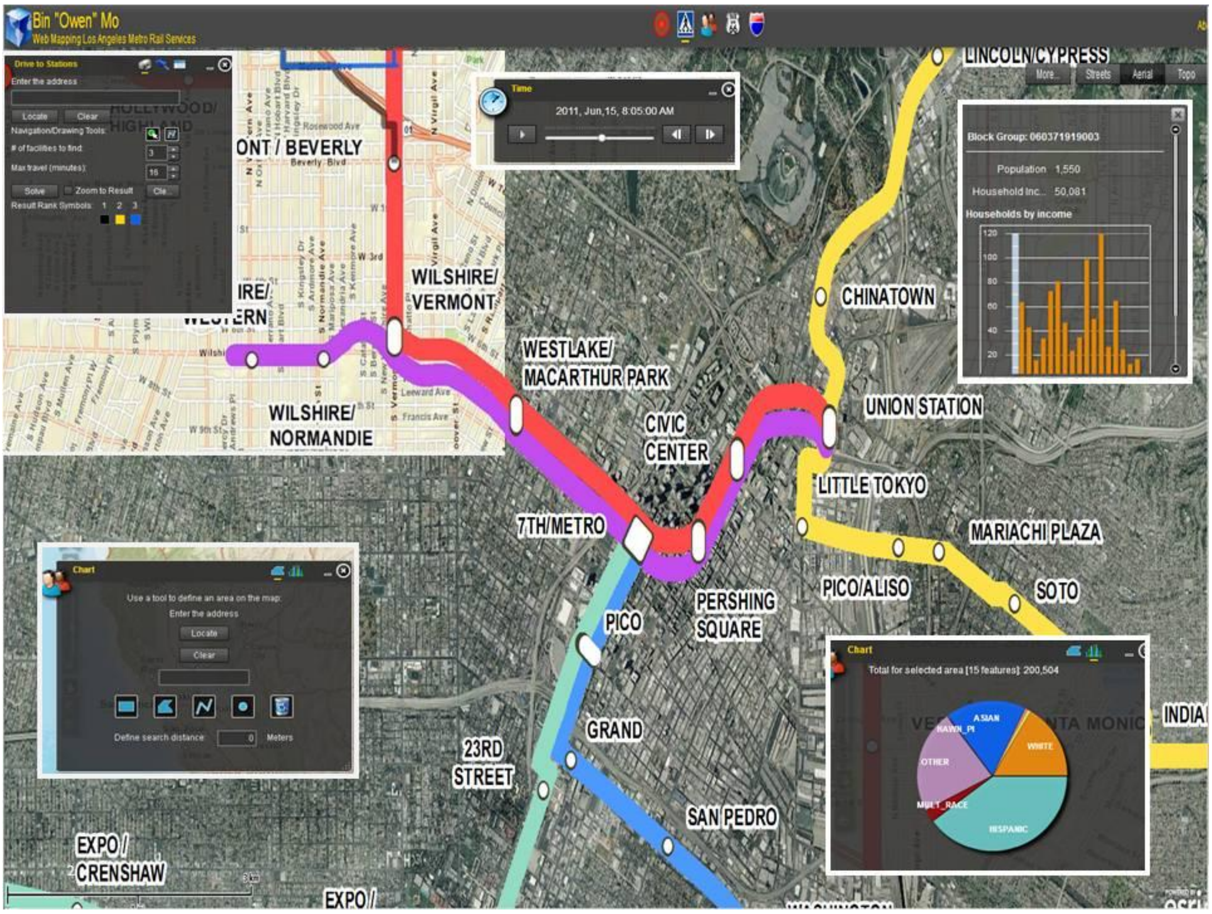
B. Mo

LACMTA, Long Range Planning and Coordination, Los Angeles, United States

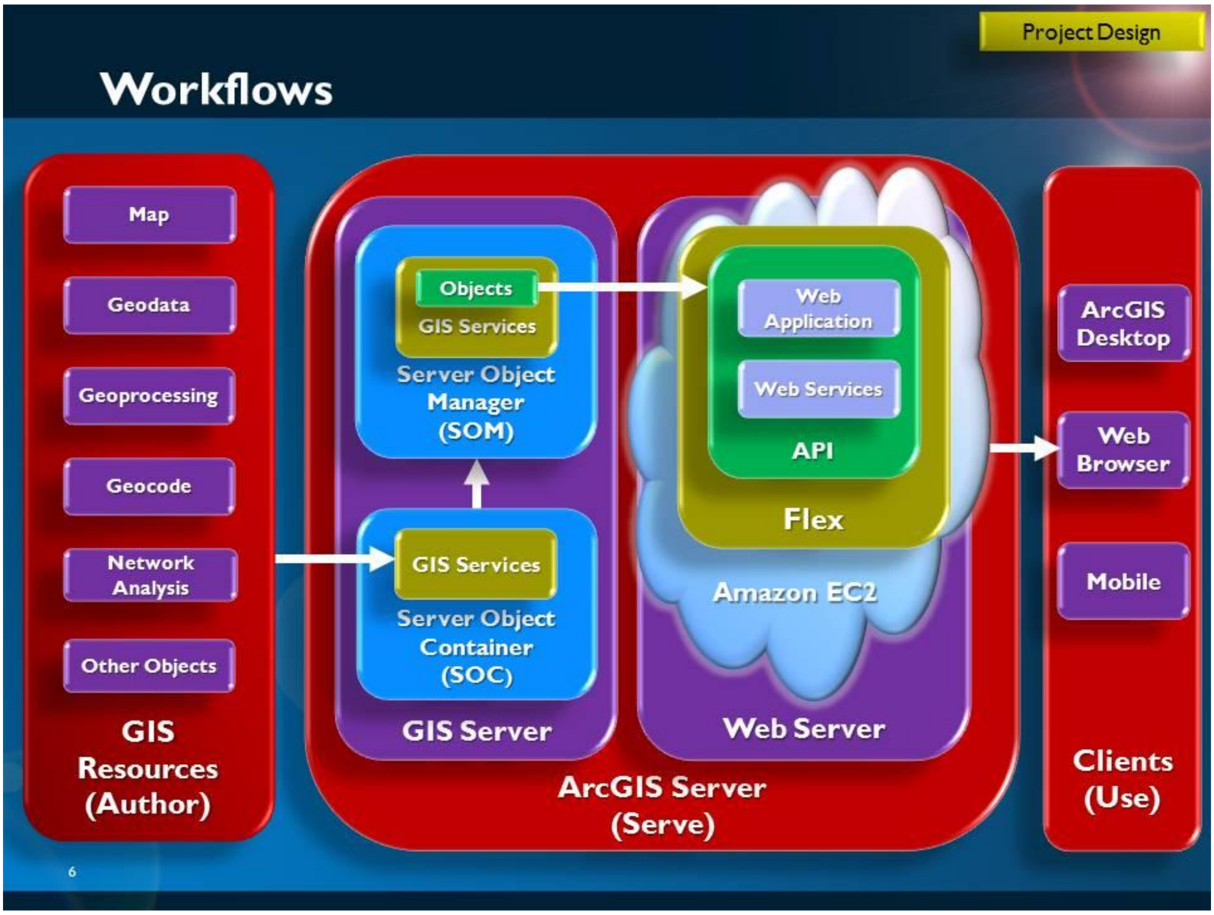
A full-length version is available and can be opened here:

_extendedAbstract\88_proceeding.*

Developing a forecasting model for effective service area and potential ridership of Metro Rail stations may take years for the collection and analysis of data, and model development. Web mapping is a new trend in cartography that changed the way maps are produced and used for transportation forecasting. By leveraging ArcGIS Server resources, Flex and API components, the GeoWeb Mapping application of the Metro Rail Services in Los Angeles County is developed to share and interact with the resources, locate the closest Metro Rail stations by access from specific locations, and estimate the potential ridership for existing and future stations. The application enables clients to achieve resources, as well as analysis results easily without ArcGIS software and other program experiences. This tool will be a huge advance for transit forecasting and service planning of a transportation system.



Web Applications:
Web Applications of Metro Rail Services in Los Angeles County



Workflows:
Workflows of Developing Web Metro Rail Services

ORAL

Session S4-F

Automated Generalisation

Tuesday, 27 August, 2013

11:00 - 12:15

4F.1 | **ScaleMaster 2.0: a ScaleMaster extension to monitor automatic multi-scales generalizations** (#466)

G. Touya, J. - F. Girres
IGN, COGIT, Saint-Mandé, France

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 193-200

Little by little, the co-existing geographical datasets are integrated into Multi-Representation Databases, where the datasets represent different level of detail, or different point of views for the same geographical features. The ScaleMaster model from Brewer and Buttenfield (2007) allows formalising how to choose the features to map from the different datasets. The paper proposes an extension of the ScaleMaster model that drives automatic generalisation rather than guidelines for manual mapmaking. This ScaleMaster2.0 has been implemented and is tested for a use case with real data.

4F.2 | **Multimapper – Prototype System for Designing Multi-Scale Maps** (#1133)

T. Samsonov[1,2], A. Podolsky[1], N. Yurova[1]

[1]Lomonosov MSU, Faculty of Geography, Department of Cartography and Geoinformatics, Moscow, Russia; [2]Yaroslavl State UNiversity, Delaunay Laboratory of Discrete and Computational Geometry, Russia

A full-length version is available and can be opened here:

_extendedAbstract\219_proceeding.*

Abstract. Various methods and rules are developed for symbolizing objects on multiscale maps. However they presuppose symbolization of multitude of scale levels, which is time-consuming task. This work presents novel approach based on hierarchy theory that allows automatic translation of symbology through levels of detail. **1. Introduction** Contemporary desktop GIS applications do not provide direct tools for multiscale symbolization. Every level of detail (usually group of layers with scale range) should be resymbolized manually to reflect scale changes. Rules and principles are proposed for symbol selection and definition of scale ranges for topographic maps (Brewer Buttenfield 2010) and hypsometric relief maps (Samsonov 2011). Roth et al. (2011) developed typology of operators for making multiscale maps legible. Current research is directed to dynamic vector maps (Gaiffuri 2012) that allow setting arbitrary scale, on-demand changing of symbols, blending geometries and adaptive projections (Jenny 2012). However the task of symbolization of multiscale vector maps is not automated enough. **2. Methodology** We offer novel method of multiscale visualization that allows adaptive and automatic translation of symbols from detailed levels to coarse. Our method is based on hierarchical tree of object states. Every node in the tree is object instance in database and it is presupposed that it has link field that points to object instance in the next coarser LoD (i.e. we do not encounter the question of LoD generation). The nodes in the tree are connected by elementary geometry transformations that are classified into 18 possible combinations. Some examples are presented on **Figure 1a**. For every type of transformation several rules are possible: color and transparency correction, width correction, symbol change etc. (**Figure 1b**). Example of full tree is presented on **Figure 1c**. One path in the tree is a chain of symbol changes controlled by transformations and scale differences. Parameters of every elementary transformation in the tree are calibrated after the whole tree is analyzed. Different scenarios of symbol changes are possible. **3. Multimapper application** Multimapper is prototype application programmed in Java that provides tools for authoring multiscale maps. Its functionality and algorithms are based on proposed methodology. The typical workflow is presented on **Figure 2**. Object geometries and symbols are automatically blended between levels of detail during visualization. **4. Conclusion** A novel scale-adaptive approach to symbolization of vector data on maps is introduced that allows automatic translation of symbols from one detailed level to others. The main advantage is that it allows automated preparation of multiscale maps on the basis of high quality multiple representation databases. **References** *Brewer CA, Buttenfield BP* (2010) Mastering map scale: Balancing workloads using display and geometry change in multi-scale mapping. Geoinformatica. 14(2): 221–239. *Gaffuri J* (2012) Toward Web Mapping With Vector Data. LNCS 7478: Geographic Information Science. Proceedings of GIScience 2012. Berlin Heidelberg New York: Springer, p. 87-101. *Jenny B* (2012) Adaptive composite map projections. IEEE Transactions on Visualization and Computer Graphics, 18-12, p. 2575-2582. *Roth RE, Brewer CA and Stryker MS* (2011) A Typology of Operators for Maintaining Legible Map Designs at Multiple Scales, Cartographic Perspectives, 68: 29–64. *Samsonov T* (2011) Multiscale Hypsometric Mapping. In: Advances in Cartography and GIScience. Vol. 1: Selection from ICC-2011, Paris, Berlin Heidelberg New York: Springer, p. 497–520.

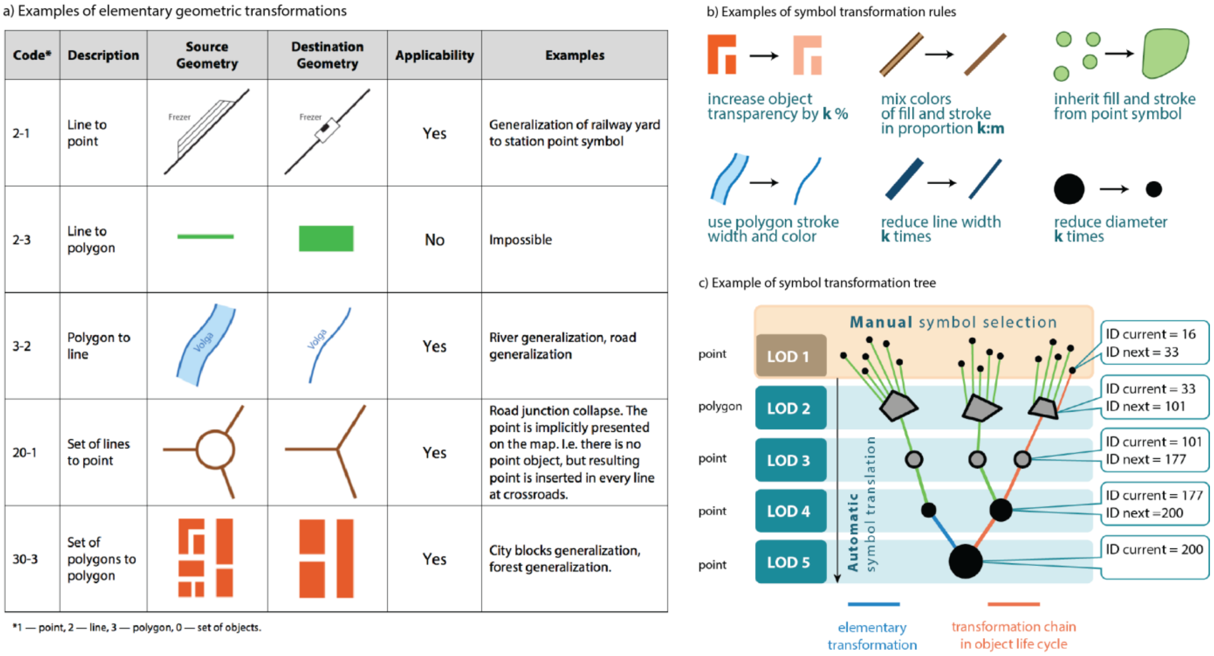


Figure 1.:
Theoretical basis of automatic symbol translation through multiple of scales

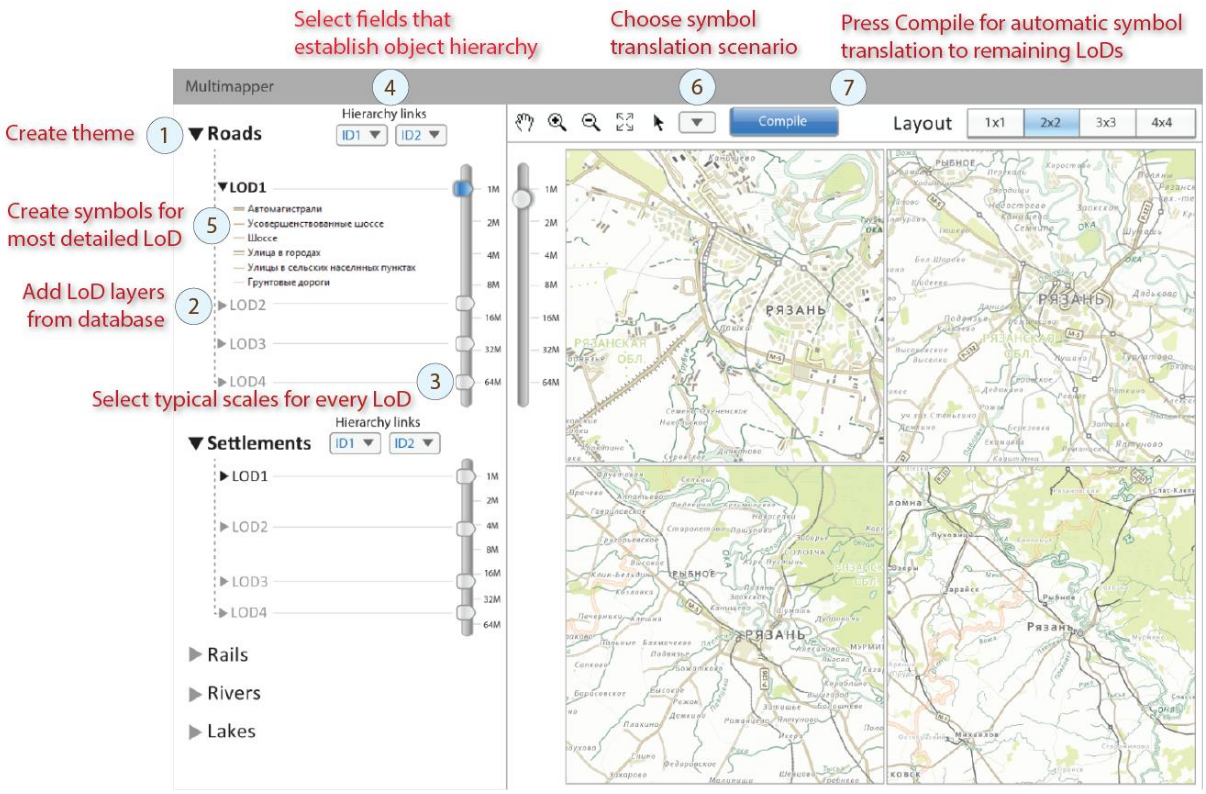


Figure 2:
Multimapper application and typical workflow

4F.3 | **New National Maps of Switzerland** (#520)

D. Käuferle

Federal Office of Topography swisstopo, cartography, Wabern, Switzerland

The Swiss National Map series is renowned for outstanding precision and graphical artwork. For almost eight decades, todays National Map design was provided on high-quality printed maps. Since the nineteen-nineties the maps were also sold as graphical raster files, the so-called Pixel Map. In 2010 the Federal Office of Topography swisstopo published the National Map series in the new federal spatial data infrastructure (FSDI). The FSDI facilitates easy access to about 200 sets of geographical information from Federal Offices of Switzerland. It provides web and mobile portal solutions and commercial products using the geo services of geo.admin.ch. In 2012, geo.admin.ch was awarded by the "United Nations Public Service Award" (UNPAN, 2012) and has won the 2ndplace, in the category of "Advancing Knowledge Management in Government". Because the National Maps serve as base maps in geo.admin.ch, they are the most frequented dataset of the FSDI. While the FSDI is a great way to provide digital access to the National Maps, for the National Map users, the best is yet to come. To take the usability of the National Map series even a step further, the Federal Office of Topography swisstopo is completely rebuilding its production workflows. The key objective is to provide topographic-cartographic data that can be accessed, queried, analyzed and combined with other geographical and non-geographical data easily using simple data queries, geo-referencing and service API's. Yet the map interface is to be easy to use and easy to read offering the comfort and reliability of the current national maps. Reliability means that the map content – being legally official data - must be trustworthy, actual and of adequate quality. To do this, swisstopo decided to build a Multi-representation database containing its high-quality topographic maps at 1:25'000 to 1:1'000'000 scales. Each map scale will be produced as a separate map dataset, a so-called digital cartographic model DCM. The features in each DCM will be linked to their underlying source features. All DCM's are produced, stored and managed in one powerful and scalable database infrastructure. DCM's are derivations of larger scale landscape models. The largest scale DCM, the DCM25 at 1:25'000 will be derived from the topographic landscape model TLM. The TLM is swisstopo's new high-resolution topographic data source. The TLM and the DCM's are both well-defined data models containing mainly geographical vector data in 3D or 2D. The models are hybrid in the sense that they also contain raster data. In the case of TLM, there is one raster contained in the form of a very precise point cloud digital terrain model DTM, and in the case of the DCM's the relief shadings and the rock and scree representations are modeled as raster. The DCM production workflow contains a combination of automated, semi-automated and manual steps. This is necessary to fulfill the requirements for both print and online products at the same time. All data transformations and the main part of the cartographic generalization is performed fully automatic. The cartographic frontend system contains many semi-automatic tools, e.g. for geometric adjustments, symbol refinement, text placement, workflow management and quality control. The professional judgment of the trained cartographer remains an indispensable key component of the cartographic workflow. But not only the maps contents and data structures are renewed. The map design with its symbols, colors and fonts has been carefully redesigned to fit the new model and needs. After almost a decade of planning and implementation, the production of the National Map 1:25'000 as a DCM25 based on the new process will start in spring 2013. swisstopo believes this to be an important milestone towards even better, more versatile and easy to use official maps.

4F.4 | **Labeling Through Scale Using Hierarchies of Thinned Road Networks for Design of *The National Map* of the United States** (#1297)

C. A. Brewer[1], E. Guidero[1], L. V. Stanislawski[2], B. Buttenfield[3], P. Raposo[1]

[1]Pennsylvania State University, Geography, University Park, United States; [2]U.S. Geological Survey, Center of Excellence for Geospatial Information Science, Rolla, United States; [3]University of Colorado, Geography, Boulder, United States

A full-length version is available and can be opened here:

_extendedAbstract\327_proceeding.*

This paper reports on progress in generalization and selective feature removal for a subset of fundamental base map layers that enables competent mapping through scales ranging from 1:24,000 to 1:1,000,000. Thinning methods are applied to road features and labels for *The National Map* of the United States. Roads are thinned adaptively, which removes features using their hierarchy and network connectivity, yet preserves characteristic urban/rural local density patterns that can be lost through simple category removals. For example, most U.S. roads are in the local category, but completely removing this category because urban road patterns become congested at a smaller scale leaves some rural areas devoid of roads. The paper describes use of road network thinning to produce label hierarchies within road categories. It also describes improved preference in placement for the most important road labels and selective removal of labels through scale. The paper reports progress on combining multiple levels of road thinning to improve the quality of road label placement (Brewer et al. 2012).   We compare road labeling and road density achieved using current methods to that achieved using series of progressively thinned road networks through scale. For example, a topographic map may be produced at a medium scale of 1:150,000. This map scale may have roads removed that do not participate in network segments longer than approximately 2000 meters, produced using a minimum road length parameter of 1000m with the Thin Road Network geoprocessing tool in Esri's ArcGIS 10.1. For example, short roads in housing developments are removed. In contrast, thinning with a large minimum road length, such as 14000m, will produce a network of the most significant through routes in the network. These roads will be labeled with more prominent labels, and those labels will be given placement priority in the ArcGIS Maplex labeling engine settings. An intermediate network, produced with minimum lengths between 3000m and 14000m (Fig. 1), will be assigned smaller labels that are placed with lesser priority by the labeling engine. Roads within the range of 1000m and 3000m thinnings will be visible on the map but will not be labeled. A map display produced using these four levels of road thinning (all roads-1000, 1000-3000, 3500-14000, and greater than 14000) is referred to as a classified map for this study (Fig. 2b). In comparison, roads are presently labeled without the benefit of thinning levels within a road category. Using all available names, Maplex may place more dynamic labels appropriately but may not include the names of major through streets that characterize a map (Fig. 2a). These major roads are the most useful for wayfinding or as a base layer for other spatial distributions. These labeling results are referred to as an unclassified map.   Quality of label placement is evaluated by statistically comparing proportions of labels placed at each level of road importance between classified and unclassified map displays. Annotation tables are compared by counting matches and mismatches name by name, using the Maplex-generated status attribute of placed and unplaced, produced when dynamic labels are converted to annotation by ArcMap. This work expands on earlier work by improving the selection of thinned class ranges and including additional road thinning levels (resulting from the Thin Road Network tool using longer minimum lengths) to refine the label selection process through scales as small as 1:1,000,000, which may be applied for the National Atlas of the United States.® Example maps at a series of scales demonstrate the labeling results for roads classified by thinning and for unclassified roads. Reference: Brewer, Stanislawski, Buttenfield, Raposo, Sparks, and Howard (2012) Multiscale Design for *The National Map* of the United States: Road Thinning for Topographic Mapping. AutoCarto 2012, Columbus, Ohio.

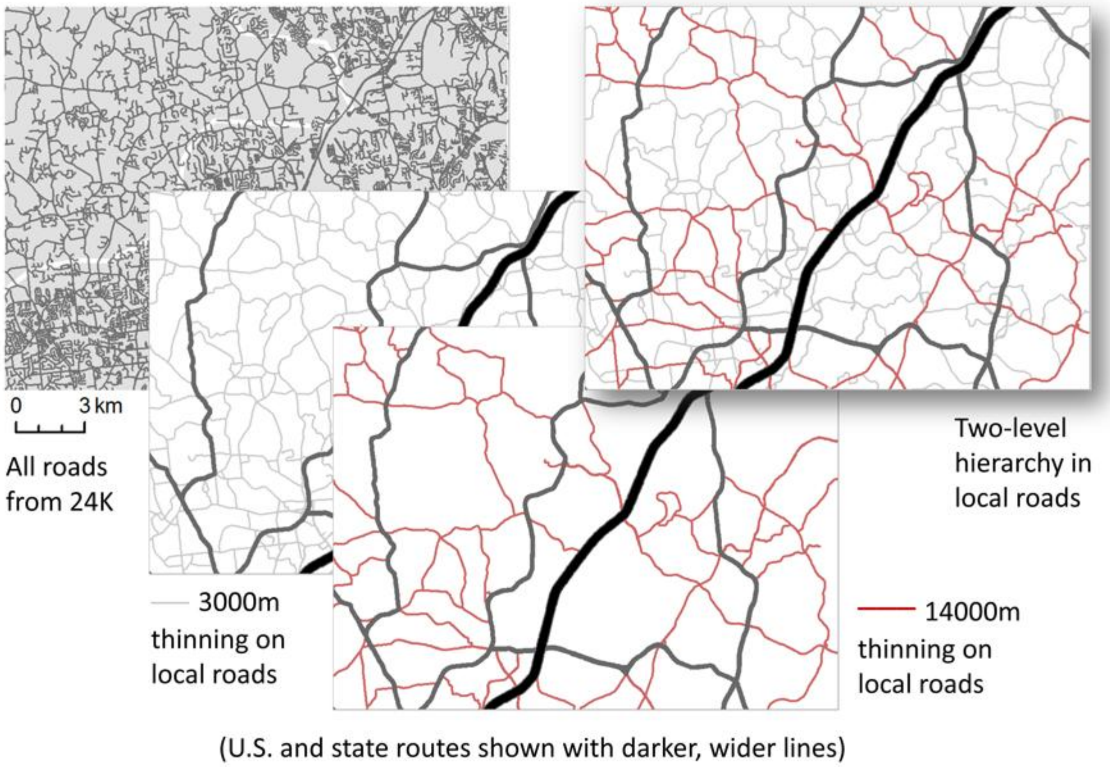


Figure 1:
Example of roads thinned to three levels of hierarchy: less than 3000m are not visible, 3000-14000m are minor roads, and greater than 14000m are major roads within the local road category.

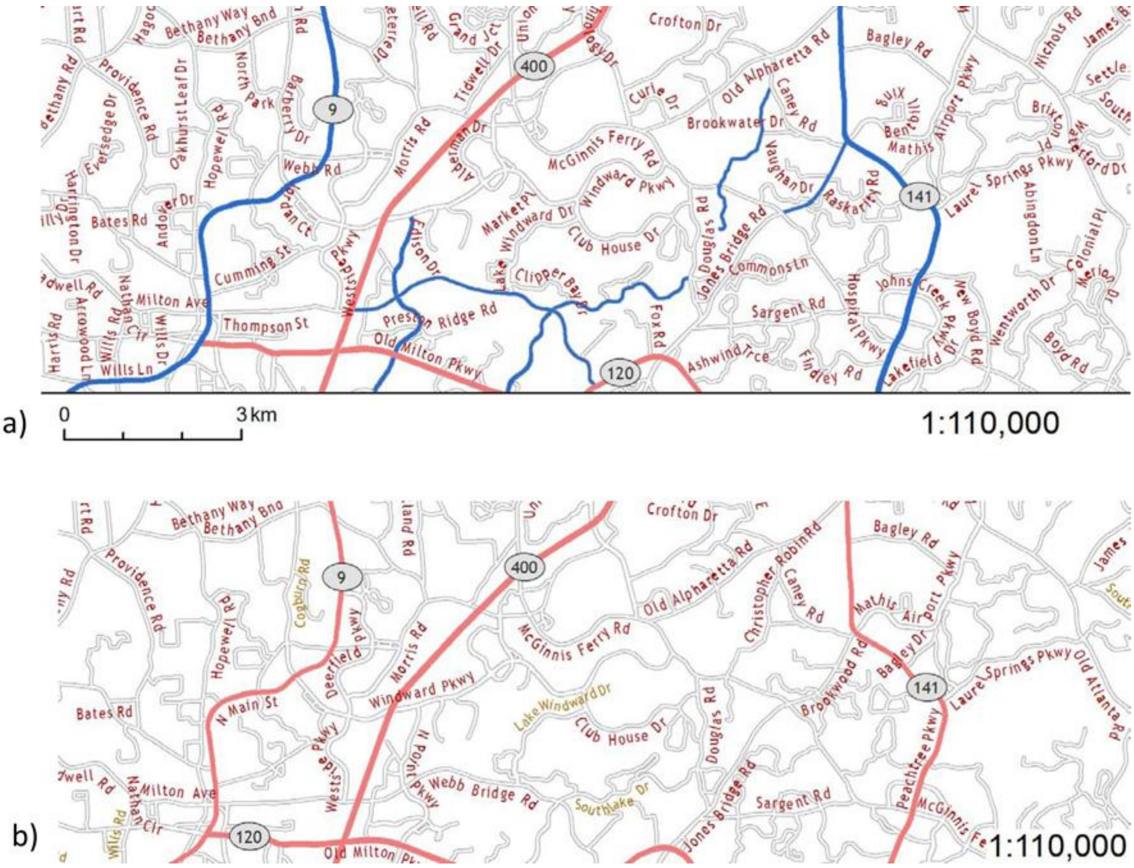


Figure 2:
Example of (a) unclassified road labeling and (b) classified road labeling. The blue lines in 2a show major through roads that Maplex did not label in the unclassified view but did label in the classifed view (2b).

ORAL

Session S4-G

Image Processing

Tuesday, 27 August, 2013

11:00 - 12:15

4G.1 | **An Assessment of Neural Networks Architecture Impacts upon Image Classification Accuracy** (#211)

X. Yang[1], L. Zhou[2]

[1]*Florida State University, Geography, Tallahassee, United States;* [2]*Thomson Reuters Lanworth, Chicago, United States*

A full-length version is available and can be opened here:

_extendedAbstract\87_proceeding.*

Artificial neural networks are attractive intelligence techniques that have increasingly been used to classify remote sensor imagery in connection to various environmental and urban mapping applications. However, their performance is contingent upon a wide range of algorithmic and non-algorithmic factors, from architectures, internal parameters, and training algorithms, to training samples and input data dimensionality. While several recent studies have targeted some of these factors, our current work aims to investigate the impacts of neural networks architectures upon image classification accuracy. We specifically consider multi-layer perceptron (MLP) neural networks and adaptive-resonance-theory (ART) neural networks in order to evaluate the performance of the two basic neural network structures: the simplest feed-forward structure (MLP as an example) and the recurrent structure (ART as an example). We carefully configure a set of neural network models with different internal parameters for each of the two major architectures. Then, we use these models to classify a Landsat Enhanced Thematic Mapper Plus (ETM+) image covering an urban area, and the accuracy of each classified map is assessed. The optimal parameter settings for each of the two architectures are identified, and their performance is further assessed in terms of the overall classification accuracy and the specific accuracy for each urban class. It is found that the MLP neural networks clearly outperform the ART networks. Although only two different architectures are considered here, our research suggests that neural network architectures can significantly affect the performance of image classification. Our further research will include some more architectures in order to better understand neural network architectures affecting image classification accuracy. This can help select and design efficient neural network models for improved performance of remote sensor image classification.

4G.2 | **Comparing Spectral Mixture Analysis and Object Based Image Analysis for Mapping Fractional Cover in Semi-Arid Savanna Systems** (#484)

N. Mishra

The University of Texas at Austin, Department of Geography & the Environment, United States

Savanna ecosystems are geographically significant, sensitive to environmental change, and are important reserves of biodiversity. With recent land use and climatic shifts, both functional and structural attributes of the vegetation of Botswana's central Kalahari savanna ecosystem has undergone large-scale changes with implications for biogeochemical processes and availability of key habitat-related resources. Sustaining this dynamic system necessitates ecologically informed decision making that, in turn, requires fundamental knowledge about land cover and functional attributes of vegetation assemblages (e.g. vegetation type, density). Fractional cover of photosynthetic vegetation (fPV), non-photosynthetic vegetation (fNPV) and bare soil (fBS) are important determinant of savanna ecosystem function and their accurate estimation across scales has been a major research theme in savanna remote sensing. Focusing on the semi-arid savanna system in Central Kalahari, this study combined in-situ measurements of fPV, fNPV, fBS with those derived from spatio-temporally coincident high resolution imagery (GeoEye) following Multiple Endmember Spectral Mixture Analysis (MESMA) and Object Based Image Analysis Approach (OBIA) to investigate: (i) How does fractional cover derived in situ relates to those derived from MESMA and OBIA approaches and (ii)What is the comparative suitability of MESMA versus OBIA approaches for accurately estimating fractional cover in central Kalahari? Endmembers for MESMA were derived from the image using established purity measures. Two-, three-, and four-endmember models were tested for each pixel under a partially constrained MESMA approach. Final composites of these results were derived based on a rule that compared the root mean square error (RMSE) of the results. Following OBIA approach the GeoEye image was segmented using multi-resolution segmentation with iteratively derived optimal segmentation parameters. Training objects were selected using 'feature view' tool and visual interpretation. Classification was performed using nearest-neighbor classifier where optimal feature space was determined based on Jeffrey-Matusita distance and included spectral, spatial, contextual and textural measures. Statistical measures used for evaluation were mean error (ME), mean absolute error (MAE), RMSE and correction between observed and predicted fractional cover. Both MESMA and OBIA derived estimates were shade normalized before validation and accuracy assessment. Results depicted that suitability of fractional cover mapping technique depended on vegetation morphology. Only in very dense shrubland and woodland areas OBIA produced slightly more reliable fractional estimates outperforming MESMA results. However in more open shrublands and grassland interspersed with shrub areas (dominant in semi-arid systems) MESMA produced more reliable fractions outperforming OBIA approach. Further MESMA produced more reliable estimated of fPV while fNPV was overestimated at the cost of underestimating fBS. Inclusion of textural measures in the OBIA classification improved the classification accuracy but also increasing the processing time significantly. Accuracy assessment using independently selected samples for OBIA results depicted that bare soil could be estimated with highest accuracy followed by photosynthetic vegetation and non-photosynthetic vegetation. Overall results of this study suggest that for deriving fractional cover estimates at landscape level in semi-arid savannas using GeoEye imagery, MESMA is more cost and time effective than OBIA approach.

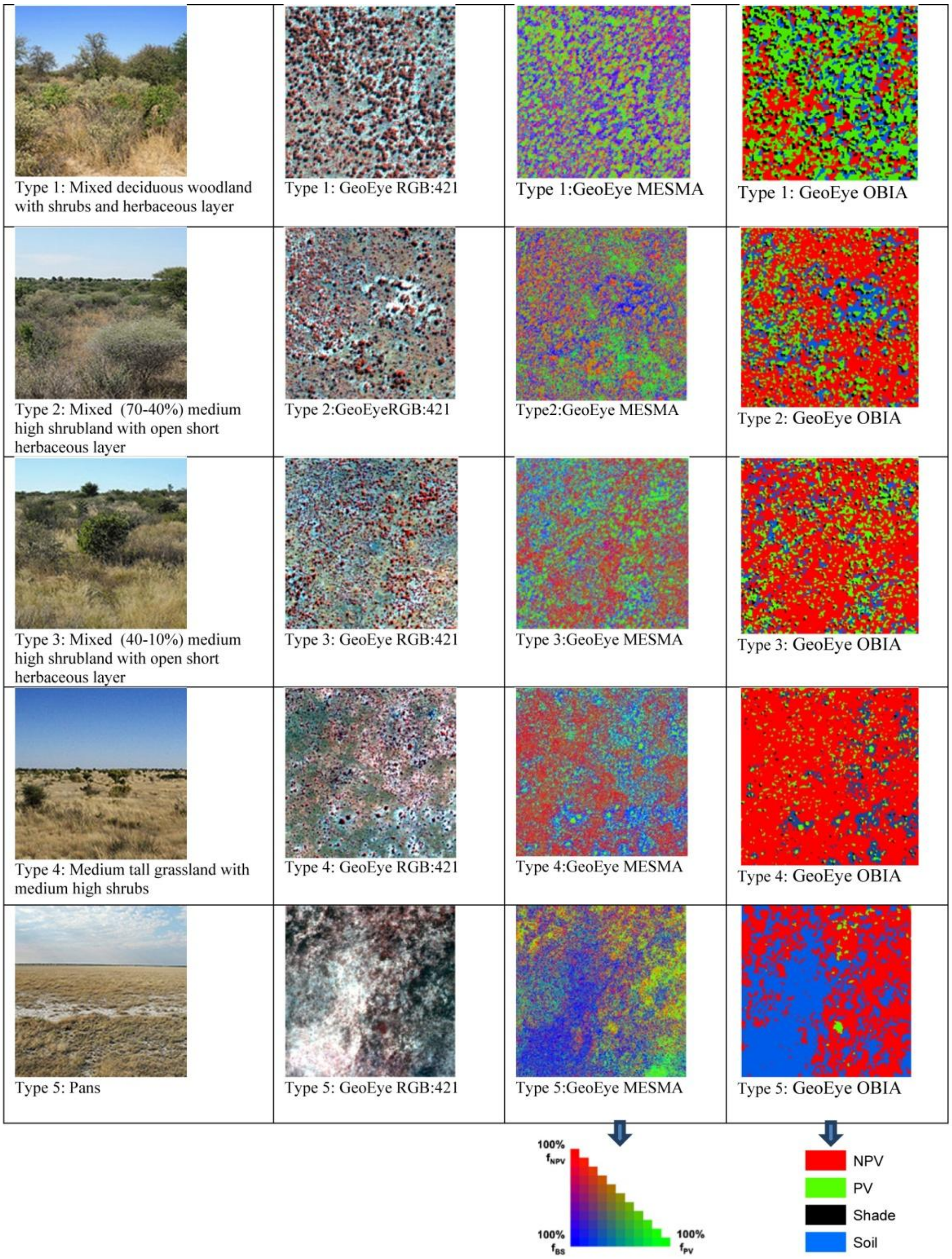


Figure: GeoEye derived fractional cover following MESMA and OBIA approaches for five different vegetation morphology types in the semi-arid central Kalahari of Botswana. First column represents field photos and each example subset of GeoEye imagery represents 450x450 m spatial area.

Figure:

Fractional cover derived following MESMA and OBIA approaches for five different vegetation morphology types in the central Kalahari of Botswana. First column represents field photos and each example subset of GeoEye represents 450x450 m spatial area.

4G.3 | **Enhancing the Locational Perception of Soft Classified Satellite Imagery Through Evaluation and Development of the Pixel Swapping Technique** (#582)

M. Niroumand Jadidi, M. R. Sahebi, M. Mokhtarzade
K. N. Toosi University of Technology, Geomatics Engineering, Tehran, Iran

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 063-078

Spatial component is the key and most likely the first element of map making so that accurate spatial information improves the locational perception of map users. In this regard, soft classified satellite imagery conveys class proportions within pixels; however spatial distribution of the sub-pixels remains unknown. So, different visualization techniques (e.g. pie-chart representation of the proportions) are suggested to communicate the detailed land cover information. However, in each of which, the perception of actual spatial location of sub-pixels is definitely difficult for map users. Recently, the Super Resolution Mapping (SRM) techniques have been developed for optimization of the sub-pixels spatial arrangement based on the concepts of spatial dependency. These are relatively new methods which a comprehensive study on their performance and also their decisive parameters is a central issue for sub-pixel land cover mapping. In this research, the binary Pixel Swapping (PS) algorithm, as a prominent SRM algorithm, is developed for multivariate land cover mapping and the accuracy of the proposed method is evaluated in two procedures of independent and dependent of the soft classification error. Likewise, the impact of some parameters (e.g. zoom factor, neighborhood level and weighting function) is investigated on the efficiency of the algorithm. According to the results, the overall accuracy of the PS technique is extremely dependent on the accuracy of its input data (outputs of the soft classification). Furthermore, as a key result of this paper, it is indicated that by increasing the zoom factor, the overall accuracy of the algorithm decreases. Also, the second level of neighborhood and inverse/square inverse distance functions has demonstrated the highest accuracies. Considering lower values than 5 for zoom factor, overall accuracy of the algorithm is determined higher than 90% in procedure of optimizing the sub-pixels spatial arrangement.

4G.4 | **MATHEMATICAL MORPHOLOGY OF REMOTE SENSING IMAGE TO IDENTIFY LOCAL MINIMUM AND AID THEMATIC CARTOGRAPHY** (#851)

A. L. Bezerra Candeias, J. R. Tavares Junior

UFPE, Cartographic Engineering, Recife, Brazil

Remote Sensing (RS) image analysis aid in the study of the terrestrial environment. These images represent the interactions between electromagnetic radiation and the targets present in a portion of the land surface (scene). One product of this analysis is the thematic map. With the visual spatial information image extracting, the user detects, identifies, and measures object (s) or pattern (s) of interest in the image. So, the user applies a transformation in the original image and extracts only the information of interest. The result could be in the form of a more simplified than the original image (type classification deforestation, extraction of roads, etc.), or as a measure of the original image (cleared area count, percentage of urban growth, etc.). The use of digital image processing automates the extraction of this information. Mathematical Morphology (MM) is a non-linear approach in image processing. It started from the sixties with George Matheron and Jean Serra School of Mines of Paris in Fontainebleau. The goal was to extract information from the analysis of geometric structures of metal or rock samples obtained by microscope images. As a result of this study emerged a theory of spatial analysis of structures that was called MM: Morphology, for help in the analysis of shapes and objects, and mathematics, this analysis is based on set theory, topology, lattices, random functions, etc. The MM was initially developed for the analysis of binary images, where the linear approach did not prove effective, and was then extended to gray levels. Some studies are being developed for color images. The central idea of MM is the decomposition of mappings between complete lattices in terms of four classes of elementary transformations: dilations, erosions, anti-dilations and anti-erosions. The whole theory of MM is built on the notion of partial order, from three axioms (reflexivity, anti-symmetry, transitivity). With MM we consider the sets provided by a partial order relation that are also lattices. In this case, one can define two operations: union and intersection which, in turn, has the properties of commutativity, associativity and absorption. MM can be compared with arming LEGO game. The parts to be fitted are: dilations, erosions, anti-dilations and anti-erosions and the operators are the objects created from these parts. With MM, you can assume a unified theory for image processing problems. It is possible to generate different methodologies to study the extraction of information on MR images using the same tools of MM. This paper presents basic concepts of mathematical morphology and how to get local minimum, without a specific threshold. Equations are developed with the tools of MM for objects that can be seen as a local minimum like roads. The dimension of the structural element will define the minimal region. If the structural element is small, more noise can be obtained in the final image. If the structural element is large, less noise could be obtained in the final image. This application can be useful for water bodies, roads and other targets with low levels of ash remote sensing images of medium resolution. The roughness of the image would generate more difficult to obtain the local minimum. The result could be useful in thematic cartography.

ORAL

Session S4-H

ISPRS/ICA

Tuesday, 27 August, 2013

11:00 - 12:15

4H.1 | **Improving evacuation maps by integrating needs and preferences of end-users in GIS** (#325)

G. Palka[1,2], K. Serrhini[1,2], S. Fuchs[3], S. Thibault[1,2], E. Neron[4,5]

[1]University François Rabelais, Polytech'Tours - Town and Regional Planning Department, TOURS, France; [2]UMR CNRS 7324 CITERES, TOURS, France; [3]University of Natural Ressources and Life Sciences, Institute of Mountain Risk Engineering, Wien, Austria; [4]University François Rabelais, Polytech'Tours - Informatic Department, tours, France; [5]Laboratoire d'Informatique, Tours, France

A full-length version is available and can be opened here:

_extendedAbstract\216_proceeding.*

During the last decades, Geographical Information Systems (GIS) have made many advances in data analysing, internet broadcasting, software ergonomics… Consequently, GIS has become a powerful tool in terms of spatiotemporal map production. However, despite studies on semiotics and perception, the design phase still depends on the knowledge and the expertise of the mapper who more often is a specialist in a specific domain than a cartographer. Thus, imperfect map composition or content presentation is common, such as for example in some current national approaches to meet the mapping requirements of the EU Floods Directive. Maps in this sense are used to communicate evacuation information to a broad variety of stakeholders, such as emergency planners, public administrations, and citizens. Adapted and specifically prepared information representation is essential to inform these stakeholders effectively and quickly about evacuation roads, or to decrease the spatiotemporal uncertainty of decision makers allowing them to take necessary action in emergency situations. The results of recent European research on flood risk cartography [MEY 12] have shown that it is possible to create generic map models according to the needs of various end-users. Using methods from social sciences and medicine, a tool – graph of preferences – was built based on the major characteristics of flood risk maps, and three models of these maps were produced that represent the specific requirements of different stakeholder groups. Nevertheless, experience and knowledge of the mapper are still needed which is regularly limited because of two reasons: Firstly, flood risk management still relies on a combination of different maps (content, scale, graphic representation) to be used by individual stakeholders; and secondly, so far, the suitability of enhanced maps – in terms of an increased information flow or with respect to an increased information power – still needs the approval by end-users, which so far is only achieved by a number of individuals volunteering during this process [FUC 09]. Based on these constraints, an innovative mapping protocol and representation tool – cartographic profile – is being developed, which is more closely embedded in the GIS. Based on Marr's approach of vision, cognitive and perceptive models [MAC 95] and features of visual search, the needs and preferences of the end-users were translated into layer-semiotic characteristics. This model considers the global complexity of an evacuation map, the hierarchical organisation between the layers and the graphic representation of each layer. The model is built in three steps to take into account the particularities of the evacuation communication with a strong link to mental representation by a technical visual tool (eye tracking). Firstly, the model system is defined by the purpose of mapping, the end-user needs and the needed data thanks to a web survey. Secondly, needs and preferences of the end-users are translated into cartographic parameters according to the data and the purpose of use during and before the evacuation phase. An interactive web mapping survey with an algorithm for decision support proposes a pre-adapted map and helps each end-user to build his/her map. Thirdly the figuration is evaluated to define attractive or difficult symbols by eye-tracking, and to evaluate the complexity and usability of the map. Finally, the method can be repeated to continuously improve the results. The conceptual approach and first results will be presented and the resulting improvement for evacuation maps will be discussed. [FUC 09] FUCHS, S.; & al. (2009): Evaluating cartographic design in flood risk mapping. Environmental Hazards 8 (1), p. 52-70 [MAC 95] MACAECHREN, A. M. (1995): How Maps Work. New York: Guilford Press, 513 p. [MEY 12] MEYER, V.; & al. (2012): Recommendations for the user-specific enhancement of flood maps. Natural Hazards and Earth System Sciences 12 (5), p. 1701-1716

4H.2 | **Mixing, blending, merging or scrambling topographic maps and orthoimagery in geovisualization?** (#910)

C. Hoarau[1,2], S. Christophe[1,2], S. Mustière[1,2]

[1]IGN France, COGIT Laboratory, Saint-Mandé, France; [2]Université Paris Est, Marne-la-Vallée, France

A full-length version is available and can be opened here:

_extendedAbstract\185_proceeding.*

Geoportals and cartographic applications provide heterogeneous geographic data such as topographic maps or orthoimagery layer and lead to various geovisualization applications. In this paper, our purpose is to analyze advantages and drawbacks of both representations and to look for methods to design in-between representations mixing, blending or merging them. This design will be guided by the results of our study of geovisualizations in use in websites based on the French geoportal (Hoarau 2012). Can we learn from one representation to improve the other one or merge their strengths? This paper outlines why it is a great opportunity to use topographic maps and orthoimagery together to design in-between representations without scrambling initial information. One key issue is then how can we blend both representations to design in-between representations. In this paper we will explore how to go beyond the single use of transparency to superimpose images and maps, as traditionally encountered in numerous geoportals. Could we use the photorealism of orthoimagery data in order to texture empty areas of topographic maps and make them more expressive (Patterson 2002)? Could we use graphic rendering tools in order to make maps more natural (Jenny 2012)? Could we use the colors of the orthoimagery in order to make topographic maps more realists? Could we adapt the symbolization of the roads depending on the color of an orthoimagery background in order to make them more readable? This issue invites us to first analyze the perception given by both representations and their role and use in geovisualization applications. How the world is perceived through topographic maps and orthoimages, which both aims at depicting the same landscape? Maps provide an abstract representation of the world, where features are categorized, selected, and represented with hierarchized and artificial symbols, and where additional information such as geographical names may be added. Orthoimages display all features that may be seen from the sky, with realistic or natural colors and textures, but without prior categorization, which may lead to misinterpretations. The role of the different spatial representations has also to be questioned. As long as maps were only available in paper format as the unique resource of spatial information, they were considered as the main way of storing spatial and geographical knowledge. With the emergence of present technologies, this knowledge has been stored in geographic databases. Maps thus become more adaptive to users' needs and preferences. Moreover, maps are not any more designed has self sufficient representations but increasingly used to visualize complementary data. They could thus be adapted, faded or lightened in order to fulfill this usage. This evolution generates a "competition" between maps and orthoimagery data as background layers. One preliminary result is the use of orthoimagery patches instead of the green tint area widely used in topographic maps portraying vegetation. This first attempt should be improved weakening transitions from orthoimagery to map visualization, stylizing gradually textures from tint area to photorealistic patterns and adapting the symbolization of vector cartographic features to be better contrasted when overlaid to an orthoimage. Hoarau, C. (2012) Orthoimage or map visualization in use in geoportals, case study on the French geoportal. In AutoCarto2012. Jenny, B. (2012) Pseudo-natural Maps Research Project Website. http://cartography.oregonstate.edu/pseudo-natural/ Last visited 1/11/12. Patterson, T. (2002) Getting Real: Reflecting on the New Look of National Park Service Maps. Cartographic perspectives, vol. 43.

4H.3 | **Distribution Patterns of Typified Façade Elements for Virtual Three-Dimensional City Models** (#923)

J. Mathias, J. Krisp, H. Kumke

Technische Universität München, Department of Cartography, Munich, Germany

A full-length version is available and can be opened here:

_extendedAbstract\58_proceeding.*

The visualization of virtual three dimensional city models is an evolving area in cartography. City models ranges from block models to very detailed architecture models. Therefore the question of interest is how a visualization should look like in general or in a particular context? To answer this question the target user or the target user group and the circumstances under which the visualization should be used has to be taken into account (Meng et al., 2008). On one hand city model visualizations can be used in a stationary and on the other hand in a mobile environment. To find feasible city model visualizations for a mobile user seems to be the more demanding task. To achieve the goal of user oriented visualizations on small displays the theories, concepts and approaches of the traditional cartography have to be expanded to create abstract and information reduced visualizations. The abstract visualization of city models which seems to fit most for small mobile displays (Jahnke et al 2011). With this approach it is possible to add semantic information to the visualization even if it is displayed on a small display. Simplified buildings gave the whole city an abstract appearance therefore not only the building ground plan has to be simplified. Façade objects like windows, balconies and entrance areas have to be simplified as well. In the case that many façades offer a regular distribution of windows the generalization operator of typification can reduce those elements (Fan et al., 2009, Li et al., 2004). Within this paper we suggest a visualization approach by flattening façade objects like balconies and window sills to an outer shell of the building and reducing and typifying the number of façade elements to a scale dependent appropriate size we can reduce the amount of edges and surface areas by about 80%. When typifying façade elements the distribution of these elements have an important impact on the recognition factor between real world objects and the artificial objects of the visualization. Figure a) shows a picture of our test scene and figure b) shows the associated model. The figures c) and d) show two different distribution patterns for façade elements. We have conducted a user survey with 67 (37 male, 30 female) participants, that indicate us that the distances between façade elements should be the same as before typification. The evaluation of different distribution pattern of façade elements shows a difference and user ranking between the different distribution patterns. The differences are significant but small. The work documents the importance of generalizing and typifying a building for an appropriate visualization in particular for small mobile displays and that resizing the building is not the right way to please the user. FAN, H., MENG, L. & JAHNKE, M. 2009. Generalization for 3D Buildings Modeled by CityGML. *In:* SESTER, M., BERNARD, L. & PAELKE, V. (eds.) *Advances in GIScience* Heidelberg, Berlin: Springer. JAHNKE, M., KRISP, J. M. & KUMKE, H. 2011. How Many 3D City Models Are There? - A Typological Try. *The Cartographic Journal,* 48**,** 124-130. LI, Z., YAN, H., AI, T. & CHEN, J. 2004. Automated building generalization based on urban morphology and Gestalt theory. *International Journal of Geographical Information Science,* 18**,** 513-534. MENG, L., ZIPF, A. & WINTER, S. 2008. *Map-based Mobile Services: Design, Interaction and Usability,* Berlin Heidelberg, Germany, Springer.

a b c d

Figure:
a) picture of the scene, b) the associated model, c) and d) two different distribution patterns for typified facade elements

4H.4 | **Eye-tracking Study on Different Perception of 2D and 3D Terrain Visualization** (#1120)

S. Popelka, A. Brychtova
Palacký University in Olomouc, Department of geoinformatics, Czech Republic

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 240

The use of computer-generated perspective views, often named as 3D maps, is growing. These terrain visualizations should be more understandable for users without cartographic education, which are not familiar with contour lines.
Within the study, two eye-tracking experiments and online questionnaire were used for investigating the differences between user cognition of classical 2D visualization with contour lines and perspective 3D view. Questionnaire was focused on maps understandability, suitability and aesthetics. Results of the questionnaire shows, that the majority of participants prefer 3D visualization.
First eye-tracking experiment was designed as a pair of maps in one stimuli. One shows 2D visualization, the other 3D visualization. No significant differences between user preferences of 2D and 3D visualization were found, but the results were influenced with the order of the maps in the stimuli. Because of that another experiment was designed. In this case stimuli contained only one of two possible visualizations (2d and 3d).
ScanPath comparison of this experiment results confirmed, that users have different strategy for cognition of 2D and 3D visualization, although statistically significant difference between both types of visualization was found in the ScanPath length metric only.

Session S4-I

Business Meeting of the Commissions on Map Design, Neocartography

Tuesday, 27 August, 2013

11:00 - 12:15

Session S4-J

Business Meeting of the Commission on Geospatial Analysis and Modeling

Tuesday, 27 August, 2013

11:00 - 12:15

POSTER

Session P1

Poster Session

Tuesday, 27 August, 2013

12:15 - 12:45

P1.2 | **The Cognitive and Opinion-forming Role of Geocomposition as an Independent Semiotic Existence** (#281)

Z. Kozieł

Nicolaus Copernicus University, Department of Cartography, Remote Sensing and GIS, Toruń, Poland

A full-length version is available and can be opened here:

_extendedAbstract\281_abstract.*

P1.3 | **MENTAL MAPS: THEORETICAL AND METHODOLOGICAL ISSUES AND CONTRIBUTIONS** (#76)

P. M. Ferreira Dionisio

Federal University of Rio de Janeiro, Geography Department, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\18_proceeding.*

Mental maps are not the result of international cartographic conventions; they are the unique, subjective, and selective representations of reality, cognitive or mental images of an environment constructed by an individual or a group. This construction is an active process and the individuals are considered a conscious map builder, capable of developing their own maps with symbols, measures, and peculiar projections. Therefore, mental maps are important methodological tools for reflecting about the relationship between individuals and places. This paper aims to perform a brief overview of the theoretical discussions and methodological issues of mental maps. Firstly, the concepts of perception and image, according to theoretical currents in Psychology and Geography, are discussed, laying the foundation for further theoretical discussion about mental maps. In this last section, the many nomenclature and definitions related to this imaging instrument are addressed, as well as its methodological possibilities, difficulties, contributions to the study of the mind, and especially, its contributions to urban research and the geographical science in general.

P1.4 | **IDENTIFICATION OF STYLES IN TOPOGRAPHIC MAPS** (#979)

J. Ory[1,2], S. Christophe[1,2], S. I. Fabrikant[3]

[1]IGN France, COGIT Laboratory, St Mandé, France; [2]Université Paris Est, Marne-la-Vallée, France; [3]Geographic Information Visualization & Analysis (GIVA), University of Zurich - Department of Geography, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\274_proceeding.*

The notion of cartographic style is identified as an essential element of map design in the cartographic literature, but is has not been systematically studied. (Kent & Vujakovic 2009) characterize style as “appearance and content”, dependent of the geographic space represented in the map. On the one hand, (Beconyte 2011) emphasizes the complexity to formally define the structure of the employed style, but on the other hand she also argues that “the concept of style is applicable to every type of maps” (p. 1). Both authors suggest that it is possible to distinguish different map styles, according to a set of quantifiable parameters or systematic criteria. (Christophe 2012) presents some potential approaches such as, visual categorization, map specification, and artistic design style characterization to systematically capture the notion of style. We contend that a specific map design method may produce cartographic results with typical visual characteristics that can be identified as a cartographic style. In this paper, we propose a systematic approach to formalize cartographic styles, to be able to identify and to automatically design maps based on a chosen cartographic style. We contend that a specified style may be applicable to any type of geographic data, and is thus able to create data independent so called stylized maps. Furthermore, we assume that the consistent application of stylistic rules may significantly improve the graphic quality of the resulting map, dependent also on users’ needs. We propose to formalize and implement stylistic rules with and for existing cartographic design tools. Our challenge consists in proposing a comprehensive design framework, taking also into account data preprocessing (ie, selection, generalization, etc.), the visual variables, legend design, and the geographic features to be mapped. Data-dependent styles, thus dependent on the displayed geographic features, may also be useful for style formalization. We aim at systematically specify and visually characterize topographic maps at the same scale (i.e., 1:25000), according to cartographic pre-processing, map legend design, and mapped feature types, but from two different mapping agencies, both with a long-standing mapping tradition (i.e., IGN France, and Swisstopo). We chose topographic maps for our research, because they are aimed at effectively depicting territorial complexity. The IGN and Swisstopo maps also illustrate different cartographic practices and resulting styles. This allows us to specifically evaluate the graphic composition of a topographic style and the resulting visual impact it may have on users’ map perception and cognition. We are currently also considering thematic maps, such as subway maps and ski trails maps, in order to obtain a broader understanding of cartographic styles. With this work, we hope to extract operational design knowledge such as, relevant criteria and parameters, to be able to design stylized maps, considering different cartographic practices for varying geographic areas. References Beconyte G. 2011. Cartographic styles: criteria and parameters, In Proc. 25th International Cartographic Conference (ICC’11), 3-5 July, Paris, France. Christophe S. 2012. Cartographic Styles between traditional and original (towards a cartographic style model), In Proceedings of AutoCarto Conference 2012, 16-18 September, Columbus, Ohio, USA. Kent A.J. and Vujakovic P. 2009. Stylistic Diversity in European State 1:50 000 Topographic Maps. The Cartographic Journal 46 (3) pp.179–213.

P1.5 | **Evaluation of maps based on the level of figure and background differentiation** (#1017)

Z. Šterba

Masaryk University, Department of Geography, Brno, Czech Republic

Cartographic products are nowadays used by more and more users that primarily want to get required information as quick as possible and with appropriate accuracy. The increasing interest of general public on the availability of all cartographic products, such as interactive maps, caused higher emphasis on preference of the technological aspects of used tools (better GIS solutions or geocollaboration tools). The content of these tools and the way of cartographic visualization are getting less important and overlooked by some authors. Some of the examples could be documented even in such a crucial field as crisis management. From these reasons we should be more focused on possibilities of the cartographic visualization according to the defined purpose. Evaluation of newly proposed cartographic symbology must be an integral part of mapmaking process. This paper deals with the possibility of making the evaluation process of cartographic products more objective. Cartography is not just about creating maps, but it is also necessary to evaluate these maps according to their purpose. Before such an evaluation process we always need to know what is being assessed and which quality should we put emphasis on. The most important aspect is a determination of the relevant criteria of the evaluation that must reflect all the user's needs for every specific cartographic product. In fact, utility value of the map must be always derived from the interaction between the users and the map and from the way these users perceive the visualized information. Map legibility is very significantly determined by the user's ability to distinguish more important symbols in foreground. Therefore level of differentiation of figure symbols and background information could be a possible way to evaluate proposed cartographic symbology. The level of differentiation is, beside the association value of figure symbols, considered as a crucial aspect of proposed evaluation method. This method is based on two visual properties of a map. At first the differentness of colour parameters between figure and background is assessed. Another aspect describes a visual complexity of the map, which helps to measure number of visual distractors. Both of these factors could be considered as a highly predictive way to evaluate the map usability. The proposed method is subsequently employed to selected visualizations of crisis maps used in operational emergency centres in the Czech Republic, because a capability of providing the required information quickly and precisely is the principal assumption of these maps. From this reason the level of differentiation of several map samples is assessed, including the differentness of colour parameters and the visual complexity measures. Eventually the results of the evaluation process are interpreted with an emphasis on the usability of the maps.

P1.6 | **Quantifying Magnitude of Change for Animated Maps** (#1449)

E. - K. Kim, A. MacEachren

Pennsylvania State University, The Department of Geography, University Park, United States

A full-length version is available and can be opened here:

_extendedAbstract\366_proceeding.*

The development of multimedia technologies has resulted in production and distribution of various types of animated maps, in which users can easily recognize movements or changes of map components over time and space. Animated maps are fundamentally different from static maps not only in terms of the characteristics of phenomena represented, but also the perceptual-cognitive aspects of visual stimuli. For example, animated maps are based on a one of the core principles of the vision mechanism for processing visual stimuli, *retinal persistence*, based upon which animated maps can be effective in emphasizing changes between map scenes (Cauvin et al. 2010). Owing to these traits, cognitive and usability research has evaluated effectiveness of animated maps. They have revealed that although animated maps represent time-dependent phenomena well, animated maps sometimes fail to satisfy the Apprehension Principle (Tversky et al. 2002), by which "the structure and content of the external representation should be readily and accurately perceived and comprehended." Some empirical studies imply that too complex and dynamic animated maps lead to difficulties in conveying information (Bétrancourt & Tversky 2000, Goldsberry & Battersby 2009). Therefore, to make well-designed animated maps, it is fundamental to address the question of how dynamic visual variables including magnitude of change (MOC), duration, order, display date, frequency, and synchronization (DiBiase et al. 1992, MacEachren 1995) influence users' performance in map reading. This study focuses on MOC because representing changes between map scenes is a main advantage of animated maps. Some research has discussed the cognitive aspects of transition behaviors of animated maps. Specifically, Goldsberry and Battersby (2009) dealt with the cognitive issues of animated choropleth maps, in particular, focusing on change detection; the authors proposed that change-characterization arrays can efficiently quantify the magnitude of changes in each enumeration unit's fill appearances in animated choropleth maps. Battersby and Goldsberry (2010) associated transition behaviors with the level of measurement, visual variables, and data classification methods. From a map usability evaluation perspective, quantifying MOC is useful to evaluate effectiveness of animated maps in the way that quantitative indicators for MOC allows researchers to control the amount of changes in scene transitions, one of experimental conditions, when generating experiment materials operationally; accordingly, researcher can conduct the experiments, in order to answer the question of what amount of changes would significantly influence users' performance in detecting changes. In this research, we develop the way of quantifying MOC for various types of animated maps by using change-characterization arrays in the way similar to Goldsberry and Battersby (2009), in which while they focused on the method of quantifying MOC for animated choropleth maps, this study suggests more universal ways of quantifying MOC, with suggesting different methods of quantifying MOC for different types of animated maps. To develop suitable quantifying methods, we classify the types of animated maps first. There are existing classifications of animated maps; Lobben (2003) and Cauvin et al. (2010) classified depending on whether characteristics of the phenomenon represented including time, space, and attributes are static or variable. However, because map users' perceptual-cognitive performance is more linked to how to measure the phenomena and how to represent map elements visually than the phenomena itself, we classify animated maps in terms of the level of measurement (nominal, ordinal, and numeric), dimension (point, line, area, and volume), and visual variables (color, size, orientation, texture, spacing, and so forth), and finally, we suggest methods of quantifying MOC to fit each type of animated maps according to our classification.

P1.7 | **Spatial categorization and visual variables: is the spatial regionalization damaged through the change of orientation and landmarks represented on a map?** (#437)

G. A. Marangoni[1], R. D. D. Borralho[1], J. V. M. Bravo[2,3], F. L. D. P. Santil[1]

[1]*State University of Maringá, Departament of Geography, Brazil;* [2]*Federal University of Parana, Postgraduate Program on Geodetic Science, Curitiba, Brazil;* [3]*CNPq - National Counsel of Technological and Scientific Development, Brasilia, Brazil*

A full-length version is available and can be opened here:

_extendedAbstract\218_proceeding.*

In geographic context, the regionalization is a methodology for the management of Earth resources and is applied in order to understand social behavior patterns. That is highlighted by many authors as an important issue to be studied in environmental sciences. They say that the geographers' role is to understand and to provide sustainable patterns to create foundations on the issue of "spatial regionalization". Geographers and other related professionals created the idea of regions to understand space, and since then, there are several sciences such as Economy, Sociology, History, among others, that use this definition in order to understand spatial phenomena dynamics. Despite misinterpretations about the understanding of "region" concept and its range, we seek the comprehension on how individuals use maps in order to generate regions. Also, we ask if the spatial regionalization is damaged by changes on the orientation and landmarks' symbols on a map. The present work aims to evaluate the performance on creating spatial regions by undergraduates and MSc students in Geography and others professionals graduated in different areas of knowledge. We used a map with the geographic boundaries of Paraná State (Brazil) to test their mental categorization and to measure their understanding processes while drawing regions. There were 25 subjects divided in 2 groups: (a) experts and frequent map users in geographic regionalization contexts; (b) non-experts; professionals without previous experience on geographic regionalization using maps. The methodology is based on the Qualitative Method (SUCHAN & BREWER, 2000), and performance measurements were extracted through questionnaires analysis. The task flow was based on the presentation of 3 maps: (1) a world map, (2) a map with planimetric elements and hydrographic features and (3) a map with planimetric elements without hydrographic features. A semi-structured questionnaire was given formed by 9 (nine) questions related to spatial analysis applied to spatial regionalization tasks. The hypothesis to be proven was: an inverted orientation and the modification on visual variables representing landmarks on a map will cause the individuals having lowest performance achievement, compared to those using the same criteria or mental processing used on normal orientation and normal landmarks. The analysis was based on Lakoff (1987), Rosch (1973), MacEachren (1995), related to mental categorization processes and also regionalization. Also we used the Peterson's (1987) model of visual information processing. Discussions concerning GESTALT laws were made, relating them to the issues presented by the first approach of regionalization (MacEachren, 1995; Tversky and Hemenway, 1984). Also, we try to explain issues related to the subjects' (mis)interpretation/regionalization on tests. First results indicated that all users at experts group were capable to recognize the Paraná State boundary. However, in both groups, there were subjects which pointed the north "region" at the lower part of sheet. This can be explained by users being always presented to maps in which the north is oriented to the upper part of the sheet. About landmarks, points were used to represent cities, and lines were applied to represent rivers. Subjects used these landmarks to delimitate regions although they were not prevalent in the decision of region orientation. We may conclude that individuals used their cognition to identify the Paraná State boundaries, and orientation perception was a predominant aspect which made users get confused in the map reading task. Features located in the map were used in order to carry the regionalization out, but they were not recognized and prevalent on the region nomination task. This indicates the presence of GESTALT related processes in the map interpretation.

P1.8 | **The influence of cultural and education heritage on the map reading** (#174)

M. Wieczorek[1], M. Schmidt[2], T. Wang[3]

[1]*University of Wroclaw, Department of Cartography, Poland;* [2]*Adjunct Professor, Faculdade de Engenharia Civil (Civil Engineer Department), Uberlândia, Brazil;* [3]*Singapore-ETH Centre, Future Cities Laboratory, Singapore*

Digital and printed maps are astonish communication vehicles that bring cartographers‘ interpretations of reality to user’s reality. Nowadays, when communication is very fast and in many ways, the ever-increasing websites of online maps allow users to get spatial information from any part of the world as wish. The correct map interpretation will be possible if the solutions are sufficiently adequate representation in the capabilities of users as self-localization, map rotating and map reading skills. But, in this cartographic interchange, the question that stands out is how those users interpretation is affected when seeing maps built by foreign cartographers for the very first time. Cartography has a tradition of researching the cognitive and perceptual aspects of map use and communication processes. The cognitive processes by which some of these features are highlighted and stored in internal representations involve knowledge, identification, selection and interpretation of symbols. Only few researchers concern about how individual spatial abilities or differences in background and training in map users might affect the effectiveness and efficiency using map displays. According to some of them the interest in cognitive and perceptual user studies decreased in favour of research focusing on the evolving and advancing technologies. But in the last few years the interest in how people perceive and interpret maps has arisen again. Regardless of whether the map is a digital or printed, the map reading process is an individual task because, beside the common steps of symbols recognition, interpretation of map, users’ culture and intellectual formation might influence the understanding of representation. Other studies that the analysis of age, level of formal knowledge, experience time in map use, among others, although extremely difficult to measure quantitatively, are important for the understanding of user behaviour and it helps when performing tests. Some authors reported that differences show certain advantages in the ability of navigation and map reading in men, while women have advantages in verbal tasks and provide more accurate spatial memory. Potential interrelationships between spatial ability (individual difference) and gender (group difference) for a map-based road selection task under varying time pressure scenarios and the results corroborate the previous studies were examine too. Although, those evidences we state that culture has a lower influence in the organization of spatial information in internal representation than frequency of map use and formal education in geography or cartography. Therefore, our objective is to validate hypothesis that people from different countries read maps in the similar way and culture has a minor influence on reading maps skills. In the study the authors used small-scale topographic maps without legend and labels from three countries and questionnaires. All documents are stored in a web server and the tests are performed by the users visiting our website. The volunteers open an image and, at right side of the page, they answer the questions by clicking in one alternative. The questions include self-localization, distance and orientation estimation, and internal representation evaluation of short-term memory. This evaluation is being proceeded through criteria of level of education in geography, GIS and geodesy, accuracy of the answers and speed (time pressure) of map reading. The volunteers are from Brazil, Poland and Singapore and the answers are inserting in a database for later analysis.

P1.9 | **THEMATIC CARTOGRAPHY IN THE SYSTEM OF CARTOSEMIOTICS** (#213)

J. Strauhmanis[1], J. Strauhmanis[2], J. Strauhmanis[2]

[1]professor, Department of Geomatics, Riga, Latvia; [2]professor, Department of Geomatics, Riga, Latvia

Semiotics is a science that deals with systems of signs, their general characteristics and rules of their functioning. Signs or symbols are the language of maps and cartosemiotics or cartographic semiotics is one of the branches of semiotics (as well as of cartography). However, there is no definition of cartosemiotics which shows the structure of this branch in literature that deals with cartography. But it is needed, because in the official documents of certain countries cartosemiotics is assigned the tasks that are dealt with by the science of cartography. A characteristic example of this is the international standard „Cartography" (confirmed in 2002) which requires that the task of cartosemiotics is to use cartographic methods. The Internatinal Cartography Association should pay more attention to the problems of terminology, and it refers also to theoretical cartography which includes cartosemiotics. There are two basic branches in cartosemiotics: topographical semiotics and thematic semiotics. These branches, of course, have common characteristics, but, in my opinion, there are also notable differences between them. Firstly, while topographical symbols are officially confirmed and therefore they are obligatory in creating a topographical map, then thematic symbols are made up even for state thematic maps. In addition to this, there are generally accepted colours that are used in geological maps, but it does not mean that they should be obligatory used in the maps of certain countries.

Semiotics in thematic cartography is a creative process that begins with the projecting of a map, although the main emphasis should be put on the needs of the would – be users of the map. The matters of thematic semiotics are often dealt with by an expert of the concrete branch and only then their offer is evaluated by the cartographer. Secondly, thematic semiotics has an additional function: to characterize the depicted object or feature with the help of a symbol (not by means of the writing at topographical symbols). Therefore, it is necessary to deal with the matter of their readibility when elaborating (or choosing) the symbols for the corresponding thematic map. Thirdly, thematic semiotics have additional tasks: overlapping of symbols, readibility of thematic symbols on the coloured background, localization of geographic names at thematic symbols. Fourthly, symbols in a thematic map form a certain system together with subsystems. This problem should be paid special attention to in cases when a thematic map is prepared by means of special software. **References** Wolodcenko A. (2009) Cartosemiotics.e-dictionary. Dresden Schlichtman H. (2011) Cartosemotics. A short dictionary.ICA, Regina Strauhmanis J. (2012) Thematic Cartography and Cartosemiotics: Common and Distinctive Features. (in Latvian). Scientific Journal of Riga. Technical University.Vol.8. pp.25 – 29.

P1.10 | **Effect of spacing on legend interpretation of maps** (#347)

Z. Qin

Zhilin, Li, Cheng Du, China

A full-length version is available and can be opened here:

_extendedAbstract\289_proceeding.*

Legend design is an indispensable component in designing maps. Effective design makes visual search in a legend more efficient and accurate. Results from a short questionnaire-based survey for evaluating some current legends indicate that some legends are more effective than the others. It has been found that one of the differences among those legends is spacing. There are many types of spacing within a legend (e.g. spacing between a symbol and its description). Thus, our purpose is to investigate the effect of spacing on legend interpretation of maps for effective legend design. To do so, time expenditure of visual search in a legend is effectively recorded by using human-computer interactivity for analysing the efficiency. An experimental evaluation of different combination of spacing for designing effective legends has been implemented in form of Web-based test and results indicate that to make a legend more effective, all types of spacing within a legend must follow a hierarchy (from large to small): surrounding spacing of groups (columns/rows) of items, spacing between adjacent items, spacing between a symbol and its description, spacing between words in a description, and spacing between letters of a word.

P1.11 | **Visual Communication in Art Design of Maps** (#344)

C. Ma, C. Ma, R. Li

Wuhan University, School of Resource and Environmental Science, China

A full-length version is available and can be opened here:

_extendedAbstract\127_proceeding.*

Entering 21st century, map, as a tool for human being to understand his environments, has been extended from paper to computer/digital media, which leads to the appearance of new types of maps, such as digital maps, web-based maps and virtual maps, etc. Although the said new products of maps, its nature as a tool of understanding the environments has been kept the same: Human still needs to use his brain and vision to obtain the perception and conclusion on the spatial relationship and distribution of physical and social phenomena at global and local scales, dynamic tendency, scale, size and density, quantity, quality, etc. Therefore, the principle of the design and making of any piece of map should still be based on maximizing the information availability for users of the map, via the visual channel. Therefore, the key element of map, style of visualization, makes users of map to read and understand geographical information promptly and precisely. Creation of a map is not only a technical process, but involves many subjective factors of its designers. Thus, to the designers, realizing and answering the question, how to design a map to satisfy the cognitive characteristics of its readers, is the key of guiding a map creation. Additionally, to map's readers, they are best entitled to judge the quality of a map and gives feedbacks as to making changes of a map so to make it better meet the requirements of its readers, such as easier reading and understanding and more availability of information, etc. The article, based on theories of visual communication design of map, Communication, Aesthetics, Symbolic, studies systematically the patterns of cognition and visual perception of maps by their designers and readers, provides the guidelines and strategies for better designing a map to effectively communicate visual communication design of map, explores and summarizes the inner relationship between the idea and rules of the vague beauty of map and scientific activities of map creation, to improve the process of map creation.

Ma chenyan:
Doctor, associate professor, mainly engaged in teaching and research work of cartography and geographic information engineering

P1.12 | **Base map layers usability evaluated by eye tracking device** (#1195)

R. Nétek
author, Dept. of Geoinformatics, Olomouc, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\229_proceeding.*

This paper assesses usability of base map layers on web map portals. As a base layers are mentioned satellite or standard topographic background under the thematic maps, used for orientation on the map. Chosen background play important role in reaction time, which user needs for finding given target, in fact how fast user can find given target depend which map background is elected. Moreover it influences popularity and usability of each map. For objective research eye tracking technology was chosen. Eye tracking system provides great opportunity for design, analyze and evaluate both digital and analog maps. The research was made on SMI iView 250 RED device, is placed in Eye-tracking lab at Department of Geoinformatics, Palacký University in Olomouc, first eye tracking lab in the Czech Republic for field of cartography and geoinformatics. The eye position and eye direction of view is detected by infrared light reflection from the cornea at 60Hz temporal resolution. System latency at 60Hz is < 25 ms which is quite sufficient value for this research. Twentyseven women and eighteen men, fourtyseven person in total, with age range 19-28 were tested by eye tracking device, than oral discussion with all of them was made. Three different couples of both satellite and standard base map were shown, six maps in total. Order of standard or satellite background was randomly changed. On each of them, different city as a target was given, and user´s reaction time on the map from defining goal to find the goal was measured and tracked. The instructions were given by oral form. When previous task is done and confirmed by mouse click by participant, empty screen is shown and operator gives the following task; then next map is shown. Wilcoxon test (paired sample) was used for statistical evaluation. According to results, we can not confirm that the difference by conventional criteria is statistically significant between maps in the first couple, but in other two couples we can confirm that difference is statistically significant and standard base map layer is more suitable compared to satellite base map. Oral discussion with participants confirmed, that the reason is background colour and density imbalance on satellite maps, which complicate orientation over the map.

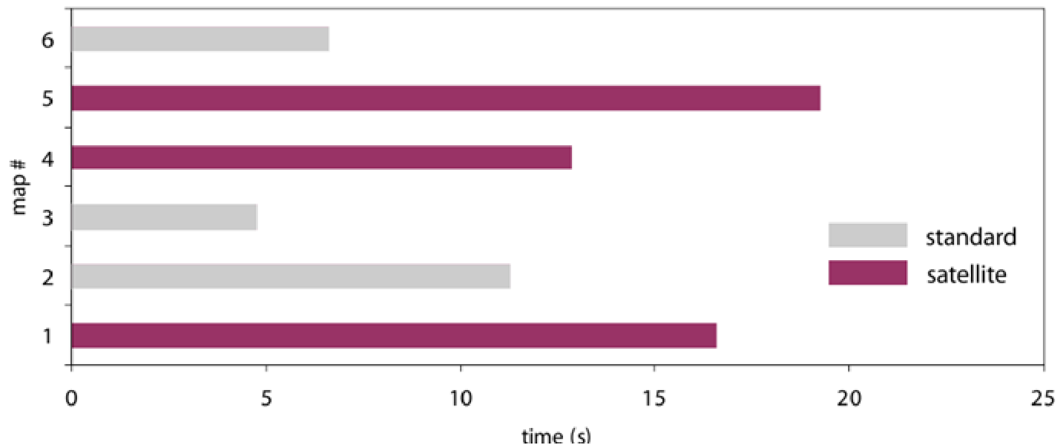


Figure 1.:
Average reaction times for each map

P1.13 | **Does the dynamic cartographic variables have interference on map reading? The case of variables shape and velocity into representations of weather phenomena variations** (#438)

E. V. Beier[1], J. V. M. Bravo[2,3], F. L. D. P. Santil[1]

[1]*State University of Maringá, Departament of Geography, Brazil;* [2]*Federal University of Parana, Postgraduate Program on Geodetic Science, Curitiba, Brazil;* [3]*CNPq - National Counsel of Technological and Scientific Development, Brasilia, Brazil*

A full-length version is available and can be opened here:

_extendedAbstract\214_proceeding.*

The use of geographic information data grew and it is common when one see a cartographic representation into media vehicles, such as television. In this way, people are even more interested in handle geographic data and also are components of processes that involve the construction of geoinformation, like Volunteered Geographic Information (GOODCHILD, 2007). Thus, the present research work aims to investigate one of the more common types of cartographic representations disseminated through television: dynamic weather maps. That is necessary because, as said by Blok (1999), animations or, in this case, dynamic cartographic representations allow users to see dynamic data at their spatial and temporal contexts and they are also powerful tools to represent phenomena like weather movements. More specifically, we sought to analyze how do people understand the climatic phenomena by these representations when there is the use of shape and velocity as visual variables and investigate if these elements provide interferences into cartographic communication process. To achieve it, we constructed tests based on tasks of spatial analysis and also in the proposition of Suchan and Brewer (2000), the Qualitative Method of analysis. The performance measurements were extracted through questionnaires analysis. The subjects were divided in 2 groups: (a) experts, with individuals with specific knowledge about spatial analysis and climatology, they are a geographer and a student in geography (last year of undergraduation); (b) naives, composed by a high school student and a gastronome. The task flow was based on the presentation of satellite images from *Centro de Previsão de Tempo e Estudos Climáticos* (CPTEC) available at web site of *Instituto Nacional de Pesquisas Espaciais* (INPE) – Brazil. They composed the dynamic cartographic representations used to test the individuals and were constructed based on the examples of dynamic variables from MacEachren (1995): shape (e.g. areas with less or more forested regions) and velocity (e.g. urban increase of areas at Brazilian territory, first slowly, after, becoming faster). We used the concepts of Taxonomy and Partonomy, treated by Tversky and Hemenway (1984), as tools to identify the mental processing changes and the capabilities of individuals to use or not their cognition when they are interpreting dynamic cartographic representations. Preliminary results pointed that the individuals were not recognizing, at first time, the format of continent or countries, which were elements presented on representations. The non-specialist participants identified clouds but were not able to indicate the processes behind the cloud movements; they only identified elements by the fragmentation of spatial elements, partonomy. The tests proved that slow animations were more effective with non-experts because they used the partonomy to define what kind of objects which they were seeing. That can be explained by the different weights at the visual scene given by the grey scale present in the representation of features. The group of experts had identified clouds and the climatic processes behind the movements of these elements. That situation indicates a mental process based on taxonomy: region classification through the type of events. In this way, we also realized that the subjects preferred faster animations to understand the process which was involved behind the representations. Thus, we may conclude, until now, that these representations are effective to individuals with specific expertise in tasks related to spatial analysis; the velocity of animations can cause interferences on the map reading tasks and also in the process of recognition of shapes or "parts of space".

P1.14 | **Perception of landmarks by day and night: case nature trail** (#475)

P. Kettunen[1], K. Irvankoski[2], C. M. Krause[2], L. T. Sarjakoski[1]

[1]*Finnish Geodetic Institute, Department of Geoinformatics and Cartography, Masala, Finland;*
[2]*University of Helsinki, Institute of Behavioural Sciences, Cognitive Science, Finland*

Cartographic generalisation is physically necessary for presenting and abstracting the desired information on a map. Furthermore, cartographic generalisation is important for the users of maps as it leads to coherent information contents which are easy to interpret and organise by the user. Cartographic generalisation commonly applies selection of features for choosing the particular features that deserve the greatest visual importance in the map. The selection is usually based on expert knowledge on what is important to communicate to the users. However, at the same time, needs and wishes of the map users should be acknowledged and taken into account in order to create cartographic representations which would support the cognition of the users as far as possible. Many spatial activities are carried out not only by daytime but also by night. Considering nature, on which we concentrate in our research, such activities include recreational hiking, rescue services and defense activities. Lighting conditions induce very different perceptions of the environment by day and night, and people certainly perceive and remember their surroundings differently in light and dark. However, these differences are scarcely studied using the scientific method although knowledge on the differences between times of day could potentially be applied in many spatial applications. For example, adaptation to the context could be used in mobile map implementations. We collected user-level information on important landmarks in day and night conditions in nature through behavioral experiments with 23 participants. The participants walked through a 1.3 km nature trail that was guided by an experimenter and thought aloud their perception of the route. Half of the participants walked in daylight and the other half in dark night with a powerful headlamp. On the first half of the route, we asked the participants to memorise the route so that they could later walk it through without guidance. On the second half of the route, the task was to memorise the route so that they could describe it to another person after the walk. The route passed along a nature trail that goes around a valley of a small river in a typical Finnish forest with small hills, paths, outdoor trails and roads. We recorded the walking and route drawing with audio and video and transcribed the recordings. We also collected Santa Barbara Sense of Direction scale questionnaires as well as background questionnaires on the participants' gender, age, experience with maps and experience on walking in the nature. We analysed the use of landmarks in the collected thinking aloud protocols using natural language processing (NLP) methods developed in our previous study which considered seasonal differences. We compared the relative frequencies of the identified landmark groups between day and night conditions through statistical analysis and track the causes of the differences, taking into account the different backgrounds and spatial skills of the participants acquired through the questionnaires. We also investigated the effect of the task on the results: memorising a route for oneself differs from memorising with a goal to verbally guide another person.

Figure 1:
Half of the participants walked the route in dark night in the light of a powerful headlamp

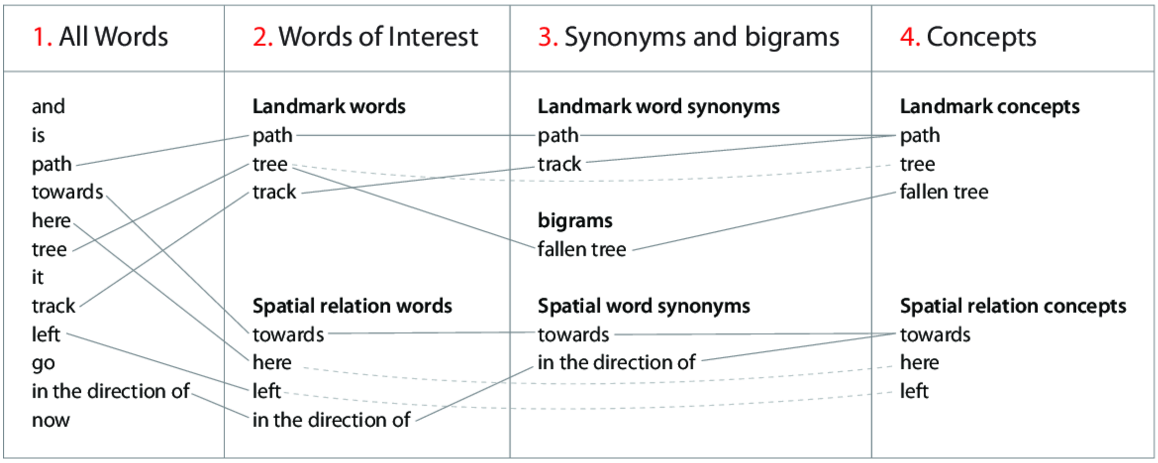


Figure 2:
The thinking aloud recordings were analysed using natural language processing (NLP) methods

P1.15 | **Framework for studying Spatially Ordered Treemaps** (#1245)

R. Ali, J. Dykes, J. Wood

City University London, School Of informatics, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\93_proceeding.*

We now live in an era of data deluge, where our ability to generate data outstrips our ability to analyse it. Organizations collect and have access to large amounts of data with the aim of getting some benefit from it. Whilst organizations acknowledge the value and importance of their data, many do not know how to make sense of the information or what to do with it (Few, 2011). Maps have a long tradition of being used to make sense of information. However, in this data dense era, conventional methods and traditional GIS tools do not support or meet the constant emerging user needs (Andrienko *et al*., 2007). Spatially Ordered Treemaps (SOTs) are designed to address some of these needs (Wood & Dykes, 2008a; 2008b). SOTs are space-filling graphics that show hierarchical geographic information in a space efficient way, using one rectangle per data item in an iterative manner through the hierarchy. Unlike the conventional choropleth maps (usually sized by geographical area), SOTs can be sized according to need – for example by population (number of people living in an area) to result in a space filling hierarchical cartogram (Wood & Dykes, 2008a; 2008b). Although, SOTs have been used in various applications e.g. in local government (Figure 1) to manage and allocate resources (LCC, 2010), we lack empirical evidence on how effective the technique is in communicating spatio-temporal data either for educational purposes or for knowledge discovery. The key questions under consideration are:

1. *To what extent are people able to interpret data and geography in a SOT as they would in choropleth maps*.
2. *To what extent are support mechanisms useful during data exploration and interpretation of general spatial distributions.*
3. *To investigate the effects of spatial ability, that is to examine how task performance and support mechanisms are modulated by spatial ability with respect to SOT.*

We propose a comprehensive research framework to empirically investigate complex *visual inference tasks*, *support mechanisms* (animated transition using morphing or vector overlay), and how *spatial ability* affects people's learning and knowledge construction process from Spatially Ordered Treemaps (SOTs) as compared to conventional choropleth maps. This effort is inspired by the call of the new International Cartographic Association commission on Cognitive Visualization (CogVis), which proposes *"developing a sound theoretical framework based upon cognition and perception discipline"* (Fabrikant, 2011). The framework aims to explore SOTs in the context of both *'in-vitro'* (Figure 2) and *'in-vivo'* settings. This study is grounded in cartography but also conforms to experimental design standards in perception and cognitive sciences. **References** Fabrikant, S. (2011). Evidence of geovis(ual analytics) utility and usefulness. Paper presented at: Persistent problems in geographic visualization:, ICC 2011 Workshop, 2 July Organized by the ICA Commission on Geovisualization Retrieved 09/11/2012 from http://geoanalytics.net/ica/icc2011workshop.htm Few, S. (2011). Visual Business Intelligence for enlightening analysis and communication. Retrieved 09/11/2012 from Perceptual Edge http://www.perceptualedge.com/ Leicestershire County Council (LCC). (2010). Delivering a Sustainable Transport in Leicestershire. Retrieved from http://bit.ly/9r98dQ Wood, J., & Dykes, J. (2008a). From Slice and Dice to Hierarchical Cartograms: Spatial Referencing of Treemaps. "Proceedings of the GIS Research UK 16th Annual Conference GISRUK 2008." , (Lambrick, D. Eds.), pp. 1-8, Manchester Metropolitan University, Manchester. Wood, J., & Dykes, J. (2008b). Spatially ordered treemaps. IEEE Transactions on Visualization and Computer Graphics 14, no.16 ,pp 1348–1355. iences.

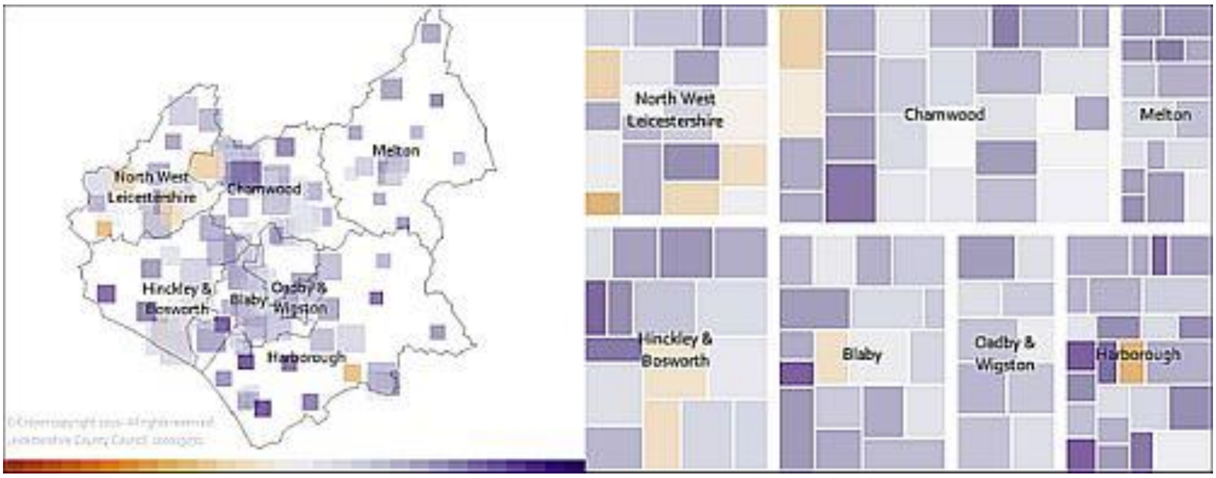


Figure 1:
A geographical map (left) and a SOT (right) of Leicestershire showing satisfaction (purple) & dissatisfaction (orange) of public service. The high level of dissatisfaction is more evident on the population sized SOT than geographical map.

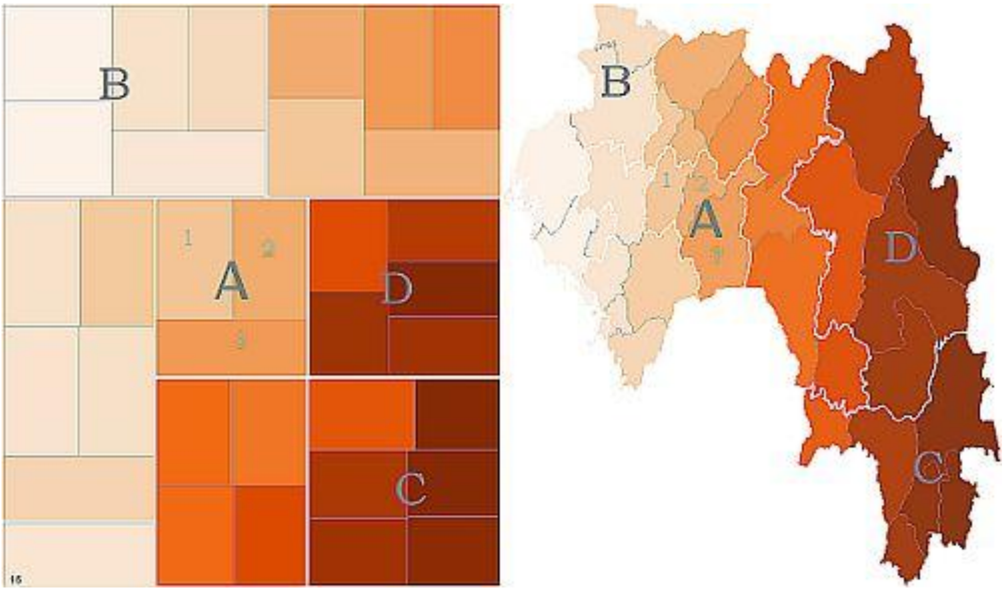


Figure 2:
An example of SOT and equivalent Choropleth map to be used in the 'in-vitro' setting. The map is showing the geographic hierarchy: the whole map area, region(A,B,C,D) and districts (1,2,3) .

P1.16 | **CARTOSEMIOTIC ASPECTS OF LITHUANIAN SCHOOL GEOGRAPHICAL ATLASES** (#575)

I. Žalalienė

Vilnius university, Faculty of Natural Sciences, Lithuania

Maps have been designed to convey information. This cartographic form has particularly old communication traditions; even older than the script. Symbolism, or map language, encodes much information which is daily used by people of variable age and education searching for different information. In order to read, perceive and assimilate cartographic information represented in a cartographic model it is necessary to know the cartographic language which already should be properly toughed at school. The educational quality of cartographic production is directly related with the cartographic literacy. Therefore, the cartographic models are expected to represent the information in an easily perceivable and easily memorisable form of cartographic symbols. The Lithuanian pupils have a wide choice of cartographic products yet there are certain doubts as to whether their quality is sufficient. Many cartographic products are compiled by unprofessional cartographers with a rather poor mental outfit. Modern technologies also bring confusion into compilation of cartographic products. In their aspirations to invent something attractive and original, even professional cartographers forget that they are supposed to obey the elementary cartographic rules and principles. The present work is an attempt to introduce the research results obtained from semiotic analysis of the systems of symbols used in the maps of school atlases. In total, 1 403 (17 215 cartographic symbols) maps from 17 school atlases were analysed. The method was worked out taking into consideration the psychology of perception of cartographic image and the contingent of users. A method for assessment of communicative quality of thematic maps elaborated by M. Dumbliauskienė was used. According to this method, systems of symbols are evaluated in three aspects: semantic, syntactic and pragmatic. Within each of them criteria are distinguished which are critical for correctness, perception and memorisation of cartographic signs. The performed semiotic analysis of the maps of geographical atlases for schools showed that insufficient attention is paid not even to the signs themselves but also to their interrelations. Even when the semantic differentiation is correct the distinguished groups often are not named. Very few maps reveal taxonomic relations of represented objects and phenomena. Moreover, in some cases the expression of transition also is incorrect (the quantitative, qualitative and proportion scales are at odds with the requirements of semiotics. Also it was noticed that sometimes the scope of information of maps designed for senior pupils reduces. This happens because cartographic images are made too schematic, i.e. their graphic load is small. The readability and perceptibility of maps also is aggravated by lack of optimality in the majority of analysed maps. In order to improve the quality of educational cartographic products and stimulate the pupils’ interest in them it is necessary to eliminate the mentioned defects and to develop new more original forms of representation which are so far lacking in the school geography maps.

P1.17 | **Values associated with nature — Mapping the ombu tree in Uruguayan landscapes** (#844)

A. Vallarino Katzenstein

University of the Republic, Faculty of Architecture, Design Laboratory, Montevideo, Uruguay

A full-length version is available and can be opened here:

_extendedAbstract\335_proceeding.*

P1.18 | **Dotting the Difference – Strategies in finding the best suitable Dot Value**

(#996)

A. Hey

University of Rostock, Professur für Geodäsie und Geoinformatik, Germany

A full-length version is available and can be opened here:

_extendedAbstract\46_proceeding.*

P1.19 | **EVALUATING ANTROPOGENIC IMPACT WITH TOPOGRAPHIC MAPS**

(#795)

T. Vereshchaka[1], G. Kachaev[2,1], N. Bilibina[1]

[1] *Moscow state university for geodesy and cartography, Cartography and geoinfomatics, Russia;*
[2] *Oboronkadastr, Cartografic, Moscow, Russia*

An aggregate of interrelated processes that progress in the territory are the factors of its ecological state. All the factors—of natural processes and economical activity—are reflected on topographic maps. Anthropogenic objects are depicted on topographic maps most dramatically. Interpretation of the maps' contents discovers qualitative and quantitative ecological characteristics of a wide range: from single types of jeopardy to integral rates of general ecological state of a described locality. Ecological assessment of a territory may include absolute, relative, and conventional rates. The characteristics of a territory are obtained from topographic maps with the methods of cartographic study technique, that includes operating parameters that are retrieved from topographic maps directly or are derived. *The directly retrieved from map* parameters: characteristics that are shown directly on inscriptions, or that are obtained from direct geometric measuring, also can be retrieved from semantic attributive information of a digital map object. *The indirect* parameters are derived from comparison or conversion of one or many elementary ones. Generally presented by comparative and composite indices of single objects and classes of objects. Can also be sequentially derived from primary indirect parameters Methods of cartometry, morphometry, mathematical analysis of maps, and mathematical statistics are used here. Both types of parameters could describe quality or quantity. An aggregate of ecological indicators makes it possible to create derivative maps: both general geo-ecological ones and of more narrow subject area. Various map could be used for complementary evaluation: - representing spatial characteristics of objects (remoteness of ecologically vulnerable objects from dangerous industries, right of ways of transmission facilities); - maps of natural area complexes and functional zoning of a territory. The role of topographic maps in evaluating the range of anthropogenic impact on nature is described through the main object classes. *Population* is of direct influence on the nature through demographic pressure. It is easy to highlit the zone of extensive antropogenic activity, to define the rate of spatial concentration of the population and settlement patterns (seat, arealis, belt, solid). Social signifisance of water-, air-, and soil-polluting indices is determined with the number of people exposed to the stress. *Power supply and industrial objects* (especially mining ones are representative indicators of actual disturbance of the environment: they appear to be the sources of pollutions, land impoverishment, impact on biota. One of the most stressful and widespread impact factors for environment is *agriculture and farming activity*. Soil erosion and deflation are widely distributed due to its reiterated cultivation. *Water supply objects and hydro technical facilities* are shown on the maps in details. They bring a wide range of changes to local and regional environment—both during the construction process and while being exploited. The rate of *transport* impact on the environment depends on difference of its types and intensity of the tracks' maintenance. Topographic maps clearly depict the density and extent of roads of all kinds and show their operational functionality. Social and economic objects build a demo-economic framework that can be allocated on different scales. It shows the structure of population settlement and industry distribution, defines areas of prevalent anthropogenic loads. Transport structures are the linear component of the framework. They reflect the features of territorial concentration of the population and characterize the limits of out-of-town connections. The report portrays the role of social and economic objects, form and extent of their impact to environment. Compiled derivative maps illustrate the issues under consideration, including the demo-economic framework.

P1.20 | **Cartographic activities of General Command of Mapping / Turkey** (#1421)

&. Nalci, Ö. Simav

General Command of Mapping, Cartography, Ankara, Turkey

A full-length version is available and can be opened here:

_extendedAbstract\133_proceeding.*

This paper, describing cartographic activities of General Command of Mapping (GCM) (Turkey) is briefed under the headings of Production Activities, Research Projects and Relations with other organizations. According to her law of foundation, GCM is responsible for the production of maps needed for defense and development purposes. Therefore, the production of base scale maps at 1/25.000 and other topographic maps at 1/50.000 and 1/100.000 scales which are generalized from base scale maps, 1/250.000 scale Joint Operations Graphics (JOG) series maps and Low Flying Charts (LFC), 1404 series 1/500.000 scale maps as well as 1301 series 1/1.000.000 scale maps covering Turkey are under the responsibility of GCM. Beside these products, GCM is also carrying out the production of small scale thematic maps and Raised Plastic Relief Maps. The other data produced by GCM is Gazetteer of Turkey in which geographical features extracted from Physical Map of Turkey at scale 1/250.000. An important research project under cartographic production is Holographic Map Production System. Several prototypes of the Holographic Maps (Figure-11) have been developed and exhibited at some national and international conferences. Due to the project timeline, some new and advanced techniques are planned to be implemented until the end of 2014. Also field tests will be conducted after development of the new prototypes. In order to contribute to the national/international cooperation and collaboration, to catch up with the latest technological developments and benefit from international expertise and provide the staff with fast and updated information, GCM having been National Mapping Agency (NMA) for Turkey is eager to work closely with national/international organizations and national mapping agencies. Geographic activities in NATO have been carried out in accordance with the decisions taken by "NATO Geographic Conference (NGC)" and "NATO Standardization Agency (NSA)". GCM participates in the relevant meetings regularly. Apart from its active participation in geographic events in NATO, GCM is a member of Turkish Board of Experts on Geographical Names (BEGeoN_T). This board is subordinated to the Ministry of Interior General Directorate of Provinces. The board is working on standardization of geographical names and also is responsible to represent Turkey in UN Geographic Names Conference and United Nations Group of Experts on Geographical Names (UNGEGN). Within the frame of the activities of BEGeoN_T, the list of “Turkish Exonyms of Country Names and Capitals” containing countries recognized by Turkey officially was finalized in 2012 and is published in the websites of the General Command of Mapping (http://www.hgk.msb.gov.tr/urunler/diger/ulke_baskent_bm_uye_tr_tanima_onay_2012.pdf) Besides International Cartographic Association (ICA) and the UNGEGN mentioned above, GCM is also a member of ISPRS, IUGG and EuroGeographics.

P1.21 | **WEBMAPPING TOOLS FOR VITICULTURAL MANAGEMENT** (#265)

C. Mena Frau, Y. Ormazabal Rojas, Y. Morales Hernandez
Universidad de Talca, Centro de Geomática, Chile

Geomatics and its associated disciplines are being incorporated in vine producing countries like Australia, Francis and USA, in order to help to take decisions such us irrigation control, fertilizing application and plague control, among others. Some examples of the Geomatics using in viticulture are the identification of suitable places for vineyards in California, Italy and France, application of GIS in the development and management of the vineyard, and expansion of the vineyards and its impact over biodiversity and the landscape. In Chile, a technological applications was developed by the Geomatic Center and Wine and Vineyard Center of Talca University (2011) whose aim was to generate an integrated system of control and management for the vinicultural sector of Maule Region, that incorporates a graphic and digital platform with spatial location of the vineyards and the technical information of wine production using GIS and webmapping. The methodology was implanted and tested through a geo-informatic application were a color mosaic SpotMaps was utilized as a cartographic base, generated from satellite images Spot-5 that were ortho-rectified to a scale 1:10.000 with a spatial resolution of 2,5 meters and a geometric accuracy and located from 10 to 15 meters (RMSE). On the mosaic it was added the vector information to generate thematic cartography of the zone in study. It was considered a geometrical validation of the mosaic through checkpoints GPS. On ortho-rectified image mosaic it was digitalized each one vineyards *"cuarteles"* of the regions (17.304 total), storing the information as geo-referenced polygons within a digital layer of ArcGis. This layer was integrated to a thematic cartography to generate planes to a local scale that were used as field base instrument. In the field, it was identified each vineyard *"cuartel"* equal or bigger than on hectare. It was considered aspects like technical productive, social and administrative data. Through an alphanumeric codification it was attached the obtained information for each vineyard *"cuartel"*. Finally, it was elaborated a geographic data base of the productive units and wine elements that permits to update local statistics, to plan interventions on the territory to analyze tendencies of economical evolution. The webmapping permits visualizing with great level the details of viticulture characteristics in the zone, permitting gather existing alphanumeric base with the territorial information and realizing specific analysis for management and decisions taken, as also realize analysis and reality characterization of viticultural sector. In that context and considering the plantations equal or bigger to one hectare, were identified 42.365,93 hectares of vineyards in the Maule Region, equivalent to 43% of the national total. 55 wine variety were identified, 35 of the red and 20 white. The great majority of vineyards are produced under a conventional culture system, that is, the regulation of the use of agrichemical in the productive process, existing up to date only 1.249,57 hectares, 2,9% of de vineyards that had implemented or are implementing organic production systems. In harvest doing moment, 72,9% of the total of Maule vineyards surface are harvest with manual methods. 48,3% of vineyards use the traditional system of surface irrigation and 43,1% the drop or ribbon irrigation system, putting in evidence the two realities present of the vine growers of Maule Region; from one side the enterprises with high grade of intervention and technification and other side a great number of growers that maintain ancient culture technics.

P1.22 | **Thematic Mapping in Poland – thematic cartographic elaborations provided by polish geodetic and cartographic service** (#657)

K. Szyszkowska, I. Leszczynska

Head office of Geodesy and Cartography, Department of Geodesy, Cartography and Geographical Information Systems, Warsaw, Poland

In accordance to the Act of 17th May 1989 – the Geodetic and Cartographic Law, (Journals of Law, 2010.193.1287), the Surveyor General of Poland is responsible for development, maintenance and provision of special and thematic cartographic elaborations (Art. 7a, Sec. 14e). Furthermore, in accordance with the Enactment of 3rd October 2011 – on the Cartographic Thematic and Special Elaborations (Journals of Law, 2011.222.1328), the Surveyor General of Poland performs and provides thematic elaborations in the form of digital maps, including hydrographical maps, sozological maps, geomorphologic maps, agricultural-soil maps, land cover maps, land use maps, maps of technical infrastructure, maps of the average transaction prices of land, maps of the territorial divisions of the country, atlases of Republic of Poland and special maps – typhlographical maps intended for the blind and visually impaired. The Hydrographical Map of Poland in scale of 1:50 000 is a thematic map, which has been prepared by Surveyor General of Poland and Marshalls of Voivodships since 1985. The map presents, in complex manner, the conditions for water circulation, in connection with natural environment, the level of its development by man, as well as its transformations. It is developed on the basis of topographic map, upon which the results of fieldworks and charting of water objects and phenomena, soil permeability, and a lot of information related to management of water resources, assessment of water quality, as well as data concerning hydrosphere monitoring network. The thematic content of the map consists of the following groups of elements, arranged at several levels of information, among others: topographic watersheds, surface waters, underground water outflows, first level of underground water, soil permeability, phenomena and water management facilities, hydrometric points for stationary measurements. Since 1990, Surveyor General of Poland and Marshalls of Voivodships have prepared the Sozological Map of Poland in scale of 1:50 000 – a thematic map, presenting the condition of natural environment, as well as causes and consequences – both negative and positive ones – of changes taking place in the environment, due to various processes, mainly anthropogenic activities, as well as the ways of protecting natural values of that environment. The thematic content of the map consists of the following groups of elements, arranged in several information levels such as: forms of environmental protection, degradation of components of natural environment, counteracting degradation of natural environment, environmental remediation, wastelands, supplementary signs. Both hydrographical and sozological maps, in the form of analogue printout, are one of final products of the complex, thematic environment executed in GIS technology. Since 2011, the Surveyor General of Poland is preparing the project *Data model and database management system with spatial information on natural environment in aspect of thematic mapping*. The Project determines an expansion of GUGiK previous works conducted by the National Geodetic and Cartographic Service on the cartographic thematic elaborations related to natural environment such as the Hydrographical Map of Poland in scale of 1:50 000. The main challenge is to develop a data model with database management system, which enables a widespread access and use of spatial information on natural environment in the scope of hydrographical and hydrological spatial data.

P1.23 | **SANDBAR SHORT TERM SEDIMENTATION ANJOS COVE - ARRAIAL DO CABO, RIO DE JANEIRO STATE - BRAZIL** (#317)

A. C. da Silva[1,2], R. B. Medeiros da Fonseca[1,2], J. W. A. Castro[2], C. N. de Almeida[2], F. F. Dias[3]
[1]Brazilian Navy, Rio de Janeiro, Brazil; [2]Laboratório de Geologia Costeira, Sedimentologia e Ambiental (Museu Nacional- UFRJ), Universidade Federal do Rio de Janeiro (UFRJ), Brazil; [3]Departamento de Análise Geoambiental, Universidade Federal Fluminense, UFF, Niterói, Brazil

One of the major concerns to the nautical charts production is the faithful representation of the coastline contours. The benchmark from which altimetry and bathymetric measurements obtained are critical points to the cartography representations. The present work shows results of studies about sedimentation processes to short term in sandbar on a semi closed cove located at inner continental shelf of the southeast Brazilian coast The study area is located in the Anjos cove, Arraial do Cabo town, Rio de Janeiro State, 140 km east of the city of Rio de Janeiro - Brazil. Being bounded by the following coordinates: latitude 22º 56' 00'' S to 23 º 01' 00'' S and longitude 041° 58' 00'' W to 042º 02' 00'' W. The survey methodology was carried out using acoustic echosounding apparatus linked to a global positioning system. The bathymetric survey was georeferenced to both horizontal and vertical reference local datum. Historical bathymetry files from Brazilian navy used here were obtained to the years 1936 until 1991 (58 years). Hydrographic charts (1:10,000) were used to show the sandbar evolution. The sandbar dimension has length 2100m by 685m wide. Recent surveys were shown slow migrations that are happening in the last years in the sandbar position. Data analysis explains the low rate migration of the sandbar in the cove with a variation of 1.72 m/year. Changes in the position of sandbar due to a short term morphology evolution pose too a problem for navigation. Fishing boats normally use this route to reach the ocean or to penetrate the cove toward the single harbor existing in that area. This work firstly aims the knowledge the dynamics of sedimentation in the cove for verify the sandbar migration processes on sediment deposition from 1936 until 1991. Overall, the results of this work point to the need for the realization of more frequent hydrographic surveys. New contours due small changes in the coastal features like observed in the sandbar should always be recorded in the nautical charts.

P1.24 | **Urban Daytime and Nighttime Population estimation and Spatial-Temporal Dynamics Modeling** (#1329)

Z. An, Q. Qingwen, J. Lili, Z. Fang

Institute of Geographical Sciences and Natural Resources Research，CAS, State Key Laboratory of Resources and Environmental Information System, Beijing, China

Daytime and nighttime urban population distribution has a clear difference. But the existing population statistics cannot reflect the dynamic distribution of daytime and nighttime urban population. The mechanism analysis of the spatial and temporal variation characteristics population of daytime and nighttime urban population has been did. The population simulation analysis units have been divided based on urban land use strength and different types. The population statistics, the basic unit investigation employment survey data, urban land use data and high resolution remote sensing data are used in this project. The coupling relationship was set up between daytime and nighttime urban population distribution and urban layout elements of land use. The population attract capacity of different land type in different period was estimated. The simulation of the urban population dynamic distribution at different times of the day and night then was worked out. The census data and basic unit investigation of the employment data are used to check in area to verify the experimental results and feedback correction model related parameters. Finally a set of population distribution of day and night simulation model and the case data are given. The results will support city planning, transportation, environment, disasters and emergencies, rescue operation by decision. The project innovations are the population simulation analysis units and simulation method. After this research, it will improve the urban population data in time and space practicality.

P1.25 | **A PROPOSAL FOR EVALUATING RBMC (BRAZILIAN NETWORK FOR CONTINUOUS MONITORING) USING DATA ENVELOPMENT ANALYSIS (DEA)**

(#1325)

S. O. Antoun Netto, J. C. Penna de Vasconcellos, A. Ribeiro Destri

Rio de Janeiro State University, Cartography, Brazil

The Global Positioning System (GPS) is maintained by the United States government and is freely accessible to every person with a GPS receiver. There is to provide location information in every time, all weather conditions, around the world. By capturing the signals from a group of satellites in earth orbit that transmits precise signals, allow GPS receivers to calculate and display accurate location, speed, and time information to the user. Nowadays, the GPS technology has been used in the several activities of geodetic and topographic positioning in precise way with accurate than centimeter. According IBGE's website in the GPS geodetic and topographic applications the use of the relative method is implicit. This means, at least one station of known coordinates is also occupied simultaneously to the occupation of the points of interest. Before the RBMC, the user interested in obtaining, with GPS, the geodetic coordinates of any point in the national territory, had to work with two receivers, occupying the point of interest and a close mark of the Brazilian Geodetic System. According also IBGE's website the stations of the RBMC have the function of representing the point of the known coordinates, eliminating the need for the user to immobilize a receiver in a point, which several times, offers great difficulties of access. Besides this, the receivers which equip the RBMC stations are of high performance, providing observations of great quality and reliability. The Data Envelopment Analysis (DEA) has been used in the calculation of performance indicators and to establish benchmarks for regulation of public sectors. The method lends itself to use in multidisciplinary issues and multiagents may be used in the estimation of production frontier functions or for incorporating the opinion of specialists, like a multicriteria method. Scientific methods for measurement and follow up of regulated firms, in special Data Envelopment Analysis, have been developed and are already being used by regulatory agencies in several countries (Chilingerian & Sherman, 2004 and Ozcan, 2008). In DEA, according to Kassai (2002), homogeneous productive units called DMU ("Decision Making Unit") must be comparable and act on the same conditions, if only in the intensity or magnitude differentiating. Thus it is very important to know the behavior of these units, as well as the homogeneity of the data. This work presents a strategic approach to evaluation the RBMC (Brazilian Network for Continuous Monitoring) using the Operational Research Method called DEA (Data Envelopment Analysis) for the establishment of benchmarks of RBMC's stations. The analytical results will corroborate to a progressive incentive for greater productivity in the Brazilian Network for Continuous Monitoring of Brazilian Institute of Geography and Statistics (IBGE).

P1.26 | **3D-Citymodel: 300 years Karlsruhe: 1715 – 1834 – 2015** (#909)

D. Günther-Diringer

Hochschule Karlsruhe - Technik und Wirtschaft, Fakultät für Informationsmanagement und Medien, Germany

3D-Citymodel: 300 years Karlsruhe: 1715 – 1834 – 2015 On the occasion of the 300-year anniversary of Karlsruhe in 2015 a 3D-Citymodel will be set up, which shows lively the historical development of Karlsruhe. In collaboration with the city museum and the surveying administration of Karlsruhe students of the University of Applied Sciences (Hochschule Karlsruhe – Technik und Wirtschaft, Studiengang Kartographie und Geomatik/ Geoinformationsmanagement) elaborate a 3D-Citymodel in Level of Detail 2 (LoD2) with texture images. In the frame of student projects and thesis works the main city area between the former city gates will be produced. There the complete processing chain of 3D-Citymodel generation will be applied:

1. GIS-based preparation of the geospatial base data, which were supplied by the surveying administration of Karlsruhe, like ALK (cadastral data), ortho aerial images, DGM (digital terrain model), DHM (digital surface model), both based on LiDAR data with 1m resolution.
2. Interpretation of historical information for the description of different time steps.
3. Digital editing of the texture images.
4. Supplementations of the given data by own digital images of house facades and their rectification and editing.
5. Construction and texturing of single buildings.
6. Converting in standardized CityGML-Format.
7. Set up of 3D database and integration of converted data.
8. Visualization and publication of the results in different output formats.
    a. Video
    b. Realtime navigation
    c. Internet

As a first pilot project a 3D-Citymodel of a branch of Karlsruhe, the so called „Dörfle“ (village) was realized and animated in different video sequences for an exhibition at the city museum. Used techniques: the preparation of the geospatial data, georeferencing and homogenizing was carried out with ArcGIS (ESRI). The editing of the texture images was done with Adobe Photoshop. The buildings and further city furniture were constructed with Google (Trimble) Sketchup and/or 3D Studio max (Autodesk). With specialized plug-ins the elements were converted to CityGML and imported to a relational 3D Geodatabasesystem (PostgresSQL with SGJ3D as user interface). There the administration and maintenance of the 3D elements was processed. For distribution and publication different export functionalities were used. For the exhibition in the city museum in September 2012 video animations were used and with Adobe Premiere and Adobe after Effects combined to a parallel flight through 1834 and 2012 (see figure 1). Realtime internet navigation is a point for following bachelor or master thesis. In the frame of another bachelor-thesis and complementary to the digital construction of single buildings, the wooden city model of the city museum, which shows the city of Karlsruhe in 1834 in a scale of 1:600, was scanned by the help of an Artec 3D Scanner. The scanned point cloud was interpreted, corrected and converted in 3D-Citymodel vectorgeometrie by the use of Geomagic software. This model can be further edited in 3D Studio max and/or Sketchup and textured with historical facades. Beyond these results single important buildings or landmarks, like f.e. the historical town gates were generated in LoD 3 in 3D Studio max (see figure 2). Based on the described steps a historical 3D-Citymodel comes into being, which represents the city development of Karlsruhe and the students get to know current technology for 3D-citymodels by realistic projects.

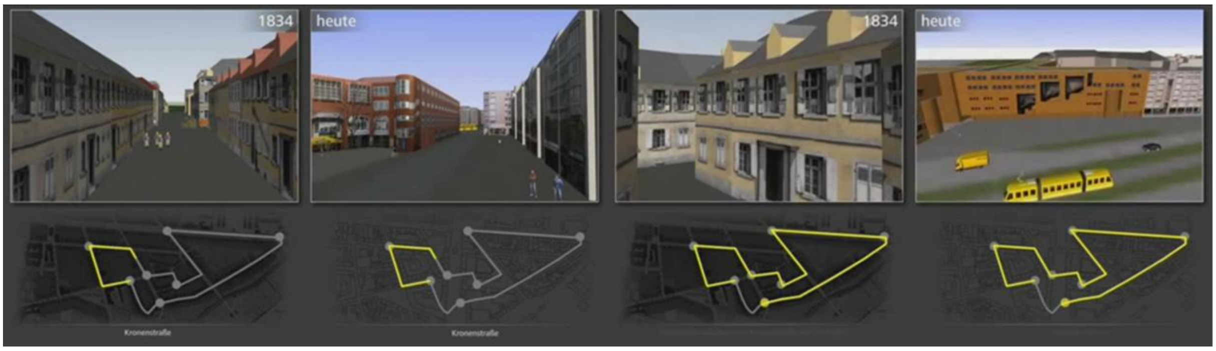


Figure 1:
Two screenshots of video-animation Karlsruhe 1834 and 2012.

Figure 2:
LoD3-model of Mühlburger Tor.

P1.27 | **Evaluating Web-based Geovisualizations Online: A Case Study with Abstraction-Realism Spectrum in Focus** (#992)

A. Boer[1], A. Coltekin[2], K. Clarke[3]

[1]University of Zurich, Depatment of Geography, Switzerland; [2]University of Zurich, Depatment of Geography, Switzerland; [3]University of California, Santa Barbara, Depatment of Geography, United States

A full-length version is available and can be opened here:

_extendedAbstract\284_proceeding.*

Web-based geovisualizations are currently being served in various levels of abstraction-realism spectrum: two-dimensional (2D) cartographic maps, aerial and satellite maps, shaded relief maps, three-dimensional (3D) objects integrated with a 2D base map, and digital globes with fully textured realistic 3D representations are available to users. All of these abstraction-realism levels are necessary; but which one is utilized for which task? To tackle the question, in this project we study a subset of geographic tasks in relation to Web-based geovisualizations by means of online user studies.

In the process we present the users with six alternative Web-based geovisualizations sampled from a popular online map provider (i.e., Google). Thus, the stimuli contain the following visualizations: map view, terrain view, map view with WebGL, satellite view, street view, earth view. In *Stage 1* we ask users (n=106) to predict which view they would use and/or prefer for a set of tasks. To design the experimental tasks we first derived task types from previous task taxonomies in the literature. Considered task types include: self-location (where am I), locating objects (where is a town, mountain, building, address) , route planning (which route to take when going from A to B, planning before the journey), real-time navigation and way-finding (which route to take when going from A to B, planning real-time), identifying places of interests (where to do what), communication (present ideas, support ideas, education), storage of information (with spatial reference), virtual tourism (explore a place). In *Stage2*; a new group of users (n=245) were recruited to execute the same tasks where we measured performance (not preference this time). Finally we analyze the findings quantitatively and compare the *preferences* from Stage 1 with the *performances* in Stage 2. Throughout the project we have utilized multiple tools for online surveys (commercial and non-commercial survey software), tools for monitoring user interaction (recording mouse clicks, monitoring the time people took to finish the task), and participant recruiting (voluntary and 'paid' user groups such as in Amazon's Mechanical Turk). In this paper we present the main findings from the study and reflect on the use and usefulness of online tools to evaluate Web-based geovisualizations.

P1.28 | **Comparison of intertwined visual and automated methods in the analysis of realistic scenarios** (#477)

L. Clemens, A. Bertone, D. Burghardt

Dresden University of Technology, Faculty of Environmental Science, Institute of Cartography, Germany

Geovisual Analytics (GVA) is still a very young research area and so far there are only a few good visual analytics tools which are mostly tailored for specific application domains. The goal of our study was firstly to develop a strategy that allows to compare such tools and to identify the most suitable ones for given Visual Analytics tasks; secondly, to understand and point out the factors or characteristics that make a Visual Analytics tool easy to use. To this aim, we analysed the submissions to IEEE VAST Challenge as the development and the improvement of Visual Analytics tools are some of the intentions of the organizers of this contest. In detail, starting from the given datasets, the aim of the contestants is to accomplish the proposed tasks by using existing or new developed visualization tools or a combination of such tools. The contestants have to submit a two-page summary that includes the obtained results and a supporting video which provides a clear explanation of the solution adopted to solve the given problems. For our comparison, we focused on the winners of the challenges of 2009, 2010 and 2011 since they were similary structured (3 Mini Challenges, 1 Grand Challenge) and dealt with similar questions like e.g. explaining the spread of a disease. The analysis was inspired by the official criteria for judging of the VAST Challenges. In detail, we distinguished between subjective and objective criteria as follows: Subjective: Clarity, Analytic Process, Visualization, Interaction, Learnability Objective: Scalability, Versatility, Data Integration, Tool/Toolkit   A matrix was used to create a ranking. Since the criteria are not equally important, we assigned them a weight. As the most important criteria, “Analytical Process”, “Visualization”, “Interaction” and Scalability got the weighting 3. “Clarity”, “Versatility” and “Data Interaction” which only have a medium weight got 2. “Learnability” and “Tool/Toolkit”are negligible, so they only got weighting 1. The contestants could score from 0 (worst) to 4 (best) points at each criteria. Then, on the top of the overall score (max. 80 points), a ranking was created. Last but not least, the comparison highlights some similarities which characterized the best contestants. We summarized them in a recommendation leaflet. These recommendations of course do not guarantee the participants to win but they can significantly increase the possibility that it happens. Not really surprisingly, a good documentation and a comprehensible video with a clear and loud narrating voice increase the possibility to be awarded. It is also quite logical that a versatile tool scores better, which permits an unproblematic data interaction. More surprisingly, the use of a self programmed tool was usually less successful than the use of an already existing tool. Using many analytical techniques and visualizations as well as the adoption of many possibilities for interaction is furthermore advantageous. However which methods in detail should be used, depends of course always on the tasks to be accomplished. Hence, when dealing with a combination of different georeferenced data as in the examined challenges, the methods the contestants mostly adopted, could be seen as a little suggestion. For instance, concerning the visualization methods, the use of Word Clouds as well as the possibility for the user to visualize the temporal evolution of the data (e.g. with a timeline) could be a good starting point. Similarly, different kind of interactions such as Drag & Drop or Mouse Over effect, could assist the user in his/her analysis and ease the overall analytical process. Furthermore interesting is, that only a few of the contestants adopted automated methods in their analysis. This fact shows that there is still a long way to cover to reach a deeper collaboration between visual and analytical methods.

P1.29 | **Testing animated mapping of land cover at Menzel Bouzalfa (Cap Bon_Tunisia)** (#1189)

M. Nasr[1], W. Chouari[2], M. Dhieb[3]

[1]Laboratory SYFACTE (F.L.S.H.Sfax-Tunisia), Geography, Tunisia; [2]Laboratory SYFACTE (F.L.S.H.Sfax-Tunisia), Geography, Tunisia; [3]King Abdulaziz University Faculty of Environmental Design, Jeddah, Saudi Arabia

Mapping is a discipline that evolves simultaneously with other sciences. Today, computers and newer technologies offer new opportunities for mapping applications. The land in the Cap Bon is reference information in constantly changing, both on the ground and in techniques that contribute to its translation mapping. This opens a wide debate on the transition from a static map, synthesizing evolutionary, to an animated map using other figurative map, other stages of the design and construction of the map and other techniques. These changes are presented as much "added value", using different senses with different levels of interactivity. These modes of evolution help to change the mapping as a tool for communication, as well as the relationship between transmitter and recipient of geographic information.

P1.30 | **Essai de cartographie animée de l’occupation du sol à Menzel Bouzalfa (Cap Bon_Tunisie)** (#1164)

N. Monaem, W. Chouari, D. Mohsen
Laboratory SYFACTE, Geography, Sfax, Tunisia

La cartographie est une discipline qui évolue simultanément avec les sciences qu’elle utilise. Aujourd'hui, l’informatique et les technologies récentes offrent de nouvelles possibilités. Nous proposons ici que l’occupation du sol dans le Cap Bon est une information de référence en perpétuelle évolution constante tant sur le terrain, qu’au niveau des techniques qui concourent à sa traduction cartographique ce qui ouvre un grand débat sur le passage d’une carte statique, synthétisant une évolution, à une carte animée en mettant en question le choix des figurés cartographiques, les étapes de la conception et la construction de la carte et les techniques utilisées. Ces évolutions y sont présentées comme autant de « valeurs ajoutées », faisant appel à différents sens, avec plusieurs niveaux d'interactivité. L’ensemble contribue à modifier la cartographie en tant qu’outil de communication, ainsi que les rapports entre celui qui émet et celui qui reçoit l’information.

P1.31 | **Don't Visualize Big Data** (#1220)

A. Turner

Esri, DC R&D Center, Arlington, United States

Big data is a new thematic buzz word to describe the increasing number of high volume, high velocity data streams that are now readily accessible. Historically the domains of weather prediction, climate modeling, land-use analysis, and other sciences have been dealing with relatively large datasets that push the limits of technology and human comprehension to easily store and understand. However by contrast, the more recent big data sources have a much higher variety of domains, attributes, sources, and uses that do not fit within the traditional techniques for visualization and exploration. There are fundamental differences in many of the new big data streams that encompass qualitative attributes such as intent, emotion, and personal perspective that were not present in previous scientific and primarily quantitative data sources. Unfortunately the majority of cartographic visualizations attempt to either display these data as simple points, quickly overwhelming the user of comprehension, or utilize simplistic aggregate views such as choropleth or kernel density "heat maps" which can be similarly misleading or even inaccurate. To state it simply, you probably should not visualize big data. Instead we need to develop new cartographic techniques that visualize information. Applying expert knowledge, analysis, and even aesthetic principles, tools should provide better mechanisms to expose the meaning and application of these big data streams to users that give new insight while still allowing for exploration and discovery through geography and the multiple dimensions of the data. Domains such as weather prediction are again excellent examples that instead of simply displaying the location, temperature, humidity, and wind speed of every single weather station - a visualization that would typically match population density - they instead apply these data to models, expert opinion, and produce geographic visualizations that convey relevant information to users. For average citizens this can be as simple as this weeks temperature, precipitation and cloud cover, or for pilots and planners larger storm and weather patterns. Considering the social media data, web traffic, spatial networks, realtime vehicle tracking, and other domains requires similar development of informative and multi-domain expressions. Converting raw data into information through which knowledge can be derived and shared will be necessary to understand and make important decisions from these new and compelling sources.

P1.32 | **Urban Subsidence Surveillance combining PS-InSAR and Visual Analytics** (#926)

L. Wei[1,2], J. Krisp[2], T. Balz[1], M. Liao[1], L. Ding[2]

[1]Wuhan University, State Key Laboratory of Information Engineering in Surveying Mapping and Remote Sensing (LIESMARS), China; [2]Technische Universitaet Muenchen, Department of Cartography, Germany

Subsidence is a big problem in the fast developing urban areas in China, which requires a continuous surveillance of urban subsidence zones. Identifying the spatial patterns of subsidence could have a great impact on increasing the safety planning of the urban infrastructure. Urban subsidence monitoring has drawn a lot of attention in radar remote sensing community. Persistent Scatterer SAR Interferometry (PS-InSAR) has been successfully applied in urban subsidence monitoring with millimeter accuracy. In PS-InSAR, a time and space analysis is carried out on a stack of SAR images acquired over time to extract deformation information of the studied area. PS-InSAR results are often difficult to interpret by non-experts. To make full use of the available information for example assisting geologists and urban planners in using the data, appropriate visualization is necessary. Visual Analytics is a way of combining automated analysis with interactive visual presentations for an effective understanding of very large and complex datasets. Visual analytics integrates visualization with many other disciplines, such as data management, data mining, spatio-temporal data analysis, etc. It has been used in astronomy, physics, climate and weather monitoring, emergency management, bio-informatics, business intelligence, etc. The huge amount of data in remote sensing also requires a visual approach to help with data interpretation and analysis. First, in the proposed paper, we are going to describe the state of the art in PS-InSAR and visual analytics. Then, we use a stack of spaceborne SAR images to extract subsidence information of urban areas with PS-InSAR method. Based on this we demonstrate the difficulties in presenting the vast amount of information in a meaningful and accessible way. For a correct interpretation of the results, a lot of information, including coherence, density of PS points, the viewpoint, and subsidence rate, among other parameters, has to be taken into consideration. Combined analysis about these massive information using visual analytic methods is carried out to improve current interpretation methods of the data.

P1.33 | **Assembling an Authoritative Global Map** (#1320)

C. Charpentier, D. Cooke

Esri, Redlands, United States

The 21st century demands a global map, at scales from continental to neighborhood. Smartphone users expect to see their surroundings in detail anywhere in the world in searchable, routable form. Emergency and humanitarian responders need current geospatial information. Businesses depend on maps to track assets and site facilities. Drivers expect electronic maps to guide them safely and quickly using real-time traffic and road conditions. All of this is possible given today's computing, sensing, communication and positioning technologies. The past fifty years have seen digital remote sensing by aircraft and satellite, unlimited cloud storage and computing, and mature GIS software that can manage and distribute huge amounts of data. Forty-five years ago, the U.S. Census Bureau needed its internal machine shop to design and build large-scale map digitizers; they were not a market commodity. We now have a full plate of technology at our disposal. How to organize resources to map the entire world down to very large scales remains unresolved. Three organizational schemes have emerged: The first is a commercial model, where the global map is treated as a commodity to be manufactured and sold. In the USA, Geographic Data Technology (GDT, 1980), Etak (1983) and Karlin & Collins (1985) were founded to exploit the public-domain Census GBF-DIME files as the basis for commercial offerings. In Belgium, Tele Atlas (1984) initially built telephone number atlases but soon switched to digitizing street maps for Europe. All firms license their products rather than selling them to control secondary distribution and construction of derivative products. A series of mergers and acquisitions has reduced the commercial field to two contenders plus two global companies (Google and Apple) that maintain map databases to support their primary businesses. The second organizational scheme employs crowdsourcing, inspired by the success of Wikipedia. OpenStreetMap (OSM, 2004) was in large part a reaction to the UK's Ordnance Survey's proprietary map policies, but its popularity quickly spread throughout Europe and the world. Volunteers, often organized into "mapping parties", collect GPS data and edit an online map database. OSM data is not in the public domain, but licensed for use under an Open Database license. OSM faces licensing and content challenges in attempting to attract commercial use. The most recent organizational model is Esri's Community Maps (CM) program established by Esri in 2009. Several requirements combined to define the CM program: Esri – a GIS software firm -- needed a suite of pre-cached maps to support "Ubiquitous GIS" on desktop, mobile and browser platforms. The second imperative was to create authoratative maps insofar as possible. The third factor was that Esri's customer base included many national mapping agencies and state and municipal GIS offices, offering an opportunity to organize their data into a world map. The Community Maps program is still very much a startup and is building a community of participants and seeking a pragmatic balance of authoritative and "best-available" content. These three models may persist or adopt practices from each other. All commercial map database companies have embraced crowdsourcing, some for map issue reporting and others for actual map editing. Esri uses commercial data in Community Maps where GIS agencies haven't yet signed up to participate. OSM wrestles with branching out from a model where all content comes from individual members; it has imported data from public domain sources such as the US Census TIGER program, but not without protests from some members. This paper reports on a work-in-progress. It's not yet clear what combinations of methodologies and sources will yield the best global map. But billions of users are quick to judge whether map offerings are "excellent", "good enough" or "unsatisfactory".

P1.34 | **Nazca Map Server** (#1333)

A. Muller, K. Hanzalova

PhD student, Department of Mapping and Cartography, Prague, Czech Republic

Nazca is a desert plain situated in Peru encompassing about 500 sq. km. The desert plateau is covered with more than 300 geoglyphs, which are ground structures visible only from above the ground. Geoglyphs in Nazca are illustrations of human figures, animals, plants and geometric figures, spirals in different forms, etc. Some of them are hundreds of meters large. In addition, there are more than 1000 lines, some of which are kilometers long. Geoglyphs were created by clearing of the upper volcanic ground layer about 10-20cm thick, revealing the underlying sand or calcite layer. But the reason why is still unknown. Major theories include for example calendar and astronomical purposes, marking of subterranean water resources, ceremonial and religious signification, extraterrestrial influence, and others. The area has been protected by Peruvian law since 1995 and is on the list of UNESCO world heritage. However, the condition of geoglyphs is in some cases very bad. The goal of a research project carried out by the Faculty of Geoinformatics at HTW Dresden in cooperation with the Department of Mapping and Cartography at CTU in Prague is to collect, manage, evaluate, and analyze data about the lines and figures of Nazca in order to permanently document this world heritage and preserve it for the posterity at least in digital form. The means used for this purpose is Geographic Information System (GIS). This paper focuses on one particular goal - the presentation of geographically referenced data and resulting information on the internet. Data are published as map services using a map server and presented in an interactive web mapping application. The mapping application is based on ESRI platform and has been created using ArcGIS Viewer for Flex. It has been localized in three languages: German, Czech and English. Data of Nazca area include raster datasets (DTM Aster and SRTM, satellite images Landsat, Quickbird, and photo plans resulting from photogrammetric evaluation) as well as vector datasets (vectorized geoglyphs and generated contours). Datasets are stored within one file geodatabase and published using mapping capabilities of ArcGIS Server v10.1 as well as WMS services according to OGC standards, so that the services can be loaded also into other applications, desktop, web, or mobile. Raster datasets published using cached map services serve as base maps. Vector layers are drawn upon them dynamically on request. Private access for researchers is protected by a username and password and includes more vector topographic layers as well as satellite images, which cannot be published due to licensing restrictions. In conclusion, Nazca map server serves data to researchers as well as public in form of mapping services http://gisserver.fsv.cvut.cz/arcgis/rest/services/nazca/ or http://gisserver.fsv.cvut.cz/arcgis/services/nazca/nazca/MapServer/WMSServer and presents them as well in an interactive web mapping application accessible at http://gisserver.fsv.cvut.cz/nazca/ . Further development includes integration of new data collected during recent field campaigns and localization in Spanish. This work has been supported by grant SGS OHK1-018/12.

P1.35 | **Regional geoportals of first-level administrative units of European Union and European Economic Area countries. A comparative study** (#948)

D. Dukaczewski[1], A. Ciolkosz-Styk[2], M. Sochacki[3]

[1]IGiK - Institute of Geodesy and Cartography, GIS, Warsaw (Warszawa), Poland; [2]IGiK - Institute of Geodesy and Cartography, Innovations, Warsaw (Warszawa), Poland; [3]IGiK - Institute of Geodesy and Cartography, GIS, Warsaw (Warszawa), Poland

A full-length version is available and can be opened here:

_extendedAbstract\257_proceeding.*

Increasing need for spatial information and its fast publication, advances in web technologies, and legal determinants related to the INSPIRE Directive have resulted during last 5 years in considerably intensified development of regional geoportals in countries of the European Union and European Economic Area (EEA). Recently it is possible to observe a growth in the number of geoportals, an increase in the scope of information they publish, and enhancement of functionality. The number of regional portals publishing webmaps is decreasing in favour of regional geoportals, employing at least WMS or WFS solutions and publishing harmonized spatial information. This implies a need for a monitoring of regional geoportals, taking also into the consideration it's relationships with INSPIRE. According to a survey carried out in September 2012, EU and EEA countries have 143 geoportals of first–level administrative units. Spatial data (of reduced scope) have also been published through 151 public administration portals of this level. In these ways, spatial information has been published in the case of 87.23 % (42.43 % and 44.80 % respectively) of the first–level administration units existing in EU and EEA countries. The aim of research was an analysis and synthesis on the actual state of development of the regional first-level administrative unit geoportals of EU and EEA countries. The carried research on 130 regional geoportals active (and wholly accessible) in September 2012 included the analysis of the thematic scope of spatial data published through these geoportals, along with the functionalities of geoportals (classified into 46 proposed types of functions, belonging to 7 main groups), as well as employed methods of cartographic presentation (and their semiotic correctness). The results obtained from the research allowed for the proposing of two typologies of regional geoportals, taking as a criterion the thematic scope of published spatial information (relating to the spatial data themes mentioned in appendices of the INSPIRE Directive, and to other spatial data important for regional policies). The authors have proposed a typology of geoportals, employing the criterion of available functions. It was also possible to propose a typology of regional geoportals taking into consideration employed methods of cartographic presentation. The carried investigations allowed for the proposing of a typology of similarities in thematic scope of spatial information published through the regional geoportals, employing Bertin's method of data processing (Bertin, 1967) and data order algorithm proposed by Ciołkosz-Styk (2011). It was possible to distinguish 6 groups of similar regional geoportals and 1 (5-element) group of geoportals not revealing any similarities in terms of the thematic scope of published information. The authors have proposed also a typology of geoportals employing the criteria of both number of published thematic groups and number of types of functions. The conducted research has demonstrated that EU and EEA regional geoportals are still relatively diversified in terms of the thematic scope of published data and the level of development of functionalities. It is to be emphasized that most geoportals are supplied with well-developed functions as regards navigation, visualization and the administration of data. Meanwhile it would be appropriate if functions of spatial and temporal analyses were be more developed. It should be stressed that, as in the case of national geoportals (Dukaczewski & Bielecka 2009, Bielecka *et al.* 2010), diversified versions of the interfaces of regional geoportals have appeared recently (targeted at professionals or whole public), as well as versions offering the visualization of spatial information using different mobile devices. The results of carried research will be used to update and extend GEMS – the Geoportals in Europe Metadata Service, maintained by the Institute of Geodesy and Cartography.

P1.36 | **Development of Electronic Map Resource in Russian State Library** (#984)

M. Golyasheva, L. Zinchuk
Russian State Library, Map Department, Moscow, Russia

A full-length version is available and can be opened here:

_extendedAbstract\416_proceeding.*

Development of Internet technologies makes it possible to provide an access to library collections for remote users. The paper considers to one of the ways to exhibit map collection to the users. In 2011, the Map Department of the Russian State Library (RSL) started a development of the electronic resource of cartographic items available in its map collection. The cartographic collection of the Russian State Library is one of the largest in the world and counts about 200,000 items, including rare and manuscript ones. Since late 1990s a development of the electronic catalogue (OPAC) has been started in the Russian State Library. The catalogue reflects mainly new map submissions. The major portion of maps and atlases issued both in the USSR and Russian Empire is still accessible via a traditional card catalogue. Thus existing RSL map catalogues cannot provide a full-function and up-to-date search for cartographic materials. The development of an electronic map resource was started with a thorough study of the available map catalogues and services. A set of the retrieval functions was compiled. Then the working principles of the new retrieval service for maps and atlases were developed. Alongside the theoretical researches, a retrieval mechanism for cartographic materials of the RSL is being created. The first version is already working in test and debug mode. The new retrieval service will provide a free access to full bibliographic descriptions, advanced search for maps and atlases and an opportunity to receive electronic copies of maps. The main principles of the retrieval mechanism are as follows:

- the service shall be accessible for remote users via the Internet;
- every map (even if it's a part of an atlas or series) shall have a full description and a thumbnail image;
- atlases and series shall have summary descriptions with links to their content;
- descriptions shall be interconnected via hyperlinks;
- a set of numerous characteristics shall be provided for a search by keywords, authors, edition data, scale, projection, etc;
- users shall be able to filter results of the search using, for example, a chronological filter or filter by scale;
- the service shall provide an opportunity to search a map by geographical location in the window where an interactive web map is displayed.

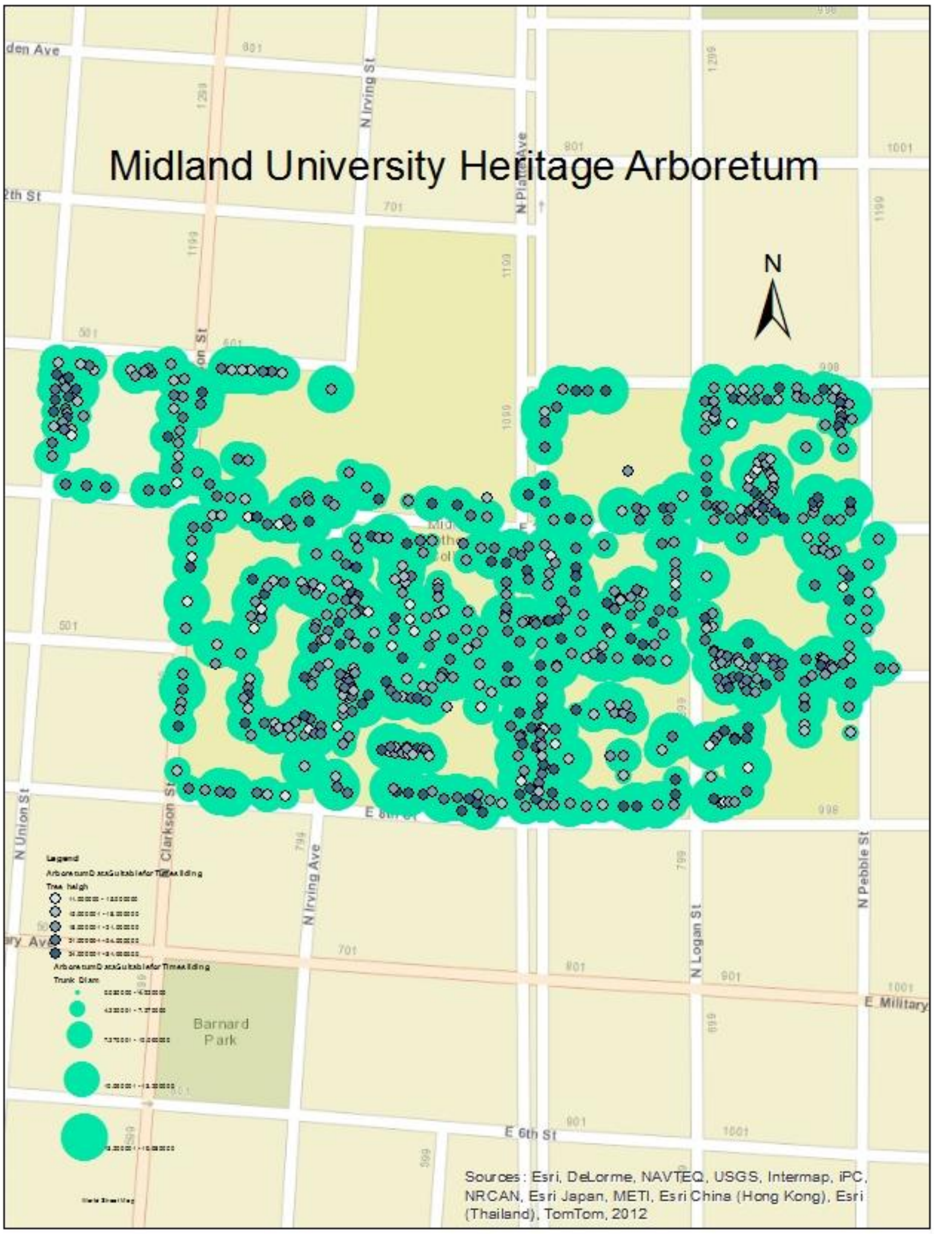
The digitizing of the RSL map collection in order to form a retrieval service database will start from the Russian old maps and atlases, which are the most popular and demanded items. The paper will present the results of the investigation.

P1.37 | **Web Mapping: a Solution to Nebraska Heritage Arboretum Data Standardization** (#1447)

S. Trowbridge, R. Cammack

University of Nebraska at Omaha, Geography/Geology, Omaha, NE, United States

Affiliate sites of the Nebraska Statewide Arboretum are in need of a standardized way of displaying arboretum maps. Utilizing online resources, it is possible to do this. Once locational data is collected for each tree, it can be imported to mapping software for display along with any other pertinent information regarding each tree. The ability to obtain more information about a tree than just its common name and scientific name can add to the enjoyment of the arboretums. Once data is obtained for each arboretum including tree locations and tree types, an application can be used to harvest this data and display it in a standardized way. Any application for this purpose would have to be able to read and interpret several data types such as straight text documents or comma separated variable format as with Microsoft Excel in the event that one arboretum caretaker was using a different data entry system. Scientific data for each tree and tree species can also be captured and kept with this information. This repository of scientific data could be maintained year after year and made available to the public along with links to the individual site locations. Affiliate arboretum sites would benefit, as well as the community as a whole, from the scientific knowledge to be accessed using a standardized display technique. All arboretum locations can input their data for display in a standardized format from a centralized website. This project will create an application that will consume data from multiple site locations and display them in a common format.



Arboretum Map:
Map demonstrating trunk diameters and tree heights

P1.38 | **A cartographic support for the geodata visual querying** (#1322)

K. Stanek, L. Friedmannova

Masaryk University, Geography, Brno, Czech Republic

In Our research projects we are focused on design of a visual querying system for geodatabase systems. A map is the most natural mean of a direct perception of spatial relationships. But, the map, as a part of the user interface plays only passive role in the process of querying. The project result will be software, generating SQL query based on users' interaction with user interface. This interface will be based on a combination of the cartographic representation with a sketch.   The project builds on existing approaches to visual querying of geodata with a greater emphasis on the use of cartographic tools.   In this paper, we will deal with just on cartographic aspects of the above mentioned project. A key role is played by visualization of the level of similarity of provisionally selected objects. Subsequently, attention will be paid to elements of cartographic support user interaction - fixation of objects, visual alerting, suppression of unselected objects. The basic mechanisms of design of sketch graphics components and mechanisms of their visual links with objects and situations addressed will be discussed.

P1.39 | **WEB EXPERT SYSTEM TO PRODUCE THEMATIC MAPS** (#436)

L. S. Delazari, A. L. de Mendonça
Federal University of Parana, Geomatics, Curitiba, Brazil

This paper presents an expert system, designed to classify semantic information in a geographic database, aiming to assist non-expert map-makers. Despite the fact that GIS science has been discussing how to deal with ordinary users and their relationship with map production, especially due to the popularization of GIS and webmapping technologies, there are still issues concerning map production. Some of these issues are related to data classification methods, knowledge about levels of measurement and, to map symbolization itself. In Brazil, this subject can be of special interest to municipality and state government departments, NGOs and institutions which use maps for planning and for decision-making support. At least in part, problems seem to occur because of the ease of GIS use, together with employees' lack of education in cartography. In this context, an expert system seems to be a proper choice to ensure that ordinary users can take correct decisions in the map-making process. According this context, initially it was developed a digital Atlas based on an expert system to classify data. Originally, this software was built as an offline product to assist Social Assistance Department users, from Parana state (Brazil), in their activities. Currently, this system has evolved to a web environment and is publicly available on the internet. It has been used to analyze possibilities in assistance for map-makers. A cartographic specialist system in a web environment has special requirements, mainly related to users' roles and database design. The proposed website should work in three important aspects: to help the Atlas users in their need of producing maps, considering the huge amount of data available in this subject; to make possible that users in general produce maps, using their own spatial datasets and that these maps would be adequate, considering thematic mapping aspects; and to improve cartographic symbols specification, in order to produce richer depictions in web environments. For the two first aspects, it was proposed that the system would benefits from a specialist system. First of all, specialists were asked about the way they take decisions on which map symbology works best, taking into account only the data characteristics. Second, there are spatial and non-spatial elements, both equally important in the process of taking decisions about map symbology. Finally, in order to guarantee that user's would be in fact learning from specialist use, the spatial database was built considering two temporal stages: the preliminary database, which exists only when the specialist is working with some data at the website; and the consolidated one, which exists after the map evaluation. If the proposed symbology works, the map is high-rated and the database stores statistical data about former data, in order to help ordinary users using similar data. The dynamical process of producing map symbols using SLD specification is about to produce map symbols according to user's entry. For choropleth mapping, for example, system will expect the user define a color schema, number of classes and methods for data classification. However, SLD's manipulation used in this framework can be improved to support other thematic mapping techniques, such as proportional symbols maps and dot maps. This can be done by means of incorporating vendor options specifically for parameters associated to these techniques. After testing this first version of the online Atlas, it is intended to develop additional functionalities in order to improve the expert system concept that has been started with this research, as well as the interface use experience. The main objective is to make this system a reference for ordinary internet users who need to get their data symbolized according to map design expertise.

P1.40 | **Web Driven Dynamic Generative Mechanism of Thematic Map** (#592)

F. Ren, Q. Du

School of Resources and Environmental Science, Wuhan University, Department of GISc, China

In recent years, development of GIS has been able to integrate navigation data with a high level of positional accuracy and high-resolution remote sensing imagery increasingly, and is embedded into the various specific and practical model applications on a grand scale. But nevertheless, GIS often results in implicit representation of important decision support information, and allows decision-makers to generalize or extract these information by technical means, such as spatial analysis, spatial statistics, spatial data mining and so on, from the different perspectives of problem solving. In contrast, traditional analog thematic maps (atlas) usually are an achievement which is designed and complied carefully by cartography experts and domain experts together, which focus on intuitiveness and usability of thematic maps, and represent explicitly various space-related decision support information. But considering the web driven incompatibility between traditional cartographic communication model, which takes map making and map using as independent processes, and web users' individual demand, which composes of dynamic updating of information sources, free expression of map symbols, convenient interaction of user interface and impressed customer experience, the paper puts forward a new idea of online dynamic generative mechanism of thematic map, which establishs a fast path between socio-economic thematic statistical data and thematic maps, and achieves web-based integrated manufacturing pattern of thematic cartography from raw data to map products, which enable traditional cartography to better fit into those established web patterns. It is an effective way to convert various map data into flexible dynamic thematic map services of which users can make the most effective use by supporting updating original data on command, switching range of spatial statistics flexibly, adjusting the thematic symbols dynamically and outputting thematic map with high resolution. It can serve as a new pattern of web cartography. In this article, realization of the online dynamic generative mechanism of thematic map depends upon model design of thematic map and implementation of technological engines. A 5-turples model of dynamic thematic cartography is proposed, and thematic symbols are constructed based on theory of syntactic structure. An information system consisting of seven software engine modules based on SOA ideas are established. Exampled by a running project of Shenzhen in this paper, the model and the system analyzed in detail, becomes significative to similar thematic map projects. Therefore, the paper explores a new pattern of thematic cartography for web representation of spatial information, from "data→designing→making→publishing→updating" traditional pipeline execution mode to "{data, design, making, publishing, analyzing, using, updating}" modern integrated manufacturing model, and it provides common software platform of value-added applications for the traditional map publishing industry.

P1.41 | **Research on Measuring Similarity of Spatial Topological Relations based on Topological Predication** (#911)

X. An, Y. Yang
state key laboratory of Geo-Information Engineering, Xi'an, China

A full-length version is available and can be opened here:

_extendedAbstract\199_proceeding.*

Measuring similarity of spatial topological relations is the important part of measuring similarity of spatial data, and also is the basic and key technology of spatial data retrieval and spatial scene query. Its meaning is to measure the similarity of the topological relationships between multiple data entities in different sources, different sources scales of the same region,Common topological relations have been abstracted into nine topological predications. Current research mainly focus on the topological relations similarity measuring between two simple entities, topological relations similarity measuring for the entire data sets, as well as the complex line involves few. The paper presents a method of measuring simple topological relations based on 9- intersection matrix, That is, the distance between two 9- intersection matrixs as the simple topological relations distance to measure the differences between two simple topological relations, so that we can get a simple topological relations similarity. Then considering the quantity similarity and dimension similarity between entity sets, so that we can get the simple topological relations similarity measuring model between entity sets. the paper establish similarity measuring model of complex topological predication by using the strategy of decomposing – combination based on simple topological relations similarity measuring model. Firstly, The complex topology relationship is broken down into a number of local topological relationships, Then through a combination of local topological relations similarity measuring model get the complex topology relationship similarity measuring model.At last, the method is used to measuring similarity of different scales and different sources data. Experimental results show that the selection of cartographic generalization impact of the topological relations similarity between entity sets mostly, and Other factors is smaller for the experimental data in this article. Experimental results also demonstrate measuring the degree cartographic generalization impacted of topological relations change by using topological relations similarity.

P1.43 | **Museum and tactile mapping: introduction to heritage education to the visually impaired** (#1203)

T. M. Tamura[1], F. L. D. P. Santil[2], A. Oliveira[2], J. B. D. S. Silva[2]

[1]*State University of Maringá, civil engineering, Maringa, Brazil;* [2]*State University of Maringá, Geography, Maringa, Brazil*

A full-length version is available and can be opened here:

_extendedAbstract\36_proceeding.*

Keep the memory and rescue cultural values are the basic quest for identity. What is intended is the awareness of the communities on the importance of the generation, recovery and safeguarding of cultural heritage sites. This paper proposes such questions permeate discussions with the objective of providing the visually impaired to read the world around you from the cultural heritage, recognizing themselves as active citizens, belonging to a social group that is peculiar. In practice, this was consolidated with visitors in the Museum of the Paraná Basin, State University of Maringá, who provided photographs and tactile materials (scale models and maps). Chaui (2000, p.161) comments that "advertising and propaganda make us prefer the" new "," modern ", the" latest fashion ", (...) also appears in the proliferation of disposable objects, in the way the construction industry destroys entire cities to make them "modern", destroying the memory and history of these cities. " This policy coupled with the media cause changes that affect society and its citizens, including the visually impaired who ends up suffering the deprivation of stimuli and information from the surrounding environment, requiring a form of respect and communication that instigates the his thinking. Moreover, the new generations do not identify with the museum, because the identity consider supporting the oldies, nostalgia which refers only to "older". These facts were discussed with the participants, and then there was the analysis of the photographs embossed with their inclusion in the city's history. Making historical recovery, for example, with household contributes to building the story, but allow the student to create their own identity and historicity from your site will make you more conscious of their actions. This search has been made possible from the preparation of fotopapers images that are manipulated with the help of the program CorelDRAW ® X5, have proposed to simplify the landscape and facilitate the reading of the scene were recorded and printed on paper microencapsulated in Laser printer. The fotopapers allowed the visually impaired perceive the face of the city and the changes imposed by urban growth. We sought to establish a standard that facilitates the reading, ie, detect the differences of tactile elements in the picture according to the proposed by Griffin & Gerber (2010). This step served, if necessary, to reshape the materials to facilitate not only the reading by the visually impaired, but to parse the message to be transmitted proposed noiseless (Andrews, 1988). Thicknesses were obtained for basic avenues and streets, and the definition of geometric shapes to squares and blocks. But one should consider reformulating their representation to meet the practical use by visually impaired. Regarding the material was tactile difficulties in reading it. In the case of your informative level model is more selective, which imposes the groping and recurring memory as the user. This scaling back the search for a new mental outlook, as the cartographic generalization adapts to the elements and their semantic relationship is changed. It turned out that the visually impaired do not have basic concepts of orientation, scale, among others, and emphasized that it was important to make this material available in schools because they deem essential to know their city, is the autonomy of citizens who are in "play." The goods will require small adjustments because maintaining the relationship between them "objects seen" interfered at different scales, but it was not decisive, in reading the participants. Nevertheless, the proposal of "standardization" is not feasible initially, because culture is a barrier to this proposal. This will be a challenge as well as the evaluation of the material and its inclusion in school.

P1.44 | **Combining digital technologies and traditional artistic procedures for the compilation of cartographic panoramas** (#1301)

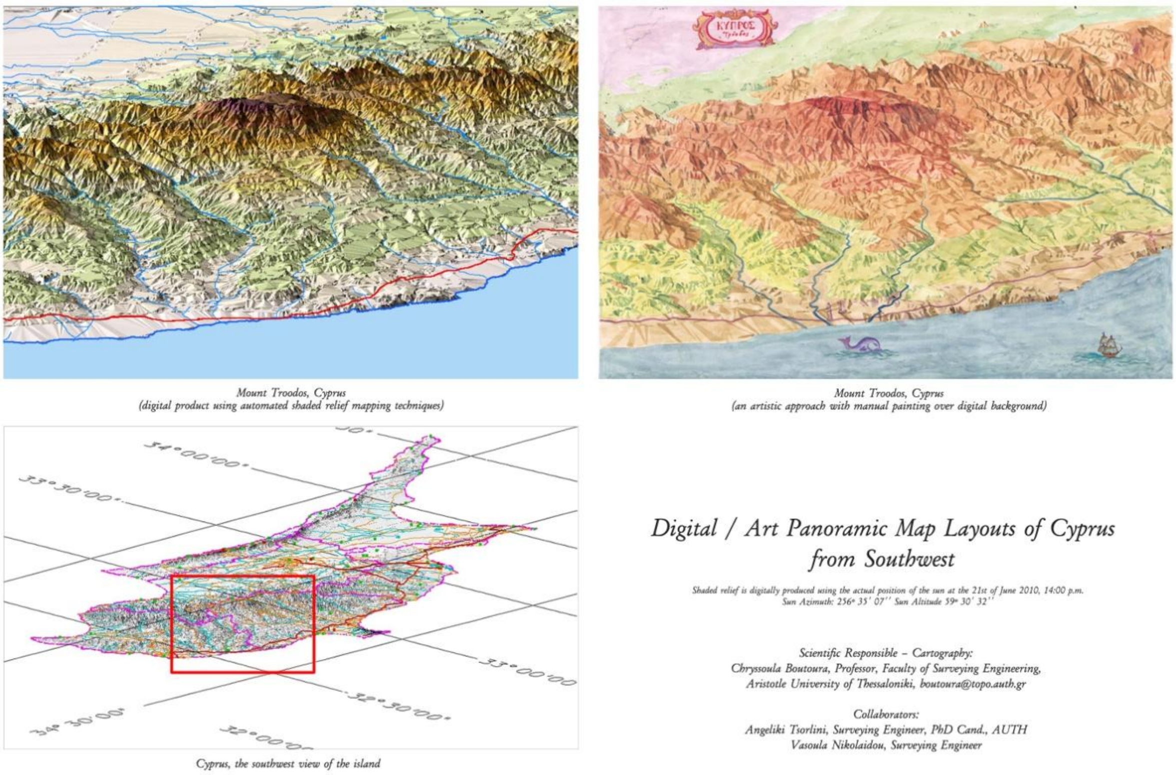
C. Boutoura[1], A. Tsorlini[2,1], V. Nikolaidou[1]

[1]Aristotle University of Thessaloniki, Department of Cadastre, Photogrammetry and Cartography, School of Rural and Surveying Engineering, Greece; [2]ETH Zurich, Institute of Cartography and Geoinformation, Department of Civil, Environmental and Geomatic Engineering, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\408_proceeding.*

Maps, apart from their scientific hypostasis include a number of aesthetic elements, a number of embellishments which not only help for making map particular and attractive, but also facilitate the very important function of reading and understanding. Every map helps the user to perceive space and the phenomena, geometric, physical or human relative with it, while it can be a piece of art, showing the changing consensus of people and cultures about the world.   Panoramic maps were always to be considered exactly at the line where the borders of cartography and art meet. Panoramas, from Leonardo Da Vinci's first approach till now give a more realistic view of the third dimension. The development of technology gave new methods on producing 3d cartographic views, giving the opportunity of perceiving space better. The main concept of this work is to use fully digital cartographic technologies in order to produce accurate panoramic 3d views of the island of Cyprus and especially mount Troodos, experimenting digitally on parameters of shaded relief, such as sun height and azimuth, sun intensity and z-scale as well as color palettes for height variation, trying to have an artistic result. As a second approach, using the main 3d shaded relief depictions of mount Troodos in gray scale, an attempt to transform it to a painting artistic product by hand was made, using watercolors and the main rules of painting. The results are very interesting and can be a real good part of the concept of combining cartography and art, keeping the geometry and cartographic accuracy both in cooperation with basic artistic procedures, with a really impressive result.



digital_paint.jpg:
Digital / Art Panoramic Map Layouts of Cyprus from southwest

P1.45 | **Academic SDI: concept, methods, data** (#747)

A. Medvedev

Institute of geography of Russian Academy of Sciences, Department of cartography, Moscow, Russia

To this day the institutes of Russian Academy of Sciences have a long experience in the use of geographic information technologies, implemented many GIS projects, created databases and spatial data. Academic spatial data resources are a significant part of national information resources. The main producers of spatial data are institutions of geological, geophysical, geographical and ecological (environmental) profile. At the same time, the data is distributed, its' use is often limited by the scope of one project, where it was produced. When the project is over it is difficult or even impossible to search for existing data, access to it, carry out exchange. The reason for this is the lack of an effective spatial data management system. Its' creation would integrate data and knowledge of the territory, create models of natural and socio-economic phenomena, process data that describes the system "society - natural environment", to provide efficient land use planning and management. From these positions the overall goal of Academic SDI (ASDI) creating is to the unite the distributed resources of spatial data and the results of research, information and knowledge about the Earth, its nature, population, economy and socio-cultural aspects of societies' the territorial organization, providing free access to users in the Internet for multiple purposes. ASDI creation is aimed at deepening the knowledge of the environment, natural resources, environmental conditions, the territorial organization of the society and their possible changes, improving the efficiency of scientific activity, the growth of the innovation potential of science, the possibility of the introduction of its results in practice and educational programs. ASDI subject area is Earth science, its technological basis - information and communication technologies, in particular, GIS technology, the main target audience - scientific community and students. In Russia, similar work is being done on the initiative of the departments, regions and major corporations, though, as evidenced by the extensive international experience, the device priority is hierarchically organized vertical national SDI, regional and local (municipal) levels as horizontal integration of geographically dispersed and distributed geographic information resources. The first phase of the planned ASDI with Science Data Center of RAS, united above all, the information resources of the Computing Centre, Institute of Geography and the Institute for Water and Environmental Problems (IWEP). It is assumed that the principles underlying the ASDI used in its technologies, models, and data formats, the software will provide its integration with other systems that operate on spatial data, in particular, the Russian SDI. Interoperability with foreign systems is ensured by international standards and specifications adapted to Russian conditions, the harmonization of national regulatory frameworks and international standards.

P1.46 | **SemGeo - a bridge between GIS and Semantic Web based solutions**

(#1196)

M. Strzelecki, T. Kubik

Wroclaw University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, Wrocław, Poland

A full-length version is available and can be opened here:

_extendedAbstract\325_proceeding.*

Without losing generality it can be said that the search for information is a process of generating answers to five basic questions: “Who?”, “What?”, “Where?”, “When?”, “Why?”. What is more, each of these questions relates to different domain, but together they create a context, without which the generated answers would remain incomplete or even useless. Due to variety of levels on which the search is conducted, it is not an easy task to find the relevant data, analyse it and process it into information. It requires the use of complex data exchange and inference methods. For years, a man has been trying to manage collected data and process it automatically. However, he encounters many difficulties in integrating data of different nature. One thing is to analyse text, it is another thing to analyse spatial data. In each of these areas different methods and tools are used. Recently a lot of attention has been drawn to the methods of creating and processing Internet resources. To facilitate computer analysis of these resources, the use of Semantic Web technologies began. These technologies provide methods to represent and create structural data, that can serve as metadata or knowledge base. These methods are suitable for semantic description of facts and for generating answers to questions “Who?”, “What?”, “Why?” with the use of logics and inference engines. It is a bit more difficult to use them to describe facts that answer questions “Where?” and “When?”. A major challenge in particular is the semantic description and analysis (with inference) of spatial data. Spatial analysis are performed well in GIS. However, these systems analysis methods are based on arithmetic calculations, not logic and inference systems. Therefore, it is difficult to integrate them with other semantically described resources or those exposing structured data. This paper presents a solution built to create a bridge between GIS and solutions supporting Semantic Web technologies. It starts with an analysis of possibilities of implementing geospatial services with the use of Semantic Web technologies. It covers evaluation and comparison of two spatial ontologies based on different approaches – NeoGeo Ontology and GeoSPARQL. The paper focuses on authors’ tool called “SemGeo” which is a bridge between spatial database and knowledge base. SemGeo is using NeoGeo ontologies to semantically represent spatial data. In first step spatial data is semantically indexed - unique identifiers URI are generated for all spatial features from selected PostGIS database. Semantic annotation is then performed on both geometry and topological relations between features. Geometry is described with NeoGeo Geometry ontology. Extracted features are spatially analyzed to produce topological relations between other features from selected schema. Features and their relations are annotated with NeoGeo Spatial ontology which is based on RCC8 calculus. Both geometry and feature descriptions are available in RDF/XML notation by URI dereference. SemGeo can also generate semantic topological description for selected area restricted by bounding box. This description can be loaded into knowledge base and used by inference engine. SemGeo provides standard SPARQL HTTP interface where SPARQL queries can be executed. Queries can be enriched with topological functions from NeoGeo Spatial ontology. SemGeo integrates semantic and spatial data in shared RDF Repository which can be supplemented with RDF/XML data from other sources. Authors also conducted evaluation and comparison of created tool to similar solution – IndexingSail, which is based on GeoSPARQL ontology. Paper describes potential applications of created tool. It also evaluates chances of Semantic Web technologies usage in geospatial web services.

P1.47 | **Geospatial Semantics for Topographic Data** (#507)

E. L. Usery

U.S. Geological Survey, CEGIS, Rolla, United States

A full-length version is available and can be opened here:

_extendedAbstract\324_proceeding.*

Whereas *The National Map* of the U.S. Geological Survey is based on data models and processes of geographic information systems (GIS), there is a current effort to explore the potential of semantically-based geospatial data using the Resource Description Framework (RDF) triple model of the Semantic Web. Advantages of the RDF approach include the ability to encode richer semantics, such as part-whole relations within features and geometric, topological, thematic, and temporal relations between features. Vector-based GIS datasets are composed of objects either defined as point, line, and areas or as actual geographic entities, such as roads and streams. Attributes and relationships, particularly topology, are commonly stored in relational database tables, which can easily be converted to the subject, predicate, object of the triple model of the Semantic Web. An automatic conversion process is possible in which the rows of the table become subjects, the columns become predicates, and the cell values become the objects. The USGS has implemented such an approach and has made data available in this form for specific research test sites in the United States. Further, a conversion program has been developed and made available that performs this conversion for any specified area of *The National Map* databases for vector datasets including hydrography and transportation. Raster data poses a more significant challenge since GIS data in this format commonly use a field view and do not identify specific geographic entities that can be encoded as features. Initial work to convert raster data to RDF and capture semantic relationships has used an approach of examining named geomorphic features and hand coding the relationships between features while maintaining a minimum bounding rectangle as the features geometric footprint in the raster datasets, such as terrain elevation and orthographic images. Other approaches are being examined including developing a formal terrain ontology using concepts from surface theory and geomorphology. Coding geometry in RDF for both vector and raster features relies on Well-Known Text (WKT) and the Geography Markup Language (GML), the two techniques supported by the Semantic Web, the SPARQL Protocol and RDF Query Language (SPARQL), and its extension GeoSPARQL, developed as a standard by the Open Geospatial Consortium (OGC). Using these methods it is possible to develop graphics, examine topological relationships, and perform spatial analyses on geographic data stored as RDF triples. In particular, GeoSPARQL supports geometric operations and the eight topological relationships supported by the Simple Features Relations Family of the OGC. The USGS has tested these protocols with the research datasets that have been converted from vector relational tables and is examining these approaches to handling geometry and topology for entities defined on raster data. Initial results demonstrate that it is possible to use WKT and GML to create maps and perform simple spatial analysis functions.

P1.48 | **PRELIMINARY RESULTS FOR THE INSPIRE GEOSPATIAL DATA MODEL BASED ON USER REQUIREMENTS IN THE NMA OF SPAIN (IGN-E)**

(#1161)

E. Maderal, J. Delgado Hernández, C. Sevilla, N. Valcárcel Sanz, A. González, N. Aguiar, J. García García

NATIONAL GEOGRAPHIC INSTITUTE SPAIN, CARTOGRAPHY, MADRID, Spain

IGN Spain is the NMA that produces the geographic reference data in Spain to represent the whole country at different scales with an homogeneous coverage. Current needs and legislation on geographical information implies an evolution for the IGN-E in relation with spatial data models and therefore with the production environment: from requirements oriented to cartographic map publishing towards a common frame that meets geographic information requirements of the government and to compliance with the execution rules of the Inspire Directive (Directive 2007/2/EC).   IGN-E included in the Strategic Plan the project Geomodelos to take this step. This project is created to define the actions necessary for modeling geographic reference data in the IGN-E (geometry, semantics and topology) so that they are compatible with the needs of other agencies and official authorities and that it conforms to the Inspire execution rules. In this way, Geomodelos collaborate with the organization responsible for the adaptation of the Geographic Information in Spain to the INSPIRE rules, so that there is an active participation of Geomodelos members in the thematic working groups of the Council for the Infrastructure of Geographic Information in Spain.   The project planning is developed following this four phases: a phase of Collection to identify, collect and analysis the user requirements and to study the reference rules to apply; a second phase of Design to define common technical requirements that meet the needs of data sets involved, this phase is divided into two activities, first to develop a conceptual data model that includes an application schema with and UML diagram and a catalog that includes the geographic phenomena at the highest level of required detail and second part with the develop of the processes to capture and maintenance information. The information generated in these early stages will be collected in a first draft document of data specifications. A third phase of Development is dedicated to physical database design and implementation, transferring the conceptual model to a logical model and finally to a physical database mainly to check designed models and to verify the functionality in the production GIS based environment. Finally a fourth phase of Implementation and Acceptance to approved the defined models and complete the document of data specifications to reach the maximum detail and documentation processes. All of this in accordance with ISO Family: 19100 for Geographic Information.   Geographic reference data considered for the data model in the IGN-E includes territorial boundaries, altimetry data, hydrographic elements, land cover/land use, transport networks and infrastructure, geographical names, geodetic networks that are part of the geodetic reference system, population entities, building and construction and infrastructure and services.   These preliminary results shows up to date the work for each running considered data and a first draft of a common model for geographic reference data in IGN-E. The main goal is to establish a collaborative and interoperable production of geographic reference data among government agencies in accordance with the Inspire execution rules.

P1.49 | **Retrieving information from spatial planning documents with the use of context analysis** (#964)

A. Iwaniak[1], I. Kaczmarek[2], J. Lukowicz[3], M. Strzelecki[1]

[1]*Wroclaw University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, Poland;* [2]*Wroclaw University of Environmental and Life Sciences, Department of Spatial Economy, Poland;* [3]*STRUKTURA Planowanie Przestrzenne, GIS, Gdańsk, Poland*

Providing spatial development plans requires preparing a standard of their representation that would be universal and mandatory. The complex structure of the plans including both spatial and descriptive data, as well as the interdisciplinary field of spatial planning make the creation of a closed scheme for planning data very difficult. Integration of plans in the ontological approach requires constructing a domain model for spatial planning and then feeding it with data. Information that are contained in spatial planning documents relate to provisions for specific areas that are covered by the plan. They include the future land use, development restrictions, etc. Most often, the arrangements for the zones covered by the plan are linked in the GIS system by means of assigning a zone identifier to a fragment of text. This allows the identification of the arrangements for each zone. This solution is very limited, because it requires independent interpretation of the plan and makes it impossible to perform any analysis. During the construction of a knowledge base that would collect information from a number of planning documents, it is necessary to retrieve important data stored in each of them. For this purpose, the authors take on work that will allow automating this process. The basis for the experiments is a planning document with separate zones, to which a text of detailed provisions are assigned and a domain ontology for spatial planning. Ontology was modeled using Description Logic and is an element which formalizes the input documents as well as the extracted information. A thesaurus containing hierarchical concepts and their alternative labels is used together with the ontology. The key task in ontology creation is to provide both a description of the domain knowledge and a terminology used to describe web resources. Popularization of semantic web technologies have caused the use the ontologies in many areas, including research in the field of GIS and SDI, mainly for the purpose of data integration. During the research, various methods of natural language processing are used to retrieve the required information defined with the created domain ontology. To improve readability and filter irrelevant and redundant information the input documents are preprocessed. A domain thesaurus was used as a dictionary along with the morphological analyzer "Morfeusz". In contrast to isolated text analysis methods like screen scraping which are used mainly to index resources for their future mining, experiments carried out by the authors used NER (Named-entity recognition) techniques as well as syntactic and semantic analyzers. These methods are assumed to provide a list of extracted entities categorized according to the ontology. As a result, blocks of text connected with different spatial planning zones are identified and processed. Then, the fragments, such as land use, construction parameters like FAR and development restrictions, which are most relevant to specific zones, are retrieved from text.

P1.50 | **Comparison of methods based on Geographic Information Systems and methods based on ontologies using Description Logic (DL) for modelling and spatial analysis** (#1184)

J. Lukowicz[1], A. Iwaniak[2]

[1]STRUKTURA Planowanie Przestrzenne, GIS, Gdansk, Poland; [2]Wroclaw University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, Wrocław, Poland

The purpose of this paper is to compare the traditional way of modelling of spatial phenomena, based on GIS technologies, with modelling using ontologies based on Description Logic (DL). The article presents the differences in approaches using these methods. Each of them provide different benefits and can serve for different practical purposes. Traditional spatial analyses using GIS systems are carried out by processing the attribute values (selection, ordering and aggregation), by recognizing their mutual dependencies and by the exploration of spatial (topological) relationships between specific spatial objects. Simple analyses can be linked into query sequences in order to obtain a multi-criteria analysis results. These analyses are a component of the decision-making processes. Criteria for decision-making are defined in knowledge bases. In complex decision-aiding systems, the knowledge bases use rule-based languages (e.g. Prolog, RuleML) to make a notation of the criteria for deciding on the studied issues. GIS systems produce very accurate results for well-known phenomena, described by verified theories. Missing or incomplete data, erroneous or ambiguous values, could result in erroneous results, and even more, prevent from performing an analysis. Due to its purpose, SW technologies, created so as not to constrain WWW flexibility, appear as a universal solution. Thanks to the formalism of Description Logic (DL), ontologies allow modelling any field, introducing a standard "de facto" for reality description . These techniques were rapidly adopted to describe the spatial data and resources. Topological relations can be treated as properties in ontologies. Such concepts are: W3C dictionary for geographic location in WGS84 datum, NeoGeo dictionary (http://geovocab.org/), but most of all GeoSPARQL, geospatial variant of SPARQL query language, addressed to exploring spatial RDF graphs. With these tools, SW successfully entered the field of geospatial technology. Our team researches the possibility to use SW tools to build the spatial decision support system (sDSS). Ontologies are structures aimed to provide a formal representation of knowledge for a given domain, as a logical model. They organize facts (individuals) in categories (classes, types, concepts) and define their properties, including relationships. Hierarchy of classes (taxonomy) and relations define conceptual schema of a domain, i.e. a meta-model of the described data, a so-called TBox (terminological component). A set of facts, given in the form of assertions using the conceptual schema, is called ABox (assertional component). The language dedicated to the creation of DL ontology is Web Ontology Language (OWL) which can be supplemented with rule-based languages (SWRL). Facts stored in the ontologies, can be analysed by inferencing engines: reasoners. Both models: model of the decision problem and the result of inference, are represented in form of ontologies. First integrates general formal systems (Upper ontologies), domain-models and detailed models of decision-making criteria (knowledge base). Second gives description of entities enriched with new features: expanded set of properties and reclassification of objects to the specialized categories, defined by restrictions on the properties, reflecting decision criteria. DL modelling allows to obtain comprehensive answers relating to the entire collection of objects. The article also presents the possibilities of the combined use of both approaches in spatial analyses. In such use, the results of GIS analyses become input for the inference process in DL, and vice versa, the results of DL reasoning provide input for the GIS analysis. Also, the way of presented results using traditional desktop GIS applications is shown. The document is based on the results of experiments related to the construction of the spatial Decision Support Systems based on the DL and their connection with spatial analyses.

P1.51 | **Spatial data licensing under “Open Data Strategy”** (#790)

T. Ciceli, Ž. Hecimovic

State Geodetic Administration, Sector of GIS, Zagreb, Croatia

Public sector collects, creates, produce and disseminates a wide range of information's. Last year The European Commission launched an Open Data Strategy for Europe, which is expected to deliver a €40 billion boost to the EU's economy each year. Trend in delivering data openly is being recognized also in organisations dealing with spatial data. With launch of new geoportal State Geodetic Administration started to share data under it responsibility like “wms” service without restraint. Currently four data sets are available, but without any licence agreement. In that light analyses of European practice of sharing data is investigated. Overview of current status of institutions dealing with open data in the filed of spatial domain is given, with overview of their programmes and objectives. Type of licences used for sharing spatial data under open data policies are described.

P1.52 | **Support analyzes delimitation of Geographical Indications in Brazil and local clusters of minority communities** (#783)

C. J. B. D. Santos[1], A. D. S. Santos[1], L. Fernandes[2], A. L. Gouveia[1]

[1]*IBGE - Brazilian Institute of Geography and Statistical, Cartography, Rio de Janeiro, Brazil;* [2]*INPI-National Institute of Industry Property, Geographicals Indications, Rio de Janeiro, Brazil*

A full-length version is available and can be opened here:

_extendedAbstract\429_proceeding.*

The Brazilian Institute of Geography and Statistics - IBGE and the National Institute of Industrial Property – INPI had established a technical, scientific, educational and cultural cooperation to the development and implementation of actions to standardization of procedures to support the spatial diffusion analysis, the strengthening of Geographical Indications- GI's and the inclusion of granted GI delimitaded areas in the National Spatial Data Infrastructure-INDE as determined in the Law No. 6.666/2008, . IBGE in defining of cartographic geometric representations of the perimeter of the Geographical Indications (GI's), areas referred by the association of local producers and granted by INPI verified that they contained some serious inconsistencies lease of its stroke in the territory, as well as an overlapping with areas of environmental preservation or protected indigenous areas. The only way to ensure security in the delimitation of GI areas is the interaction with the multiple geospatial information of INDE. The IBGE is the responsible institution of the Brazilian Federal Government to consolidate cartographic representation of geospatial information generated by other institutions as the granted GI delimitated areas generated by INPI. Among many interests in common with IBGE and INPI could be cited: the promotion of regional development by industrial clusters, Agricultural Poles and Local Productive Arrangements Promotion by GI goods protection, supporting team training, innovation and sustainable growth implemented the Productive Development Policy - PDP, provide the necessary technical support to local production in the areas of leasing consistent geographical indication, and encourage the training of human resources internal and external to the institution knowledge of the importance of having consistent information on the INDE. This partnership provides significant importance to the inclusion of geospatial geometry of GI as an important layer of territorial information and also ensure quality consistency of geospatial information to the INDE. Acquiring know-how to disseminate their expertise to the others partners institutions in the several government agencies, disseminating knowledge of geospatial information to the society such as local producers clusters, which tend to grow in geometric progression from the dissemination of GI concepts to others productive sectors in Brazil, as well as promoting the dissemination of the importance of INDE for local productive sectors of society. The INPI-IBGE partnership presents itself therefore as a relevant initiative to dissemination and promotion of the culture of intellectual property in the country, specifically with regard to strengthening of GI protetion and its strategic importance between various actors involved in the issue as small producers of local productive arrangements as the Maroons, indigenous communities who work with medicinal plants and some traditional communities as the Caiçaras or the Quilombolas.

P1.53 | **Taxonomies of Building Objects Towards Topographic and Thematic Geo-Ontologies** (#1415)

M. Basaraner

Yildiz Technical University, Department of Geomatic Engineering, Division of Cartography, Istanbul, Turkey

A full-length version is available and can be opened here:

_extendedAbstract\206_proceeding.*

Differences in semantics used in different data sources are one of the major problems in spatial data and geoinformation interoperability. Two identical GML/XML descriptions may mean very different things depending on the context of their uses. To achieve semantic interoperability, spatial data must be put in a machine-understandable representation. A more formal structure must be developed and the semantics of the words must be made explicit for a computer to understand the meaning of the information. The next step towards a better understanding is an explicit and semantically rich representation through ontologies, which consist of entities, relations in between, and axioms restricting or enhancing the representations. The Semantic Web community relying on such ontologies faces a different, but related, heterogeneity problem. Many individual ontologies have emerged recently, some of them representing the same contents. Despite using the same syntax, they may still differ considerably in naming or structure. Understanding the common meaning of the different representations stays difficult for humans interpreting them, yet almost impossible for machine-based approaches. This paper presents preliminary works of an ongoing ontology alignment study for buildings in various geo-ontologies. In this context, different taxonomic classifications of building objects that can be used in defining topographic and thematic geo-ontologies are given. In addition, some issues related to data integration in multi-resolution spatial databases are discussed within ontological framework.

P1.54 | **Research Agenda for Managing Roads and Address Geospatial Data**

(#1059)

<u>T. Trainor</u>

U.S. Census Bureau, Geography Division, Washington, United States

The U.S. Census Bureau is responsible for the collection and maintenance of the data contained within the Master Address File/Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) System. This data provides the framework for the Decennial Census as well as other censuses and statistical surveys conducted by the US Census Bureau. Prior to the 2010 Census, the Census Bureau underwent a modernization of the MAF/TIGER System and associated geographic services. This modernization contributed to the conduction of the 2010 Census which was both on time and under budget. In preparation for the 2020 Census, the U.S. Census Bureau must once again ensure a timely, accurate, and cost effective census. The level of currency, completeness, and accuracy of the address frame and associated housing units are required for an accurate census as well as various current surveys. Research conducted as part of the Geographic Support System Initiative (GSS-I), a 10 year lifecycle program, includes improving address coverage and currency, updating the street feature network, and enhancing quality measurement procedures. While, the goals of the Census Bureau's GSS-I are challenging, they are attainable. The initiative focuses on improvement to current approaches for maintaining geographic support. It explores new methodologies to efficiently work with numerous types of partners by collecting and using information that supports a national framework of geographic data and builds on previous investments to conduct censuses and surveys. This paper will focus on the research agenda for the GSS-I with particular emphasis on the address collection, data management, and quality assurance.

P1.55 | **Integrity constraints in spatial databases: study of the administrative network of Tunisia** (#1204)

H. Zneti[1], M. Dhieb[1,2], T. Saint Gerand[3]

[1]SYFACTE laboratoire, Sfax, Tunisia; [2]King Abdulaziz University Faculty of Environmental Design, Department of Urban and Regional Planning, Jeddah, Saudi Arabia; [3]UCBN, UFR de Géographie, Caen, France

Since independence, Tunisian territorial management was based on two main levels of divisions inherited from the colonial era. The hierarchical territorial division yielded 6 main regions, 24 "governorates", 267 "delegations" and 2073 sectors (basic units). Besides, the "communes" (towns) are divided into urban subdivisions called "Ilots". All this hierarchical subdivisions are based on geopolitical and regional considerations first. As far as we know, the recent Tunisian political events which advent the "Tunisian Revolution" do not change this general territorial scheme although one of the main popular claims deals addresses the territorial inequality. We come to the point that the Tunisian government is committed increasingly to optimize and streamline the management of its territory. Using the Geographic Information Technologies (GIT) may help a lot. Meanwhile, some notable researches have focused on the question (Ben Rabah, 2008). But the representation and manipulation of the administrative network by a GIS are not always obvious if one would like to get closer to the territorial reality. Issues of spatial data quality such as coherence, integrity, reliability and completeness in geographic databases seem so fundamental to carry out such a mission. Systems with Database Management Systems (DBMS) and non spatial core GIS software reveal the concepts of integrity constraints and spatial integrity constraints. In addition, a level of geometric modeling originates the structure of geographic information (in the form of geometric primitives). This question has been approached in several studies that led to representation models such as the model of Egenhofer 9 intersections. The topological rules are then the guide means of spatial relations that GIS users may require while respecting the structure and operating principles of the real world to be represented. In this paper, we aim to illustrate through the Tunisian example the correspondence and functional complementarities between these two crucial aspects of GIS in order to implement information related to or based on administrative boundaries at different scales representation, which would greatly facilitate the work of researchers based on administrative subdivisions.

P1.56 | **Quality Control Costs in Brazilian Spatial Data Production** (#1291)

S. S. Sato, A. L. S. Oliveira, A. J. B. Andrade, R. N. D. A. Filho, A. da Penha
Pernambuco Federal University, Cartographic Engineering, Recife, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\10_proceeding.*

The speed to collect, treat and provide data for mapping today, is a crucial factor when it comes to creating and maintaining cartographic databases. However, it is common in the acquisition phase of geospatial data they have not clearly defined their specific techniques for the purpose it was intended or even control the evaluation of their qualities, significantly compromising the integrity and accuracy of such products. The aim of this study was to understand how to evaluate and interpret spatial data quality produced by mapping companies in Brazil. Results showed provided a brief diagnostic on the current situation of the companies related to the mapping of quality control of cartographic products and portrayed that need the knowledge and deepening by companies on issues of norms and technical specifications within the national cartography and that is requires the presence of trained technical personnel in institutions for the development, supervision and approval of products and services specified n the existing national technical rules.

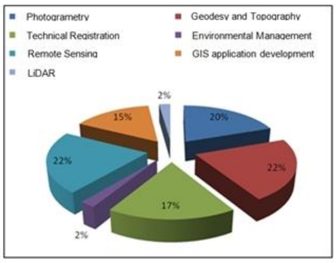


Figure 1. Area of expertise of the companies surveyed

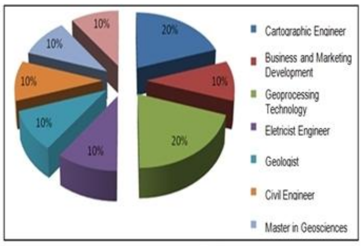


Figure 2. Professional Profiles

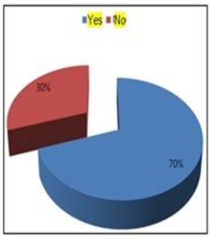


Figure 3. Companies that query the customer who fails to request their services

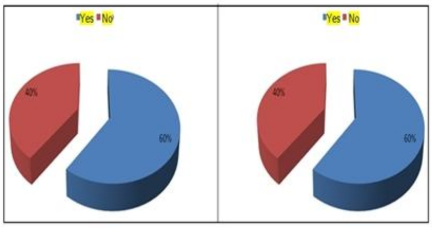


Figure 4. Companies that compare the results achieved with the planned and Realization of Statistical Control

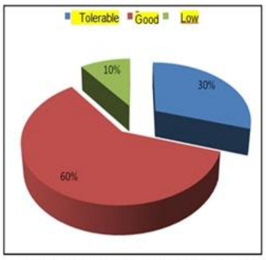


Figure 5. Quality assessment by the Director of Business

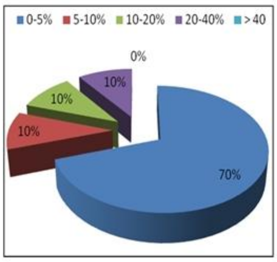


Figure 6. Percentage of Cost for the quality control of Geospatial Data

Results :

results obtained from the interviews

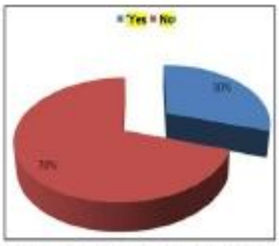


Figure 7. Availability Service Customer Service

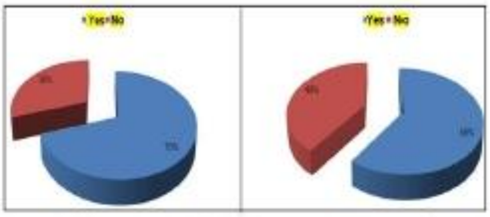


Figure 8. Implementation of Quality Management and Existence of a quality control department in companies

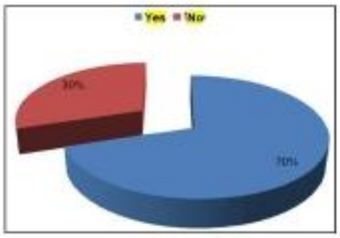


Figure 10. Financial return by investing in quality

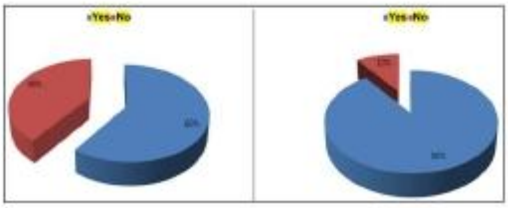


Figure 9. Certification of Companies for ISO Stocks and internal methods of quality control

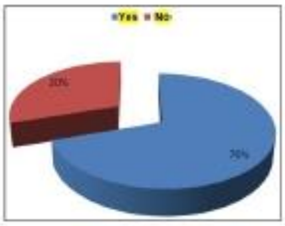


Figure 11. Management of data and metadata politic in companies

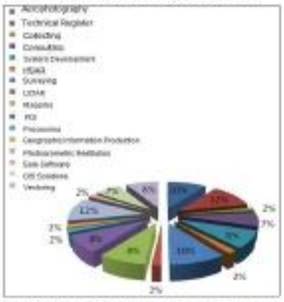


Figure 13. Traditional Techniques Activities in companies

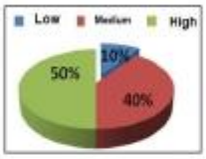


Figure 12. Satisfaction Level of companies to compare results with expected

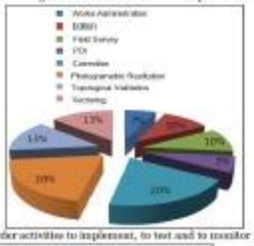


Figure 14. Harder activities to implement, to test and to monitor the quality

Figure 15. Steps in which is performed the quality control

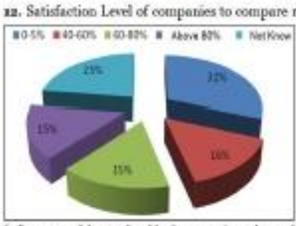


Figure 16. Percentage of data produced by the companies to the standard specified by INDE

Figure 17. Professionals responsible for spatial data quality in companies

results obtained from the:

results obtained from the interviews

P1.57 | **Quality Assessment of Geospatial Data (Logical consistency, topological accuracy)** (#1223)

M. Bouhadjar
Centre des Techniques Spatiales, SIRS, Arzew, Algeria

A full-length version is available and can be opened here:

_extendedAbstract\331_proceeding.*

The Geographic Information Systems bring together different methods and computer techniques to model, to capture in digital form, store, manage, access, analyze, and represent objects or collections of geographic objects with specificity essential to take into account the spatial characteristics of these objects as well as descriptive attributes attached to them. In fact, the GIS designation covers a wide variety of software implementations built to different technical options, features, and performance versatility. Implement a GIS without departing from the scientific rigor is a complex task, both in terms of defining concepts, functional organization, software architecture, algorithms and ergonomics. Indeed, the evolution of computer resources and emergence of software processing and analysis of spatial data have led to demands on the quality and abundance of digital data. At the national level, geographic information in digital form is provided in insufficient quantity and structure of files is variable. This shows a significant complication of use of the data and imposes a significant work of integration and standardization. Files from data entry operations must undergo several specific geometric structure before being able to use, depending on the applications planned next. The geometric structure is a way to organize data and links between them. The term data structure is sometimes used to refer to the physical organization of data and links between data in software. The structure generally consists of cleaning operations inconsistencies, connecting vertices, segmentation of static or dynamic (for linear objects). These operations are usually interdependent, and directly affect the quality of data available to potential users. Therefore, attention should be paid particularly to the execution of works that define them. To ensure the quality of spatial information, despite the current trend to free choice of input methods, we need to encourage separate criteria, mainly related to the required results. Information quality is not necessarily the most accurate information or more detailed information but whose value is in line with user needs. The contribution of this work lies within the area of improving the quality of spatial data stored in a vector format. It defines the properties, describes the principles and details the phases of the use of computational geometry. This work is divided into three parts intentionally theory, complemented by an implementation. The first part discusses techniques adaptable to any database type vector, independently of the data model. Various methods of implementation are presented at two complementary levels, conceptual and semantic. The second part concerns the geometrical and topological consistency, essential in spatial analysis, this function has indeed been our focus. The third part of our work develops the problem of topology, specifically the topological consistency, due to its frame, which is related to graph theory, the study of this topology is an important part of spatial analysis.

P1.58 | **Extracting Co-referential Objects Automatically from Multi-source POI Datasets Based on Position-correction and Semantic Matching** (#873)

J. Liu[1], Y. Wang[2], F. Zhang[3], A. Luo[4], C. Dong[2]

[1]Vice Director, Chinese Academy of Surveying and Mapping, Beijing, China; [2]Associate professor, Chinese Academy of Surveying and Mapping, Beijing, China; [3]Proffessor, Chinese Academy of Surveying and Mapping, Beijing, China; [4]Assistant researcher, Chinese Academy of Surveying and Mapping, Beijing, China

A full-length version is available and can be opened here:

_extendedAbstract\169_proceeding.*

P1.59 | **Extracting Co-referential Geo-Entities Automatically from Multi-source POI Datasets Based on Position-correction and Semantic Matching** (#739)

J. Liu[1], Y. Wang[2], A. Luo[3], C. Dong[2]

[1]*vice-director, Chinese Academy of Surveying and Mapping, Beijing, China;* [2]*Associate Professor, Chinese Academy of Surveying and Mapping, Beijing, China;* [3]*Assistant researcher, Chinese Academy of Surveying and Mapping, Beijing, China*

A full-length version is available and can be opened here:

_extendedAbstract\739_abstract.*

P1.60 | **Barriers for contributing to VGI projects** (#1154)

M. Schmidt[1], S. Klettner[1], R. Steinmann[2]

[1]*Vienna University of Technology, Department of Geodesy and Geoinformation, Austria;* [2]*Salzburg Research Forschungsgesellschaft mbH, MOWI - Mobile and Web-based Information Systems, Austria*

A full-length version is available and can be opened here:

_extendedAbstract\401_proceeding.*

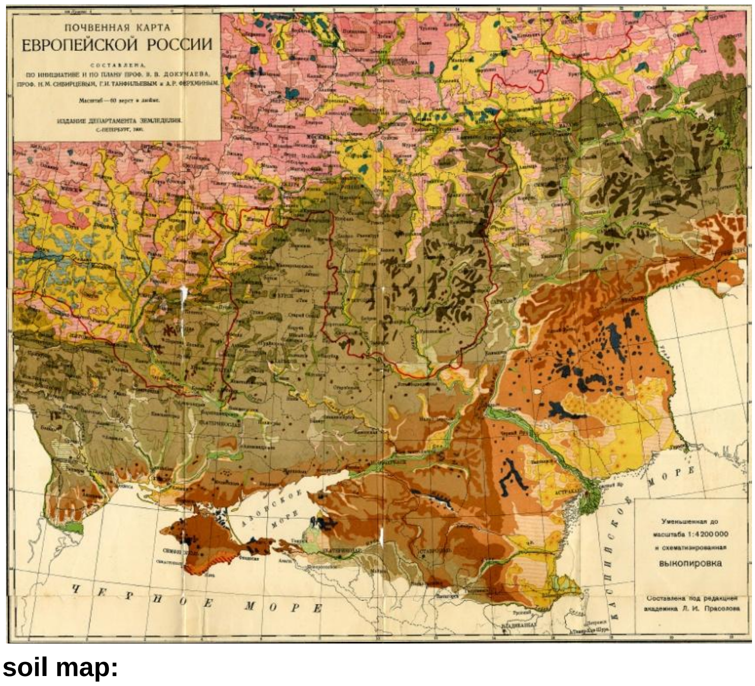
Volunteered geographic information (VGI) – the creation of geographic data outside of professional routines – has gained great importance in the field of geo information over the last couple of years. Collaboratively created geo data is not only used by private persons and non-governmental organizations, but also by companies and administrations. In order to evaluate if VGI is a sustainable source of data, it is important to know why some people participate in VGI projects and why others do not. While a range of studies have already analyzed the motivation of active VGI contributors, barriers and reasons for not contributing to VGI have not been investigated yet. As a base for our research we are focusing on the platform OpenStreetMap (OSM) – the largest and most successful VGI platform up to now. A survey by Budhathoki et al. (2010) found that only about 30% of the registered users have ever contributed or altered data. Among these, only around 60% contributed more than once. This means, that 80% of the by now 912.000 registered users are not active data contributors. While they obviously found the project interesting enough to register, we are trying to investigate, what hindered them to actually contribute. As a starting point, we conducted a study among the attendees of the 8th International Symposium on Location-Based Services in Vienna in November 2011. Of the around 200 visitors, who received the printed questionnaire, we retrieved 46 completed questionnaires. As expected, all respondents had at least heard of OSM, with 69% (N=31) stating that they are “familiar with it” and 11% (N=5) considering themselves an expert on OSM. However, only 37% (N=17) ever participated in OSM activities. Those, who never participated (63%, N=29) were asked, if they would be interested in participating in OSM activities and what their motivation would be. Only one person stated no interest in OSM activities at all. 66% stated they would be interested in data collection, 38% in developing tools which use OSM data, 21% in developing tools for OSM and 7% would be interested in organizing events for OSM. 55% are willing to spread the word about OSM. The prospect of “having free geo data” was mentioned as a motivation for a possible contribution by 79% (N=23) of the respondents. 59% find it motivating to contribute their local knowledge, 38% would be motivated by the outdoor aspect of mapping; 21% by the social aspects and 10% would like to use and improve their mapping skills. These results are in accordance with existing studies of active contributors (e.g. Budhathoki & Nedovic-Budic 2010). We also asked about the reasons for not yet being a contributor. The most often mentioned barrier was a lack of time (72%, N=21). 38% mentioned, that they do not possess a GPS device; 24% do not want to spend their spare-time on the computer; 10% stated that it is difficult to use and 7% are afraid to do something wrong. While these results are interesting, we are aware, that the number of participants is too small for wider conclusions. Also, the range of questions and answers was limited. We are therefore preparing a larger study on barriers for participating in OSM, going more into details and depth on technical barriers, usability problems and possible insecurities on working in a community project by allowing also qualitative responses. The online questionnaire will not only be disseminated within the OSM community, but also in the general geo community, to address people who know OSM, but do not actively contribute. The results will be discussed in the full paper. The study will give us more insights in barriers on the participation in VGI projects, which are important to assure the sustainability of VGI projects. VGI can only stay relevant, if there are people willing to contribute and to keep the existing data up-to-date.

P1.61 | **Interpretative Mapping of Attributive Information of Dokuchaev's Soil Map of European Russia** (#620)

V. Kirillova[1], I. Alyabina[1], D. Khitrov[2]

[1]*Moscow State University, Faculty of Soil Science, Russia;* [2]*Moscow State University, Faculty of History, Russia*

The aggregated soil map of European Russia, composed by V.V. Dokuchaev, the constitutor of Russian school of soil science, N.M. Sibirtsev, G.I. Tanfilyev and A.R. Ferhmin, was published in 1900. The same year, it was exhibited at the International Exhibition in Paris, and received the highest award. Being the first detailed soil map (the scale is 60 miles per inch, 1:2520000), it still presents a significant scientific interest not only for the history of soil science, but also as a detailed overview of Russian soils of the late XIXth c. based on a great mass of field materials. The map accumulated the data of complex physiographic (landscape) researches conducted by V.V. Dokuchaev and his followers (N.M. Sibirtsev, K.D. Glinka, S.S. Neustruev, L.I. Prasolov), covering more than 20 gubernias (provinces), and multilevel (uezd/district, gubernia/province) soil maps composed earlier. They were conducted by V.V. Dokuchaev and his followers, using not only the methods inherent for the soil science of the early XXth c., but also the traditions of studying of a country economy, in particular, on the settled criteria of grading of soils by fertility. The objective of our work was the extraction and preparation of attributive information of the map, in order to use these data, for the further combination with data on population dynamics and economic development in the Early Modern Era. At the first stage of the project, two layers of the map were digitized in GIS MapInfo: soil cover and borders of districts of provinces. A detailed study of the legend, explanatory text, and also features of the classification used to create the map, allowed to distinguish several layers of information characterizing the organic matter, their granulometric structure, salinity, rockiness, etc., separating the primary characteristics, and the recalculated parameters. Attributive characteristics, in turn, were ranged according to the objectives of the research. In particular, the granulometric structure of the soils considered in relation to a) the contribution of the parameter to conditions of soil cultivation, b) its influences on fixing of substances arriving with fertilizers, c) role in the formation of soil water regime. On the basis of the obtained data, a series of thematic maps was created, revealing both natural characteristics of soil and their impact on the land use. They provide us with the opportunity of modelling the impact of soil cover properties on the settlement of new territories of European Russia and its exploitation. The contribution of each examined natural feature to development of land resources was estimated individually.



soil map:
Soil map of European Russia - N.M. Sibirtsev, G.I. Tanfilyev and A.R. Ferhmin (ed. V.V. Dokuchaev), 1900

P1.63 | **Adaptive Cartography in the Context of Neogeography and Ubiquitous Computing: Research Issues** (#1130)

X. Zhang, T. Ai, X. Cheng

School of Resource and Environmental Science, Wuhan University, Cartography and Geoinformatics, China

A full-length version is available and can be opened here:

_extendedAbstract\270_proceeding.*

Web 2.0 and ubiquitous computing together provide a promising technological framework for individuals to map the world and events that are happening around them and encourage free use of these maps where network connection is available. For example, once people publish information via new social medias such as Facebook, it is technically possible for their friends to get informed of this information at near real-time. As much of such information contains geographic locations or information (e.g. place names) that can be georeferenced (in forms of POIs), maps provide a better interface to facilitate the information communication process. This envisions an environment for real-time geocollaboration (Chang & Li 2012), and everyone should be able to get insight as spatial relationships of events structure themselves on maps. On the other hand, as handheld devices become smarter and more spatially capable (with built-in internet accessibility, GPS, compass, etc.), people with no geospatial expertise now are more easily than ever engaged in the using, sharing and distribution of spatial information (in the form of framework data). A famous example is OpenStreetMap (OSM), where everyone can collect and edit spatial data of their familiar places and contribute to the map worldwide. Goodchild (2007) described this phenomenon under the umbrella of citizen science and termed it volunteered geographic information (VGI) as a special case of the wider Web 2.0 practice of user generated content. This may substantially change the way how the general public and scientists from other domains use maps. With all the possibilities provided by this new context, however, the question is that are there problems from a cartographic perspective? Are there problems in how individuals make and use these maps? Are current cartographic theories sufficient (need for neo-cartography)? And all in all, what are the unique contributions that the cartographic domain can offer? Kraak (2011) expressed similar concerns and argued that there is no need for neo-cartography. However, he added further that one should make better use of current cartographic design knowledge to enable an effective visualization. This paper further identifies some of the basic problems of cartography in this new context. The issues concerned have a more cartographic and geospatial flavor. In doing so, we went through several case studies. The results are described in the following: – Heterogeneity between informal (e.g. OSM) and formal information sources. The heterogeneity lies in terms of semantics, fidelity and scale of spatial data to be integrated. How should diverse spatial data be integrated to benefit both sides? – Poor map design. Although there are many web services for map styling, the control over symbol design and color scheme is still limited. How can cartographic knowledge be better integrated into the tools? – Graphic information overload. This problem is now usually ignored by neogeographers. Cartographic generalization has long been dealing with such problems. How should existing approaches be adapted for the new context? – Adaptive visualization has always been an important area where various user groups and devices impose diverse map requirements. Apparently, it becomes even demanded in the context of ubiquitous mapping as user requirements and how people interact with maps cannot be determined statically. The question is therefore: how should we model the user and context in order to provide the right person with the right information in a timely and usable way? References Chang Z, Li S (2012) Geo-Social Model: A Conceptual Framework for Real-time Geocollaboration. Transactions in GIS (online) doi: 10.1111/j.1467-9671.2012.01352.x Goodchild MF (2007) Citizens as sensors: the world of volunteered geography. GeoJournal 69:211–221 Kraak MJ (2011) Is There a Need for Neo-Cartography? Cartography and Geo-graphic Information Science 38(2):73–78

P1.64 | **Spatio-Temporal Activity Recognition of Crowdsourced GPS-Trajectory Data** (#542)

L. Zhang, S. Dalyot, M. Sester

Leibniz Universität Hannover, Institut für Kartographie und Geoinformatik (IKG), Germany

Geospatial trajectories are nowadays collected straightforwardly via Global Positioning and Navigational Systems by everyday commuters (pedestrian and vehicular). This data holds information about the representation of spatial phenomena, e.g., the geometry of the indoor and outdoor environment. Moreover, it also contains information about the spatio-temporal behavior of the moving objects. Most research work analyzing trajectories emphasized on the spatial domain only, leading to the extraction of positional information in regard to infrastructure geometries. Research investigating the temporal aspects this data encompass is still quite limited. The idea in this paper is to make use of patterns of a series of group of trajectories that share similar configuration by formulating a cluster according to spatial and temporal constraints. Identifying such clusters of GPS-trajectories makes it feasible to classify and categorize similar and specific geometries (spatial shapes) derived from motion patterns recorded (position tags). When time tags are incorporated into such process, temporal behavioral and patterns can also be classified and identified. This yields the feasibility to carry more focused activity recognition that is presented by the trajectory clusters, implying users behavior and activities classification, implying mining of collective knowledge. Better services can then be offered providing with context-aware fine-tuned relevant information that is not merely a positional one – but also a temporal one. Such services can suggest:

1. *Car sharing usability*: analyzing the spatio-temporal patterns of users can yield identifying the reason for renting a car - close-by or distant usage - in respect to time of usage (time-of-day, workday, weekends). This can help to identify usage patterns and facilitate a better service in terms of usability, distribution of car locations, etc.
2. *Bicycle hire distributions*: investigating spatio-temporal activity patterns of users hiring bicycles can improve to tune the presence of potential bicycles to hire and vacant slots in existing docking stations.
3. *Vacancy of parking lots*: an analysis of activity patterns on car commuters in parking lots around build-up areas, to enable the identification of specific time-derived patterns in case multiple parking lots exist in the vicinity. This suggests revealing temporal properties: what is the best parking lot at a specific time-of-day? Such a service will ensure that vacant parking space probably exists and avoid frustration and time spent in looking for one.

In this paper we propose to use a density-based clustering method, which will introduce temporal information in addition to spatial knowledge of GPS-trajectories. This will enable to recognize spatio-temporal activities, and also to extract important places affiliated to these activities, such as: car parking lots, bicycle docking stations - to name a few. Different granularities of patterns will be discussed: global and partial in the spatial domain, and time intervals in the temporal domain (hourly, daily, weekly, …). The paper will provide a methodology for the interpretation of spatio-temporal behavior from trajectory data. It will show the advantages of using spatio-temporal analysis of clustered travel GPS-trajectories for different applications, concluding with presentation of experimental results showing the feasibility and potential of the proposed methodology. Bak, P., Marder, M., Harary, S., Yaeli, A., and, Ship, H. J., 2012. Scalable Detection of Spatiotemporal Encounters in Historical Movement Data. Computer Graphics Forum, Volume 31, Issue 3 pt.1, p. 915–924. Zhang, L., Dalyot, S., and Sester, M., 2012. Travel-Mode Classification for Optimizing Vehicular Travel Route Planning. LBS 2012, 9th Symposium on Location Based Services. Sester, M., Feuerhake, U., Kuntzsch, C. and Zhang, L., 2012. Revealing Underlying Structure and Behaviour from Movement Data, KI - Künstliche Intelligenz, p. 1-9, 2012.

P1.65 | **The research of ancient road in Czech republic - presentation of results on the map server Vectormap** (#1478)

J. Martínek[1], A. Létal[2], J. Mirijovský[3], P. Šlézar[4]

[1]Transport Research Centre - Division of Transport Development, Olomouc, Czech Republic;
[2]Department of Geography, Faculty of Science, Palacký University in Olomouc, Czech Republic;
[3]Department of Geoinformatics, Faculty of Science, Palacký University in Olomouc, Czech Republic;
[4]National Heritage Institute, Regional Office in Olomouc, Czech Republic

No abstract or full paper available.

P1.66 | **Coordinating Views within Interactive Web Geovisualization** (#1380)

F. Hardisty, A. Savelyev

Pennsylvania State University, Geography, University Park, United States

Geovisualization methods focus on the interactive, exploratory mapping of phenomena represented as numerical and textual data. Geovisualization often requires the coordination of multiple views of this data. However, it is not clear what the best methods are for developing coordinated views in JavaScript, the programming language present in the largest number of computing devices, including mobile phones. We present here a new open source library for easing the development of coordinated views called GeoVizCoordinator.js. GeoVisCoordinator.js combines current best practices in JavaScript with past research into geographic visualization methods in Java in order to ease the development and coordination of multiple kinds of views in a web context. Past research on coordinated views for geovisualization lead to the development of a number of object patterns, including the meta-pattern called “introspective observer coordination”. This type of coordination relies on introspection and reflective invocation to allow for extensible, efficient coordination between views, including coordinating selections, spatial extents, and visual variables. However, the differing semantics of JavaScript mean that the Java methods cannot be directly applied to JavaScript. We undertook a comprehensive review of current best practices in JavaScript coordination libraries in order to develop the best ap-proach for GeoVizCoordinator.js, including libraries that use model-view, publish-subscribe, and other object and function patterns that can be used for coordination. Model-View techniques include Model-View-Controller (MVC), Model-View-ViewModel (MVVM) and Model-View-Presenter (MVP) patterns. These widely used patterns help separate the data from the presentation of the data, without the various components needing to be aware of each other. A related technique that shares this goal is the publish-subscribe or observer pattern, which is implemented in a number of leading JavaScript frameworks. We abstract the core of these libraries for use in GeoVizCoordinator.js. For future work, we also consider how new kinds of coordination are made possible in a web context. These include coordination between remote actors, coordination between servers and clients, and coordination between clients and web services represented as REST endpoints. Coordination between remote actors is possible with current approaches, but cumbersome to develop. We examine how GeoVizCoordinator.js can be extended using techniques developed in other libraries such as GeoJabber, and using standard communication protocols like XMPP to enable these kinds of coordination.

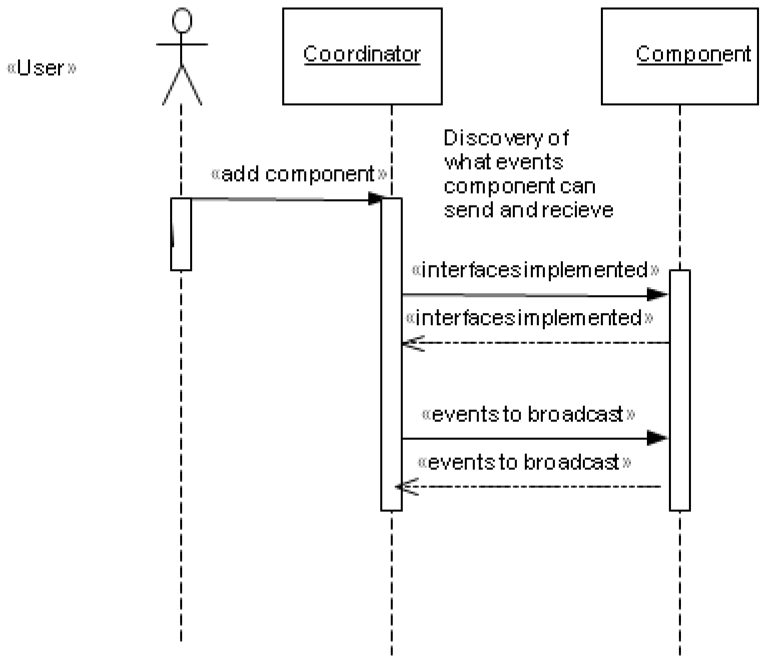


Figure 1:
UML diagram illustrating coordinator program flow

P1.67 | **Soil Map 1:200,000 (BUEK 200) – The Distribution of Soils in Germany**

(#922)

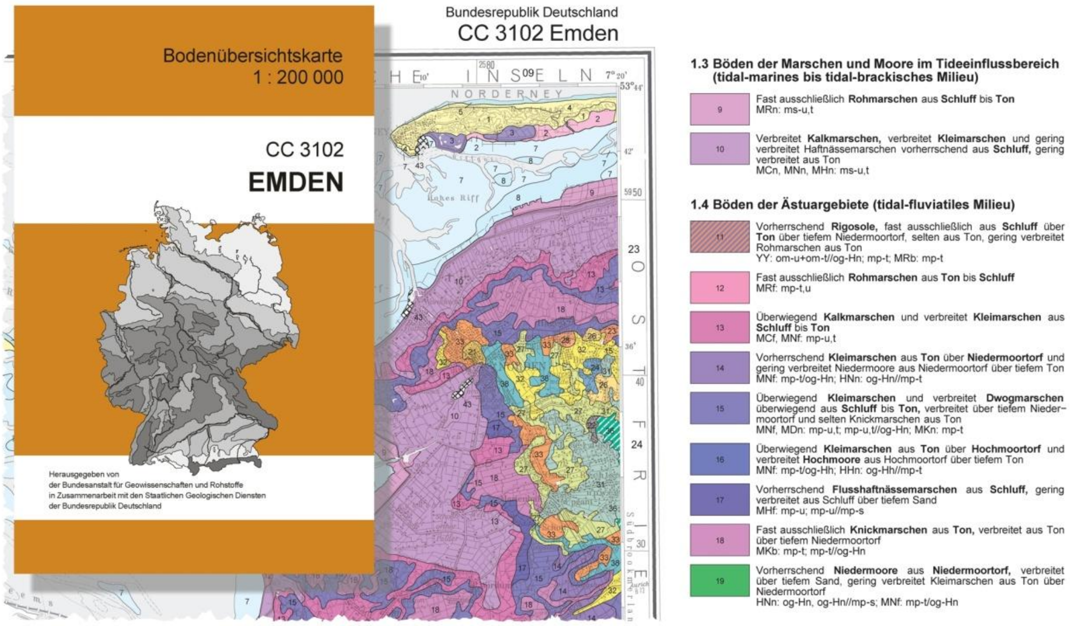
D. Krug[1], U. Stegger[1], E. Eberhardt[1,2], S. Richter[2]

[1]*Federal Institute for Geosciences and Natural Resources, Hannover, Germany;* [2]*Federal Institute for Geosciences and Natural Resources, Berlin, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\23_proceeding.*

The soil map 1:200,000 (BUEK 200) is prepared by the Federal Institute for Geosciences and Natural Resources (BGR) in cooperation with the National Geological Surveys (SGD) of the federal states in the sheet line system of the Topographic Map 1:200,000 (TUEK 200) and is published in 55 individual map sheets. The map shows the spatial distribution and association of soils and their properties. The BUEK 200 is the first nation-wide consistent soil map at medium scale with full spatial coverage. By the end of 2012, 48 map sheets have been published as printed and digital versions. The Geological Surveys are responsible for the content of the map and for the underlying soil information (attribute data), while BGR coordinates the quality assurance of the layout and the overall consistency of the map series. The resulting map is homogeneous and seamless, and the digital dataset holds uniform, corresponding background information on any map unit. The BUEK 200 is completely digitally produced within a Geographical Information System (GIS). Spatial and attribute data are recorded in a central database and can be used for evaluations across state boundaries for soil use and soil conservation. The sheet-wise processing requires for each new sheet the modification of map graphics as well as content of adjoining sheets such that the current digital dataset is ready to use for data evaluation. The map series is distributed in various formats via the GeoShop Hannover (www.geoshop-hannover.de), partly free of charge. In addition, BGR provides the data as a web map service (WMS, www.bgr.de/app/FISBoBGR_MapServer/OpenLayers/buek200.html). After completion of the dataset for the whole of Germany, a further aggregation of map units will be carried out in order to yield a nation-wide, homogeneous legend. This will be paralleled by a revision of the boundaries of spatial aggregation units (Great Soilscapes, Soil Regions). With this overall picture, quality of all map, map unit and soil profile data will again be checked. Besides this, the work will focus on thematic evaluations and aggregation for maps at even smaller scales.



Detail of a map sheet :
Title page and detail of the BUEK 200-map sheet "Emden"

P1.68 | **Research and Practice of Electric Map Multi-pattern Display** (#503)

<u>N. Jiang</u>, Y. - X. Hua, Y. - J. Zhang, X. - N. Zhang

Information Engineering University, Cartography and GIS, Zhengzhou, China

In conditions of electronic map, the influential factors of map display effects are numerous, including user factors, display device, environment, map function, area type, interactive operation etc. The influences of these factors to electronic map display are more complicated than they are to paper map. It means that the theory, method and technology of paper map and single-pattern electronic map are not adapted. So it is necessary to study to satisfy the needs for multi-use, multi-device, multi-environment, multi-area for electronic map display. This paper discusses chiefly methods for building display triggered model, data processing model and graphics designs model of electronic map multi-pattern display, and develops the prototype system based on template technology. **1. Research of multi-pattern display triggered model of electronic map.** The theoretic base of electronic map multi-pattern display design is discussed by analyzing actualities about paper map and single-pattern electronic map. Some theories of multi-scale display, ocular sensation and usability are updated and extended from the view point of conception, principle and method. Starting from the characteristics of electronic map application, chief influencing factors of display are found out. The concepts including display pattern, display style and display template are presented. Moreover, the display triggered model is established. **2. Research of multi-pattern display data processing model of electronic map.** Based on the present research of electronic map multi-scale display, the research method of data processing of multi-pattern display is proposed. We have proposed the method of solving key scale and building multi-scale display mode based on characteristic points, and then done some adaptability tests. The method of assuring the display classification of geographic elements is discussed, and the display classification model is proposed combined with qualitative and quantitative methods. **3. Research of multi-pattern display graphics designs model of electronic map.** Starting with expression contents and data characteristics, the principle of electronic map multi-pattern symbol design is investigated and design demands of multi-style display template are discussed. Second, the model of graphics design based on the trinity of multi-pattern display is constructed. Third, the law and method of symbol type design and visual variable design of fundament mode are investigated emphatically. Use mode, operation mode and device mode are also discussed. Moreover, make some templates of common display mode. Finally, the multi-pattern symbol type, visual variables and multi-style templates are tested based on usability tests, which help the graphics design effectively and accelerate the development of theory and method from single-pattern symbol designs to multi-pattern graphics designs. **4. Development of multi-pattern display system based on the template technology.** Through analyzing the existing electronic mapping systems, the research method and design principle are proposed based on template technology. We design the structure, function and data flow of software system, and investigate the display triggered mechanism, then develop the designs of data layer, configuration layer and index layer of display style template library. We also study the symbol library, annotation library, color library, the structure of configuration document and index document. The function of map data processing, template building and management, exchange of electronic map multi-pattern and multi-style display are achieved.

P1.69 | **TEXTURE MAPS – What they are; How to create them; Why and where you should use them.** (#603)

R. Smith

Managing Director, Geographx, Wellington, New Zealand

The paper is not written from an academic perspective but from that of a practising commercial cartographer. It is about raster images that display the surface detail of planet Earth in plan view. This definition includes orthorectified aerial photographs, satellite imagery, scanned paper maps, and maps designed specifically for digital display. However the paper focuses on a data type I will call “**Texture Maps**”. **Texture Maps** are composite images created from pre-existing vector map data. They are not “maps” in the accepted sense as they feature no type labels, graticules, administrative boundaries or marginalia. They are simply pseudo-photorealistic interpretations of the earth's surface, with its landforms, landcover and associated topographic features. **Texture Maps** are designed to display landcover and surface detail in a way that can be intuitively understood by laypersons – without recourse to labels or legend. Feature types are selected and layered in a pre-determined hierarchal order. Each is coloured, pattened and styled to create the desired effect – a natural harmony when viewed as a whole, yet with clear definition and differentiation of the contributing individual elements. The additive process ensures that texture maps contain only the information intended, there is no extraneous clutter. **Texture maps** do not compete with remotely sensed data types, but they do complement them. They are cheaper, seamless, and free from clouds, specular reflectivity, shadow and tonal variation. **Texture Maps** are designed for use as plan 2D or 3D backdrops for added overlying thematic material or cartographic artwork. They can be used as contextual data layers for land information geoportals. They can be draped over terrain and visualised/explored in a 3D virtual environment, and they make publishable images in their own right. The paper explains what texture maps really are, how they are constructed, and how they can be best used. It explores their strengths and weaknesses compared to other types of raster “earth maps”. It argues that because texture maps have the potential to communicate important contextual information at a subliminal level, they should be used more to help effectively communicate spatial information and relationships to a wider audience. The presentation will make frequent reference to two newly developed texture map datasets. The first is a texture map of New Zealand, developed by Geographx in 2012. This dataset maps landcover, relief and other topographical features at 4 metre pixel resolution. It pulls data from multiple pre-existing source datasets and includes up to 100 feature types. Processing is scripted and non-destructive, so the texture map can be easily maintained, updated, customised and improved. It replaces a less versatile, coarser, earlier version developed by Geographx some years ago. The second is a texture map of planet Earth (currently under development). The planned pixel resolution is 1.5 arcseconds. The process and workflow will be based on that already developed and will have similar attributes. Texture maps are not new nor championed only by Geographx. "Natural Earth" data is a global dataset in the public domain, developed and maintained by a collaboration of volunteer contributors. It is considerably coarser in resolution than the Geographx dataset now being developed, with raster images of 60 arcsecond resolution. *<u>Author's Note</u> Depending on time available for the presentation, I would propose to run sequentially:*

1. *an introductory presentation with slides.*
2. *a live Photoshop CS6 session to illustrate how the texture maps are structured and the workflow used to create them.*
3. *a live demonstration of the texture maps in a dynamic, interactive 3D virtual environment (SkylineGlobe)*

P1.70 | **Knowledge Transfer via Maps – Explanation of a Complex Process by Means of Communication Models** (#999)

A. Rau, J. Moser
Leibniz Institute for Regional Geography, Research area: Geovisualisation, Leipzig, Germany

A full-length version is available and can be opened here:

_extendedAbstract\999_abstract.*

P1.71 | **The Development of a Census Address Ontology to Enable Successful Spatial Data Sharing between Partners** (#1027)

K. Bower

U. S. Census Bureau, Geography Division, Washington, United States

A successful census or survey is reliant on a complete and current universe of housing units and a reliable spatial framework. Addresses are needed to assign the respondent data to the correct geographic unit through geocoding. In preparation for the 2020 Census, the U.S. Census Bureau is expanding partnerships with tribal, state, and local governments for both spatial and address data exchange. The development of an address ontology will provide a shared language to help ease the burden of data sharing between disparate databases. Some benefits include: encouraging effective communication and ease the burden of data sharing by establishing a standard language for the common understanding of address information and its structure; making terminology, concepts, and relationships explicit; and allowing for the discovery and comparison of relevant partner address information. This presentation will focus on the identification of the need for a Census Address Ontology, the development approach, and the application and uses of the ontology.

P1.72 | **GPS-based Crowd Sourced Intelligent Traffic Information Hub** (#1043)

R. Zhu

Gyözö Gidófalvi, Urban Planning and Environment, Stockholm, Sweden

A full-length version is available and can be opened here:

_extendedAbstract\330_proceeding.*

P1.73 | **How to Use a Timeline to Understand Spatio-temporal Data Better?**

(#1272)

P. Wang, M. - J. Kraak

University of Twente, ITC, Enschede, Netherlands

Information visualizations are important ways for geoscientists to explore hidden patterns and summarize research findings. The relations between attribute, spatial and temporal information can reflect change and help users to understand geographical phenomenon. Users' spatio-temporal questions and the properties of data are the main factors for deciding on what spatio-temporal representation to be used. Interactive graphic representations are used as a common practice, such as map and diagram in a coordinated multiple view environment (CMV). Such environment allows one to use separate views for each of the data's components. Questions related to time can be answered via the time view. A timeline is a way of displaying a list of events in a chronological order as a straight, curved, branching or crossing line. Its appearance can be simple, complex, artistic or technical (Grafton et al., 2010). Depending on the domain perspective, numerous discussions on the notion of time exist. In geographic domain, time always links to attribute and location information. The structure of time can be linear, cyclic or branching. A timeline has to be able to deal with different types of time: 1) continuous or discrete; 2) relative or absolute; 3) scale; 4) granularity; 5) linear or cyclic; 6) and combined information. For example, continuous information on timeline can give users a vivid image of an event while discrete information on timeline can let users compare different times. Timelines should also be able to manage different temporal granularities. Location information can be added as annotations while attribute information can be embedded as graphs. An interesting variation on the timeline is the time wave which combining linear timeline and cyclic timeline (Li, 2010). The type of data to be represented will decide on the kind of timeline required and as such will determine which questions can be answered. Users' queries could be related to an event's start and end time, its length, history, present and future status and trends. Similarly, users may also be concerned about the frequency, regularity, interval, topology and influence between events. To answer these questions, we consider using a timeline as a tool to help users explore spatio-temporal data in context: 1) other views like maps and diagrams can be linked with the timeline view; 2) a timeline can locate a specific event, and give users a general idea about the sequence and relationship among all events; 3) users can do comparison among events easily and clearly on a timeline; 4) a timeline can show trend of an event or multiple events; 5) and it can integrate different times. Several researchers have proposed a variety of solution to use the timeline to deal with the above points ((Silva et al., 2000), (Allen et al., 2009)). Recently, Cutugno et al. (2012)suggested a multiple timeline solution in a CMV environment. This research starts with a discussion about the relationship between the timeline and events; this is followed by an overview of existing timeline applications. Based on this inventory we derived a set of generic temporal queries, which are converted into what we call a visual timeline grammar. This makes it possible to transfer complex temporal queries into a visual narrative along the timeline. The design of the building block of this grammar is visually linked to the appearance of events related data in other views. Actions executed in the other views will reflect on the timeline narrative too. An extensive usability evaluation is planned to judge the performance of the timeline grammar in the context of a geovisual analytics environment.

P1.74 | **Criteria for the production of continental physical maps** (#1458)

F. García-Soria

Coordinator of the Spanish Braille Commission Working Group (CBE), The Spanish National Organization of the Blind (ONCE), Madrid, Spain

A full-length version is available and can be opened here:

_extendedAbstract\440_proceeding.*

Since two years ago the Relief Material Group of the Spanish Braille Commission (CBE) has undertaken a research study with visually impaired users to set up the basic criteria for the production of accessible continental physical maps with their respective interpretation guides. This study has been based on prototypes of the Europe physical map and has been evaluated by 118 Spanish blind or visually impaired users. The map presented in this Conference is the final map and includes the main observations made by visually impaired users.

P1.75 | **Overcoming heterogeneity in Spatial Data Infrastructures (SDIs) Importance, elements, solutions and progress** (#1383)

M. Abusohyon
TU Dresden, cartography, dresden, Germany

A full-length version is available and can be opened here:

_extendedAbstract\1383_abstract.*

P1.76 | **A Framework for the Automatic Geometric Repair of CityGML Models**

(#1433)

Z. Junqiao[1,2], J. Stoter[1], L. Hugo[1]

[1]*Delft University of Technology, Department of GIS Technology, OTB Research Institute, Netherlands;*
[2]*Tongji University, College of Surveying and Geo-Information, 200092, China*

A full-length version is available and can be opened here:

_extendedAbstract\217_proceeding.*

P1.77 | **Viewpoints – the world in perspective www.worldmapgenerator.com**

(#1459)

J. M. Stirnemann

Bern University of the Arts, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\441_proceeding.*

In spherical geometry poles are opposite points on a globe, which can be linked by any first great circle that comes along. Geography defines poles as intersections on a rotational axis whereby the route from pole to pole cuts along the meridians. The definition or positioning of poles on the globe happens by logic sequel. However, the placing of poles on a surface area, i.e. a world map, cannot always be determined unequivocally. In the following the question of setting poles in world maps and the distance between poles will be examined and depicted by means of the newly developed software 'Ansichtssache(n)'.

P1.78 | **U-Spatial: Supporting the Spatial Sciences at the University of Minnesota** (#1454)

F. Harvey, L. Kne

University of Minnesota, Minneapolis, United States

The U-Spatial project started in July 2011. With time, U-Spatial will provide support for Twin Cities researchers and also will provide support across the entire UMN system, including Duluth, Crookston, Morris, and Rochester campuses. U- Spatial consists of nine nodes, which later can be expanded. Each node will offer a specific blend of equipment and expertise in four core areas. For example, some nodes will offer remote imaging experts and specialized workstations for the Imaging Core, while other nodes will offer immersive visualization hardware and experts on interactive decision making for the Analysis Core. Three nodes will provide Central Core services including help desk services and training as well as support the Imaging, Data, and Analysis Cores. Secondary nodes will generally focus on a single infrastructure core in which they are experts, supporting scholars who require this specialized expertise, but also collaborate with other cores.

P1.79 | **Augmented Reality Visualization of Archeological Data** (#1519)

<u>D. Hücker</u>
Universität Hannover, Institut für Kartographie und Geoinformation, Germany

Will follow.

P1.80 | **Photorealistic Rendering of Atmospheric Effects in Interactive 3D Geovirtual Environments** (#1520)

D. Limberger

Universität Potsdam, Hasso Plattner Institut, Fachgebiet Computergraphische Systeme, Germany

Will follow.

P1.81 | **Development and Evaluation of an Augmented Reality Tourist Map Application - Case Study: Berlin** (#1521)

Y. Dadas

Hochschule für Technik Stuttgart, Institut für Photogrammetrie und Geoinformation, Germany

Will follow.

PLENARY

Session KN-3

Virtual Centimeter World Model?

Tuesday, 27 August, 2013

14:00 - 14:45

KN-3 | **The Virtual Centimeter World Model** (#1477)

F. Leberl[1], W. Walcher[2]
[1]Institute for Computer Graphics ad Vision, Graz University of Technology, Austria; [2]Microsoft Photogrammetry, Graz, Austria

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 217-232

Limitless sensing at ever greater detail, storage at nearly no cost and GPU-enhanced high performance computing have conspired to no longer constrain the processing and use of digital images in Computer Vision. If citizens collect images of ever improved quality at a centimeter pixel size and with great density, thus high image overlaps, of our environment, if Internet-based image management systems assemble these photographs to meaningful image blocks at quantities in the realm of Exabytes, when 1 million images can be processed per day fully automatically into 3D Geo-information, can we then expect an emergence of very detailed three-dimensional models of our entire urban and rural World? We argue that yes, 3D models of the World are feasible at a detail in the range of centimeters with current technology. Since that technology continues to evolve, the likelihood increases rapidly that such detailed World models will be created. Global aerial orthophotos in the decimeter range are being produced today; centimeter-type pixels are being collected along the entire street network of major cities. Very little is needed to convert such data into the reality of the Virtual Centimeter World Model at pixel-accuracy for a mixed reality experience.

ORAL

Session S5-A

VGI: Data Quality and Software

Tuesday, 27 August, 2013

14:45 - 16:00

5A.1 | **Assessing the Completeness of Building Footprints in OpenStreetMap: An Example from Germany** (#1162)

C. Kunze[1], R. Hecht[2], S. Hahmann[1]

[1]*Institute for Cartography, Technical University Dresden, Germany;* [2]*Leibniz Institute of Ecological Urban and Regional Development Germany, Dresden, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\358_proceeding.*

Volunteered Geographical Information (VGI) has become a serious competitor to official data providers. The most successful project in VGI – OpenStreetMap (OSM) – has recently reached the number of 900.000 contributors (November 2012). Over a billion nodes have been collected worldwide. Analyses of the OSM street network dataset have shown that the OSM dataset already outperforms the corresponding datasets of governmental and commercial data providers in some regions (e.g. Haklay 2010 et al. 2010, Neis et al. 2011). Consequently, business companies as well as research institutes have started switching to OSM. However, not all types of features are equally covered by OSM. Building footprints, for example, are still poorly mapped, but improvements may be expected in the near future as this feature type has currently a strong rate of growth. They are an important data source not only for urban development analyses or catastrophe management. Meinel et al. (2009) have shown how to use this type of data to derive various indicators to describe the urban structure in terms of the building types or the density dwellings and inhabitants. As the completeness of the building data is a crucial precondition for such analyses, it is of high interest to investigate it within selected test regions. Unlike the already mentioned street network, the building footprints have not yet been analysed in detail. Therefore we introduce methods to measure the level of completeness of the OSM building data in comparison to the corresponding datasets of the German national mapping agency (ALK, ATKIS). A simple method to analyse the completeness of the OSM building footprints is to compute their numbers and covered areas within small regions and to compare these parameters with results gained from the reference dataset. Spatial patterns may be investigated with the help of administrative boundaries or regular grids as a common reference. However, this method is prone to differences of building footprint modelling and accuracy. Hence, more advanced methods that are based on object-based geometric comparisons are necessary. Thus, we introduce the ‘centroid-method’ and the ‘overlap-method’. For the centroid-method the OSM building polygons are tested for intersection with the centroids of the building polygons of the reference dataset. By this method it can be inferred which building footprint of the reference dataset is represented in the OSM database. However, the reduction of polygons to points may introduce matching errors. Therefore, we also test the overlap-method, which estimates the degree of overlap of corresponding building polygons. A defined threshold (e.g. 50% overlap) decides if the building is represented in the OSM database. The results of all approaches are evaluated and visualised in choropleth maps (cf. Fig. 1). The assumption of an incomplete and heterogeneous OSM building dataset is verified. Significant differences between urban agglomeration and rural areas can be observed. With regard to these results it can be concluded that the OSM building dataset cannot yet replace governmental data or proprietary data. However, it may already serve as a source for the semantic enrichment of existing datasets. This may potentially improve models for the estimation of socio-economic parameters within the field of urban development studies. References Haklay, M., 2010. How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets. Environment and Planning B: Planning and Design, 37 (4), 682–703. Meinel, G., Hecht, R. und Herold, H. 2009. Analyzing building stock using topographic maps and GIS, Building Research & Information, 37 (5–6), 468–482. Neis, P., Zielstra, D. und Zipf, A., 2011. The Street Network Evolution of Crowdsourced Maps: OpenStreetMap in Germany 2007–2011. Future Internet, 4 (1), 1-21.

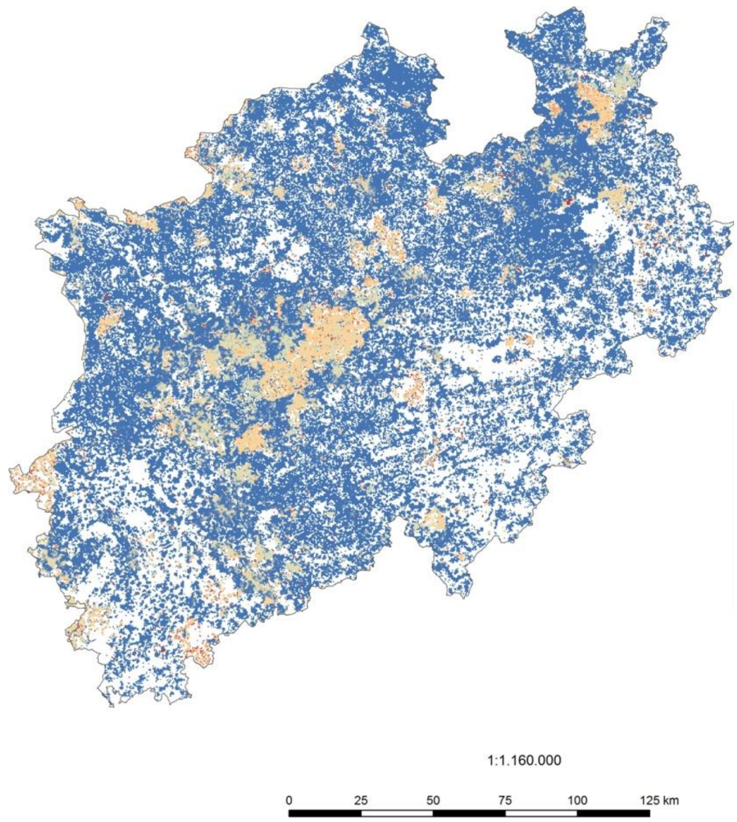


Fig. 1:
A choropleth map visualising the differences of building areas (OSM vs German cadastral data).

5A.2 | **Detecting Level of Detail Inconsistencies in VGI Datasets** (#906)

G. Touya, C. Brando
IGN, COGIT, Saint-Mandé, France

A full-length version of this contribution has been published in: Cartographica, Vol. 48, Number 2 (Summer 2013, Title:"Selected Papers from the 26th International Cartographic Conference, Dresden, Aug., 25-30: The Challenges of Visualization"), Pages 134-143

Whereas it was possible to define the level of detail of authoritative datasets, it is not possible for Volunteered Geographic Information (VGI), often characterised by heterogeneous levels of details. This heterogeneity is a curb for mapmaking, particularly when using traditional map derivation processes like generalisation. The paper proposes a method to infer the level of detail of VGI features. Then, inconsistencies between features with different levels of detail that get in the way of good mapmaking can be automatically identified. Some proposals are made to harmonise level of detail heterogeneities. The LoD inference is implemented and results are presented on OpenStreetMap data.

5A.3 | **Cartographic Representation of Spatial Data Quality Parameters in Volunteered Geographic Information Systems** (#318)

F. Karimipour[1], R. Esmaily[2], G. Navratil[3]

[1]Assistant Professor, Department of Surveying and Geomatics Engineering, College of Engineering, University of Tehran, Iran; [2]MSc student of GIS, Department of Geomatics Engineering, Kerman Graduate University of Technology, Iran; [3]University Assistant, Department of Geoinformation and Cartography, Technical University of Vienna, Austria

A full-length version is available and can be opened here:

_extendedAbstract\61_proceeding.*

Recent advances in spatial data collection technologies and online services dramatically increase the contribution of ordinary people to produce, share and use geographic information. A growing number of cell phones, digital cameras, PDAs and other hand-held devices are equipped with georeferenced data collection technologies, made it possible for ordinary people to collect spatial data, which are then shared and disseminated on the internet using web map services. It has led to a huge source of spatial data termed as Volunteered Geographic Information (VGI) by Mike Goodchild. Volunteered geographic data are constantly being added, edited or removed by the users, so different versions of the same data may exist. It is very common in geographic communities to have several versions of the same data and select the relevant one based on the quality parameters stored in the metadata. However, in case of VGI, the users are not experts and do not necessarily have high spatial knowledge. Therefore, a system administrator decides on behalf of the users to select and publish one of the produced data as the best, which is in most cases the latest one, because they believe that if the data is not correct, someone will improve it later (Goodchild has recently proposed different approaches to assure the quality of VGI). However, this is not always the right assumption. Quality of spatial data depends on different parameters such as spatial accuracy, attribute accuracy, completeness, logical consistency and updateness. Therefore, the best data may differ from an application to another. For example, for a certain application, a more complete dataset with a less spatial accuracy may be more relevant than an incomplete dataset with a high spatial accuracy. Shortly, here we confront with a situation where different users prefer different datasets, but they are not expert enough to select it based on technical metadata statements. In this article, we propose providing the VGI users with the spatial data quality parameters through simple cartographic representation and let them decide on selecting the appropriate dataset for the application in hand. The users select the desired quality parameters as well as the visualization element (e.g. color, intensity, style, thickness, etc.) to classify the desired parameters. All the datasets are represented by the selected element based on their metadata information, which help the users to visually compare them and select the appropriate datasets. The proposed approach has been implemented for a case study where 15 versions of 2D map were produced using different data collection methods (i.e., surveying, GPS and digitization) and with different spatial data quality parameters, limited here to spatial accuracy, completeness and updateness. An ArcGIS extension was developed to display the datasets based on the visual classification elements as well as spatial quality parameters selected by the user, which eventually help the user to visually compare the existing data and select the appropriate one for his/her certain application.

ORAL

Session S5-B

Tactile Cartography for Children

Tuesday, 27 August, 2013

14:45 - 16:00

5B.1 | **TACTILE CARTOGRAPHY: THE ADAPTED GLOBE EXPERIENCE ON SOCIAL INCLUSION** (#1008)

B. Jordão
USP, Geografia Física, São Paulo, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\6_proceeding.*

Social inclusion is a global trend, which beginning dates from 1960s and 1970s, and it has as a base a new paradigm of society which starts to build-up, counteracting the Aryan model, the hegemonic model, the Cartesian model and the positivist model hitherto prevailing. Since the last three decades school inclusion has been tried in Brazil. In this research, the focus were people with visual impairment who are about 35 millions of Brazilians, accordingly to the Brazilian Institute of Geography and Statistic (IBGE, 2010), whose have any disability in the visual organ. How can we represent a content to an individual with visual impairment? Within the tactile cartography perspective, at first it was opted to produce a terrestrial globe adapted to this public. Although, as the feedbacks about the usage of the materials used in the making of the globe were given, the usage of the globe in the classroom confirmed that the Tactile Cartography should not stay confined only to specialized institutions, but should be part of school's every day. Through literature research, visits to regular classroom and special institutions, we built an adapted globe from the evaluation of 90 students (of which 30 have disabilities) which could be used to teach different geography's subjects, among then the geographical coordinates. During the production of the globe, we choose a material that could give dynamism to the adapted globe, ie, a material that surpasses the one used on the regular static adapted globes, which are limited to some information. Therefore, the contents can be added according to the needs of each lesson. We selected materials that offer a good tactile perception and were low cost, providing an extension of their use in different regions of Brazil regardless of social status. As a consequence, evaluation results show that there is effectiveness; This is because, within the perspectives of Tactile Cartography in developed countries, we notice several experiments in the use of three-dimensional materials in awakening the interest in Cartography by children, adolescents and adults who are blind or not.

5B.2 | **School Tactile Cartography in Brazil: the challenge of training teachers**

(#849)

W. Ribeiro Do Carmo

University of São Paulo, Geography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\341_proceeding.*

This paper presents and discusses experiences in the continuing education of public school teachers in the State of São Paulo, Brazil. With support of the state government, were held 12 workshops with 8 hours classroom (each) and remotely activities like the videoconferencing *"Confecção de Mapas Táteis"* (available on the website: http://www.rededosaber.sp.gov.br/) and email support, with the main goal of training the teachers on School Tactile Cartography and providing classroom activities. The participants were teachers coordinators of Special Education and Geography, as well as teachers of rooms for Inclusion support, totaling approximately 200 teachers. After this experience it was possible to establish a methodology for implementing workshops, defining content and practical activities for other workshops, The paper also analyses the results of using the social networking site Facebook as a tool to support teachers and as a means of receiving feedback from course participants who have applied Tactile Cartography with all students, encouraging the processes of inclusion at schools. Cartography and Geography language becomes an important content of teaching, and it can facilitate and expand the knowledge of the studied space. The map has the power to show graphically and simplify realities and their relationships enables viewing of events or geographic space phenomena and becomes a valuable didactic resource in teaching and learning, at all educational levels. Therefore, school cartography has a crucial role in preparing the student to use the cartographic language. However, despite its importance in education, often mapping activities are not always part of geography lessons, especially for students with visual impairments. This, in general, is due to the lack of preparation of teachers to fully understand cartography and its applied issues. With an education deficit which is often common, that many teachers seek to engage themselves in continuing education courses, overcoming the lack of foundation to satisfactorily perform their teaching practice. School Geography has spent the last few decades through various stages of renovation. For many years, Geography solely concerned with the presentation of data and information about the places, based on traditional methods, such as the memorization of content disconnected from the reality of most students, what no longer fits the needs imposed by the twenty-first century. The geographic space, understood as social space, concrete, moving requires an analysis of society, nature and the dynamics between them. The School Cartography and geography can provide elements to reason and interpret reality and spatial relationships; therefore, they have an important role in understanding the globalized world with its challenges, contradictions and problems. The teaching of geography needs to address critically society, nature and environmental issues, giving students the opportunity to develop relevant skills of interpreting texts, images, maps and other graphic representations and engage them in the study of the environment. As facilitator of learning, geography teachers play an important role and can create situations in developing the educational process to promote the understanding of space built by men in the movement that society establishes in its relationship with nature. The issue of teacher training and upgrading is a key element in the improvement of education. In this sense it is important to foster discussions about the initial and continuing educations of teachers to develop and improve essential areas such as Tactile Cartography School.

5B.3 | **Children's spatial representations: comparative research in France and Poland.** (#1222)

K. Bogacz

University Lumière Lyon 2, Geography, France

A full-length version is available and can be opened here:

_extendedAbstract\345_proceeding.*

This comparative research - in France and Poland - was conducted in Lyon and Cracow. The purpose of the work is to understand the children's territories. The object is primary schools. The research, carried out with 192 pupils in Lyon and Cracow, is related to two disciplines, geography and psychology. It is supported by the postulate of spatial representations within the framework of the paradigm of spatial production. The work is part of a broader problem of the acquisition of geographical knowledge. The subject of the research mobilizes the field of tourism since the practices that stem from it are ways and means of appropriation of space that individuals implement in the construction of representations of space. Through experience, the individual constructs an interior model of his or her environment. This research project studies the modalities of spatial learning. The objective is to understand if the experience of school trips modifies children's spatial representations. To ensure that all children have an equal opportunity to build their own spatial capital, research also examines the influence on their representations of previous spatial mobility. In order to examine the children's spatial representations, the mental maps are mobilized. As mental map is, obviously, foreign to classic topographical representation, the question was to elaborate the model of analysis. Thus, my interpretation was based on the matrix of Abraham A. Moles and I proposed e few degrees of analysis of children's territories.

ORAL

Session S5-C

Historical Expeditions and Maps

Tuesday, 27 August, 2013

14:45 - 16:00

5C.1 | **"The most practicable and economical route for a railroad": U.S. Army Corps of Topographical Engineers and the Railroad Reconnaissance of the American West** (#269)

I. Demhardt

University of Texas at Arlington, Department of History, United States

The War of 1812 between the Americans and British, essentially fought over matters and claims not settled in the War for Independence a generation earlier, saw the United States confidently invading Canada. The lack of terrain reconnaissance and mapping, however, contributed greatly to significant military defeats and an ultimate draw which confirmed the territorial status quo ante. Having established a rather informal topographical unit already during the war in 1813, one of the lasting lessons taken from having fought literally in the unknown was the formation of a Topographical Bureau within the War Department in 1818. To mark the bicentennial of official topographical services in the United States this paper aims to sketch the development of the unit until the mid of the century and focus on its most eminent cartographical achievements, the maps to accompany the twelve volumes of Reports of Exploration and Survey […] in 1853-54 (Washington, Government Printing Office, 1855-61). Until the 1830s the Topographical Bureau grew and was extensively engaged in all sorts of governmental surveying from coastal fortifications and lighthouses to rivers, roads, and railroads. In addition the unit, enlarged and reorganized as U.S. Army Corps of Topographical Engineers in 1838, got increasingly involved in the exploration of the American West beyond the Mississippi. Such explorations need a sudden boost in the second half of the 1840s when the United States in swift succession more than doubled its territory by the annexation of Texas (1845), dividing up the contested Oregon Territory with the United Kingdom (1846) and the U.S.-Mexican War 1846-48, resulting in annexing the northern half of this neighbor. The simultaneous Californian Gold Rush of 1848, increasing its population tenfold to 300,000 by the early 1850s, added urgency to the construction of a transcontinental railroad. Since the U.S. Congress could not decide on one of the competing routes suggested and that the vast territorial acquisitions were, at best, only superficially known, it was the obvious choice to commission the U.S. Army Corps of Topographical Engineers with the exploration and mapping of multiple options for "the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean". After much political maneuvering the Corps in 1853-54 conducted not less than five simultaneously five survey expeditions between the Canadian boundary in the north and the Mexican in the south. As a result these explorations provided not only for the route for the Union & Central Pacific Railroad subsequently built in 1862-69, but, more importantly, five wide corridors of evidence based topographical knowledge penetrating for the first time the wildernesses of the West. The more than two dozen detail maps in volume XI of the Reports of Exploration and Survey, some in multiple sheets, were impressively summarized in G.K. Warren's Map of the Territory of the United States from the Mississippi to the Pacific Ocean (1858, scale 1: 3 million, 106 x 116 cm), the first comprehensive and scientific orientation map of the newly acquired landscapes.

5C.2 | **The Pole is Impracticable but There is a Land Northward: Austro–Hungarian Pole Expedition and Mapping of the Franz Joseph Land** (#319)

M. Altic

Institute of Social Sciences, Centre for Urban and Local History, Zagreb, Croatia

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 045-060

Austro–Hungarian Pole Expedition (1871, 1872–1874) led by K. Weyprecht and J. Payer resulted with discovery of the Franz Joseph Land. On that occasion, first maps of Franz Joseph Land were created. The purpose of this work is to analyze Payer's and Weyprecht’s original maps, the methods by which they were made and their influence on the subsequent development of polar cartography.

5C.3 | **Routes in the Transvaal, South Africa, 1906, described in Military Report on the Transvaal, Volume II, Communications - related to Major Jackson's Series of maps 1901-2** (#87)

C. Board[1,2]

[1]Christopher Board, London, Great Britain; [2]Christopher Board, London, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\156_proceeding.*

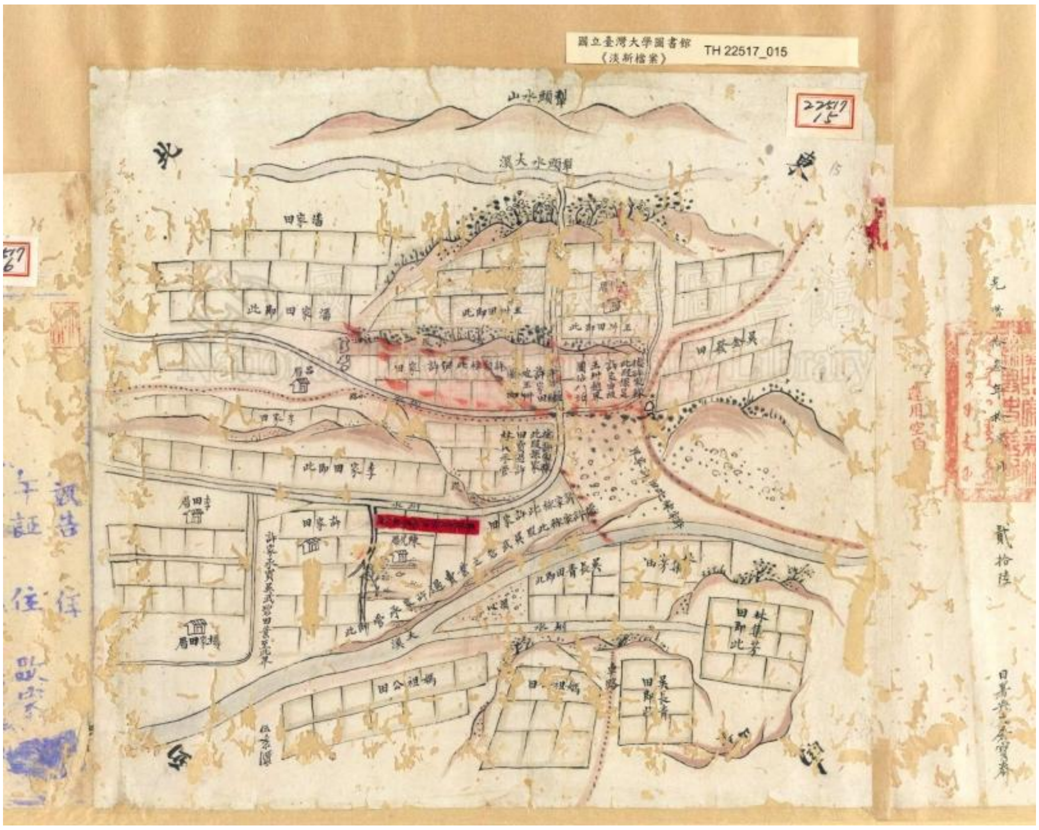
Compiled by troops who travelled mainly on horseback along the postal and other main routes, these guides reveal much about the landforms, vegetation and particularly settlement. Liebenberg has described the series at the scale of 1:148,752 at the ICA meeting in Budapest in 2012. She points out that these maps lack much of the information of value to troops on the move as they were compiled from farm surveys by the British Army's Field Intelligence Department, and only later revised in the field. The detail contained in the description of main routes is complementary to Major Jackson's series maps. Indeed each route listed refers to the specific sheet(s) over which the route passes. The information was intended for official purposes only, as were the maps, but has remained undiscovered until recently. This paper examines the information in a sample of route guides along side the appropriate sheets of Major Jackson's maps. Reference to more modern South African mapping will permit a more precise impression of the changing landscape. From each route described can be built up an picture of a semi-wild terrain owned for the most part by people of European descent, with scattered farms, stores, mines and farm boundaries. Names of natural and human features enable one to relate the routes described to later maps which are based on geodetic and air surveys with more accurate positions and heights. This study provides an introduction to a new source of first-hand description of an important British colony recovering from the damage and dislocation of war (1899-1902).

5C.4 | **Streams, irrigations, and the environment change: negotiating the land use in northern Taiwan (1870-1895)** (#1365)

S. - H. Yang[1], J. - G. Lay[1,2]

[1]National Taiwan University, Department of Geography, Taipei City, Taiwan; [2]National Taiwan University, Department of Geography, Taipei City, Taiwan

The research of the history of Chinese cartography has long focus on the pivotal influence of Cordell D. K. Yee's publications in *History of Cartography* (1994), typically characterizing mapping as application of picturesque method to show how people have the cognizance of their own environment. This paper depart from traditional view of the history of Chinese cartography by highlighting the new maps in Tan-Hsin Archive (THA), proceeding documents handled by local county governor in Qing Dynasty Taiwan which contains 182 maps, and show how ordinary people asserted and defended their property rights. In THA, different types of maps which we could distinguish from the traditional map materials made by the officials are used to settle the land disputes, particularly at the environment changes such as floods or droughts. By tracing the original records in THA, we identified the disputed land to the sites in today, then we could compares the elements of cartography drawn in antique maps with the digital terrain model (DTM) data of the relief and land use. Through the tools of GIS, we could understand not only how people use the maps to settle land disputes after floods or droughts but also what the land use and society structure they arranged. The 'micro-geographical' approach provides a new perspective that we could know the map use between ordinary people, not officials in central government.



sample map in THA:
original map that we dealed with

ORAL

Session S5-D

National Atlases

Tuesday, 27 August, 2013

14:45 - 16:00

5D.1 | **Towards a National Atlas of the Netherlands as part of the National Spatial Data Infrastructure** (#1298)

B. Köbben

ITC – University of Twente, Faculty of Geo-Information Science and Earth Observation, Enschede, Netherlands

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 225

This paper is about different worlds, and how we try to unite them. One of these worlds is the world of National Atlases: collections of complex, high quality maps presenting a nation to the geographically interested. The second is the world of National Spatial Infrastructures: highly organised, standard¬ised and institutionalised large collections of spatial data and services. In the paper we describe the two worlds and their fundamental differences and we present the theoretical framework in which these worlds could be united. We introduce a test bed we are using to try out the theoretical framework in a real-life use case. In the architecture of that test bed we introduce a National Atlas Services layer and describe how we have created an Atlas Map Viewer com¬ponent, using the Open Web Platform. We conclude by commenting on the results thusfar and taking a look into future developments.

5D.2 | **Designing Maps for a New Thematic Atlas of the Czech History** (#1081)

T. Janata, P. Seemann, J. Cajthaml, R. Zimova

Czech Technical University in Prague, Dept. of Mapping and Cartography, Praha 6, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\337_proceeding.*

Academic atlas of the Czech history is being developed as a complex cartographic work which – after a long time – summarizes findings of historical research in the Czech lands. Partially, there is some relationship with an outstanding publication, the Atlas of the Czechoslovak history published in 1965, highly appreciated at the ICA conference in Amsterdam in 1967. The new atlas is focused on the Czech lands issues (on the territory of the contemporary Czech Republic), nevertheless it covers whole range of history from prehistoric era to present and areas from small plans of castles or settlements through maps of Bohemia or historical lands to overall maps of Europe. The content of the Atlas is divided into five thematic chapters: prehistoric, medieval, early modern, top modern times and modern history. The team of authors is composed of experts from the Historical Institute of the Academy of Sciences of the Czech Republic and also of other leading Czech historians. Cartographic part of the work, however, needs the persons equipped with the necessary theoretical and technical knowledge in map creation. Therefore, the Department of Mapping and Cartography of the Czech Technical University in Prague, Faculty of Civil Engineering, has been addressed to cooperate on the cartography of the atlas. The power of geographic information systems technologies and their functions for cartographic visualization enable to design historical maps using benefits of GIS tools and current data model structures. Close and efficient collaboration between historians and cartographers is in this case inevitable. The historians are responsible for the content accuracy of the maps and they often prefer depicting as complete information as possible using recent achievements and research results, sometimes forgetting that the map size and scale need a kind of generalization of thematic layers, too. Cartographers are expected to compile maps portraying complex and spatially correct information in an understandable way. The challenge of interpreting various maps with data components representing time, space and theme issues (attributes) seems to be demanding task and in many cases the map layers structure and visualization has to be approached individually. The maps of historical events of the twentieth century are for the first time presented without the impact of communist ideology. Cartographic work on such a large thematic atlas includes many activities. It is necessary to pick up historical situation, often in relation to current state of the depicted territory. The process of map compilation starts with gathering all the relevant documents, including manuscript maps or a set of supporting historical or topographic background maps and clarifying the intentions of historians. Scanned and georectified background maps are usually used for vectorizing thematic data layers, while the sets of reference topographic elements (hypsography, waters, boundaries, sites, etc.) can be partially constructed from free available datasets, of course after necessary checking and modification. Besides setting up a data model and feeding the data to a geodatabase, it is necessary to consider mathematic aspects as particularly to determine a map projection, map scale and the size of the map frame. Map data layers are visualized by prepared set of map symbols which needs sometimes to be more or less adapted to correspond with unique parameters of particular map symbology. A special attention has to be paid to geographical names and numerous thematic labels. Finally, a map sheet layout has to be generated comprising complete compositional map elements (legends, north arrows, scale bars, etc.) and final map layers are exported in suitable data formats. On selected examples of historical maps, the process of designing various types of thematic features in the maps of the new atlas of the Czech history can be documented. A printed publication is planned to be issued in 2013.

5D.3 | **Summary and Achievements of City Atlases in P.R. China** (#570)

Q. Qi, L. Jiang, A. Zhang

Institute of Geographical Science and Natural Resources Research, Chinese Academy of Sciences, Cartographic division, Chaoyang district, China

This paper summarizes the achievements of city atlases in P. R. China. First of all, the importance of city atlases has been recognized year after year since the course of urbanization in P.R. China, and attention to edit & produce city atlases has been paid intensively and extensively, not only in terms of personnel investment and financial support, but also regarding to sponsors and investors. Secondly, contents and structures of Chinese city atlases changed remarkably in the past 30 years. Not only a snapshot, but also the whole history of cities, from far ancient time to current situation, are described in recent years city atlases, and editing comprehensive city atlases, other than singly thematic ones, appears in the new city atlases in China. Furthermore, more and more cities are concerning to excavate their exclusive features, on city atlases to build up their city name-card. Thirdly, functions of city atlases were enhanced obviously, i.e., from propagation & education to scientific reference & decision support, from narrow fields to four types of users, from summary products to intelligent tools. Fourthly, diversified source of data is integrated and utilized in the newly edited city atlases, since data owners are getting more and more compromised from isolation to cooperation, and key projects of China such as CNSDI, Digital China, lead to data integration of city atlases. Fifthly, colorful and powerful visualization was realized in recent edited city atlases, e.g. '2D+3D+image' or painting on printed city atlases, multi-media and virtual reality on electronic city atlases. Sixthly, technologies of editing and producing city atlases were improved and optimized, e.g. GIS driven technologies, and other high-tech points such as augmented reality have been integrated into city atlases. Seventhly, application regions of city atlases were expanded gradually, from key large cities to medium & small cities, and from developed regions to backward ones.

5D.4 | **THE NEW ATLAS OF ISRAEL - THE NATIONAL ATLAS** (#423)

H. Srebro

SURVEY OF ISRAEL, Tel Aviv, Israel

A full-length version is available and can be opened here:

_extendedAbstract\108_proceeding.*

The New Atlas of Israel was published in 2011 in English for the first time. The Atlas gives expression to geography of the region, reflecting its unique location. The land of Israel lies at the intersection between three continents - Asia, Europe and Africa. It is located between east and west, north and south, between the Mediterranean Sea and the Red Sea and includes part of the Dead Sea, the lowest place in the world, along the Syrian-African Rift. Its location between seas on the border of the desert, where different climate zones converge offers geographic phenomena of great contrasts, within a small area. Israel is distinguished by a variety of landscapes arising from physical conditions, including tectonic activities as well as a result of the climatic variety and following historical, political and social processes. Important historical processes, including those referred to the development of the monotheistic religions are manifested in the landscape. Central phenomena in the world, among them fast population growth and global warming leave a substantial mark on its geographic features. **The New Atlas of Israel** excels by offering a broad geographic perspective in geography, earth sciences, and land of Israel studies; and is appropriate for students in these fields and also for students and enthusiasts from the world over. All data was received from governmental sources and elite researchers and advisors who excel in their reliability. The Atlas can be used for a basic knowledge of the physical and human components of the land of Israel, its landscape and achievements. Three hundred maps and tens of diagrams were prepared using innovative methods and were published in blaze of colors, in order to allow readers and students to recognize the physical components of the landscape of Israel and the plethora of human, social, economic and settlement phenomena of the land of Israel. Special attention was given to the development of the human and settlement landscape in the last one hundred years. Here special emphasis has been placed on the layout of the population and the economy in Israel, in the most recent generations. The Atlas illustrates a series of geographic maps of Israel, and attached to each section are satellite images of the same area. Worthy of special mention, are the maps which describe the periods of immigration to Israel, as well as the decisive importance of the city in the outline of settlement in Israel. In the field of economics, for the first time a map of high-tech industry distribution appears. **The New Atlas of Israel** is highly innovative with regard to content, technological and didactic perspectives. The Atlas reflects subjects that are relevant to current reality and to significant issues on the public agenda. Amongst the innovations is a boundary map which presents a current situation report of the borders of Israel and their international status. Subject maps present Israel in comparison with Middle Eastern countries and world countries according to particular indexes. The development of the desert frontier ("making the wilderness bloom") finds expression in maps and orthophotography comparing the situation today with the situation on the eve of the establishment of the State. In the Atlas, expression is given to spatial planning policy in Israel, including its metropolitan centers, environmental quality, transportation, demographic and social processes. The focus of the editorial staff was on didactic innovations, which assimilate the ideas and comments of geography teachers and educators who use the Atlas. To this end innovative technologies were applied indeed, based upon full computerization and the use of GIS, remote sensing, aerial photography and image processing. The Atlas is intended for students all over the world, as well as to researchers and scholars.

ORAL

Session S5-E

4D Cartography

Tuesday, 27 August, 2013

14:45 - 16:00

5E.1 | **Towards 4D Cartography - Four-dimensional Dynamic Maps for Understanding Spatio-temporal Correlations in Lightning Events** (#1338)

B. Resch[1,2], F. Hillen[3], A. Reimer[1], W. Spitzer[4]

[1]University of Heidelberg, Geography - GIScience, Germany; [2]MIT, SENSEable City Lab, Cambridge, United States; [3]University of Osnabrueck, Geography - GIScience, Germany; [4]Research Studios Austria, iSPACE, Salzburg, Austria

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 266

While graphic variables in 2D maps have been extensively explored, 4D cartography is still a widely unexplored field. In this paper we investigate the usefulness of 4D maps (3 spatial dimensions plus time) for cartographic illustration of spatio-temporal environmental phenomena. The presented approach focuses mostly on explorative research rather than on enhancement and extension of existing methods and principles. The user study described in the paper shows that 4D cartography is not a well-explored research area and that many experienced map users try to apply their knowledge from 2D maps to 4D dynamic visualisations. Thus, in order to foster the discussion within the community, we formulated several basic research questions for the area of 4D cartography, which range from methods for representing time in 4D visualisations and understanding of the temporal context to finding generic methods to achieve optimised temporal generalisation and a consistent definition of definition of graphical variables for 3D and 4D.

5E.2 | **Visual Analysis of Large Amounts of 4-D Building Deformation Data**

(#1157)

L. Ding, L. Meng

TUM, Cartography, 80333, Germany

A full-length version is available and can be opened here:

_extendedAbstract\221_proceeding.*

Visualization of large amount of Synthetic Aperture Radar (SAR) data has been used in various application areas (e.g. landslide and land subsidence detection over wide areas) for a long time as a good means to allow users to see, explore and understand interesting deformation patterns. With the development of Differential SAR Tomography (D-TomoSAR) techniques, 4-D space-time individual building deformation information could be retrieved from stacks of high-resolution satellite SAR images. The derived large amounts of point clouds provide rich dynamic information for individual buildings at a very high level of detail, and thus make it possible for different user groups to monitor individual building behavior as well as assess the potential damages in urban areas. Due to the difficulties of data acquisition and specific data characteristics (e.g. directional dependency), visualization of individual building deformation has not yet been well studied. The existing methods for visualizing individual building SAR data (e.g. elevation) are mostly using color coded points and associating them with their geographic context information (e.g. satellite imagery). Although these visualization methods could provide detailed information and accurate value of each point, the clustered color-coded points are difficult to perceive and understand for general users. In order to overcome some of the above-mentioned limitations, we utilize multiple visualization techniques based on 3-D building models for general users to easily perceive building deformation patterns. The test dataset used in our research work is 4-D point clouds derived from D-TomoSAR in Las Vegas area. The main steps contain two parts. The first part is the projection of filtered points on to a reconstructed 3-D building model. Buildings are modeled as collection of simple surfaces described by some mathematical equations. The points around the reconstructed surfaces in a small threshold can be assumed actually on these surfaces, so we project them to connect theses points to the building surfaces. The second part is to design multiple visualizations based on the building model and projected points. For example, the projected points are organized by triangulation or mesh grids to form continuous surfaces. Based on these continuous surfaces, visualization methods, e.g. isolines, layered tints, could be applied based on cartographic design principles. We evaluate our visualization methods in two aspects: (1) whether the visualization results are easy to perceive (2) how accurate the information users perceive is. For the first aspect, we ask users to assess the visualization methods by ordering them according to their difficulty levels of understanding. For the second aspect, we could ask users to pick up some interesting points (e.g. hot spots) and tell us the information they perceive (e.g. deformation values), and then we can verify the accuracy by comparing them with the original data set. Finally, we summarize the preliminary evaluation results.

5E.3 | **Geovisualizing spatio-temporal patterns in tennis: An alternative approach to post-match analysis** (#818)

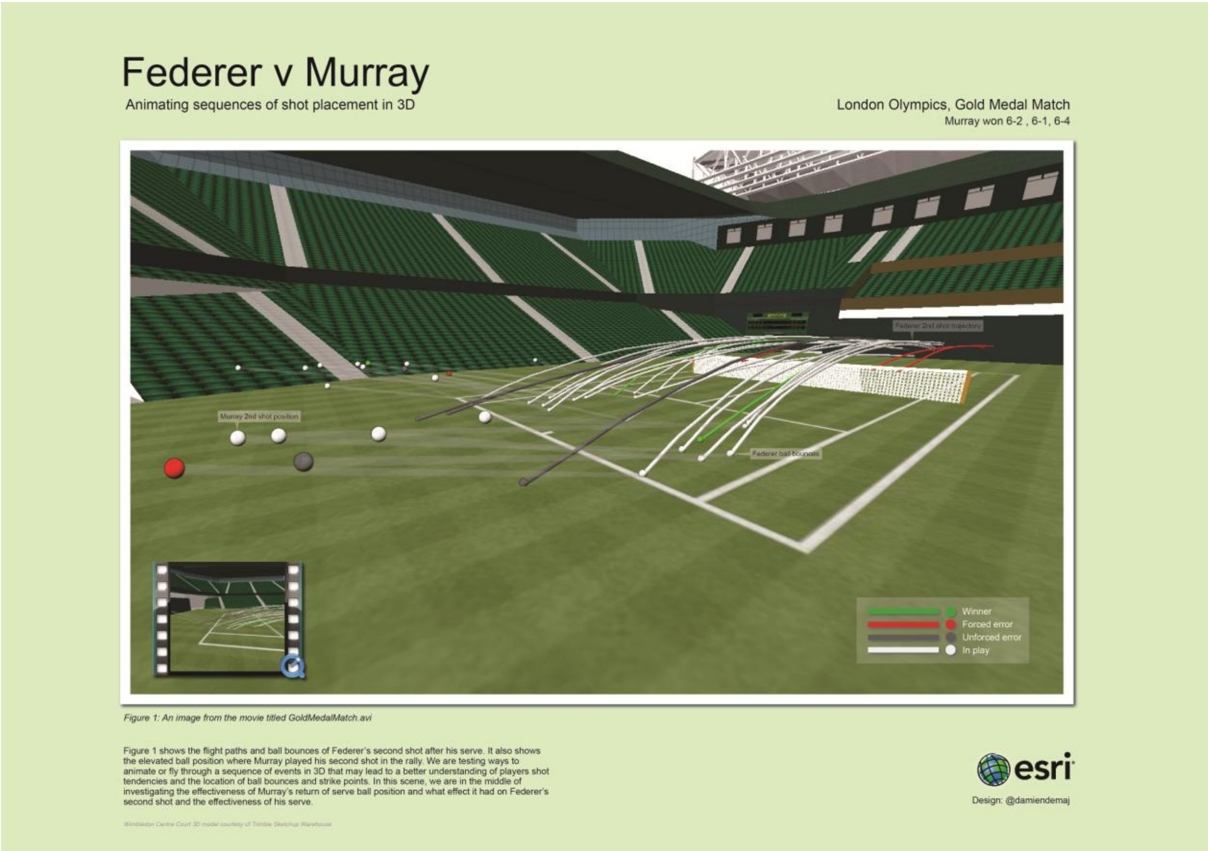
D. Demaj

Esri, ArcGIS Online Content, Redlands, United States

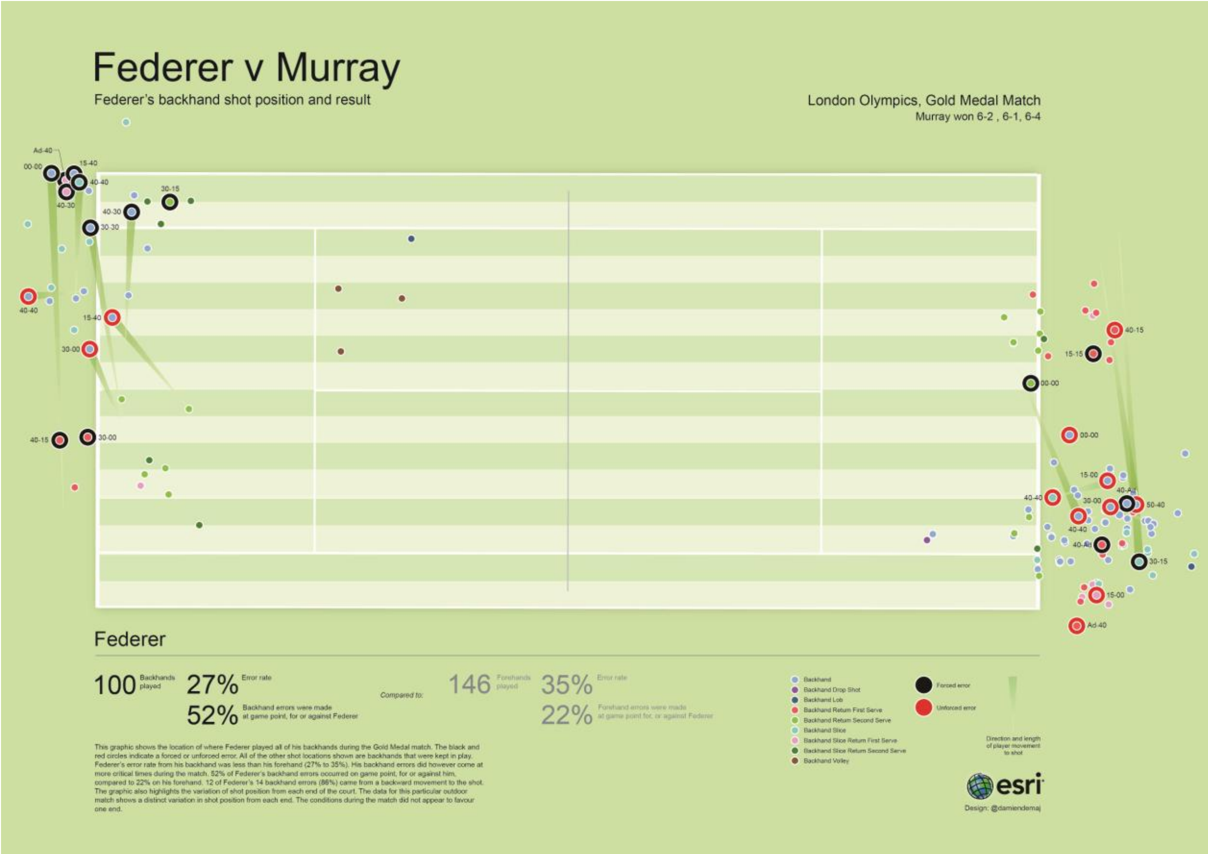
A full-length version is available and can be opened here:

_extendedAbstract\343_proceeding.*

In this paper I explore the notion that we are able to better understand the result of a tennis match by geo-visualizing and interpreting the spatio-temporal component of the game using GIS. Traditional tabular display methods of raw statistics often ignore the spatio-temporal component of a match, and fail to visualize patterns by way of map or graphic. I argue that by visually exploring and analyzing tennis match data using geospatial analysis we can create opportunities to better understand the results and actions during a match that have not been revealed before. Using ArcGIS and a comprehensive collection of data points from the London Olympics Gold Medal match between Roger Federer and Andy Murray we visualized a series of performance-based questions. In particular, we analyze the impact of Murray's return of serve position, how the temporal component of the match and Federer's movement affects his backhand shot making probabilities, as well as representing how effective each player's first-serve-in percentage affects the probabilities of other strokes during play. Our results suggest that by exploring a tennis match in this way allows coaches, players, the media and fans to very quickly learn and understand why Andy Murray beat Roger Federer 6-2, 6-1, 6-4; what tactics he employed and which components of his game were particularly effective. These types of visualizations have the potential to support the tactical preparation for players and coaches and allow them to better understand their opponent's probable shot making tendencies through match analysis.



3D Visualisation GIS:
See image



Backhand Error Plot:
See image

5E.4 | **Visualization of Trajectory Attributes in Space–Time Cube and Trajectory Wall** (#537)

G. Andrienko[1], N. Andrienko[1], H. Schumann[2], C. Tominski[2]

[1]Fraunhofer IAIS, KD - Knowledge Discovery, Sankt Augustin, Germany; [2]University of Rostock, Institute for Computer Science, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 157-164

Space-time cube is often used as a visualization technique representing trajectories of moving objects in (geographic) space and time by three display dimensions. Despite the recent advances allowing space-time cube visualization of clusters of trajectories, it is problematic to represent trajectory attributes. We propose a new time transformation – sequential ordering – that transforms the space-time cube into a new display, trajectory wall, which allows effective and efficient visualization of trajectory attributes for trajectories following similar routes. To enable temporal analysis regarding temporal cycles, we use a time lens technique for interactive visualization. We demonstrate the work of the method on a real data set with trajectories of cars in a big city.

ORAL

Session S5-F

Mixed Session

Tuesday, 27 August, 2013

14:45 - 16:00

Session S5-G

Business Meeting of the Commission on Geoinformation Infrastructures and Standards

Tuesday, 27 August, 2013

14:45 - 16:00

Session S5-H

Business Meeting of the Commission on Art and Cartography

Tuesday, 27 August, 2013

14:45 - 16:00

Session S5-I

Business Meeting of the Commission on GI for Sustainability

Tuesday, 27 August, 2013

14:45 - 16:00

ORAL

Session S6-A

Typography and Labelling

Tuesday, 27 August, 2013

16:30 - 17:45

6A.1 | **Users Characteristic Influence on the Efficiency of Typographic Design**

(#142)

R. Deeb

Ghent University, Department of Geography, Belgium

A full-length version is available and can be opened here:

_extendedAbstract\153_proceeding.*

Cartographic texts are indispensible map components for understanding the map contents and its purpose. They have a primary task of indicating the geospatial address and a secondary task of addressing its function. In addition to points, lines, and polygon, typography on maps is considered as the fourth symbol type. The symbolization rules of typography can use the same rules of objects symbolization using Bertin visual variable. The efficiency of the typographic design is the main concern of this paper. Besides that, the influence of users' characteristic on the efficiency is presented as well. A controlled experiment was constructed to examine whether Bertin's visual variables have the same implementation on texts as other graphical variables. The experiment involved maps populated with point and areal data and their associated labels. The graphical variables of size, shape, texture and pattern (cfr. Bertin) were applied to these map labels to visualize the level of importance in the labels and thus in the associated objects. The experiments mentioned before is a user study, in which 40 topographic and thematic maps were presented to the participant. The maps used during these experiments were visualized on-screen, representing (fictive) geographical regions. Each map showed small variations in the applied graphical variables on the labels typography (size, shape, texture, and orientation). During each trial, a target label was presented with a map. The participant had to find the target label. All targets were presented in neutral font with a fixed size meanwhile the labels on the map face changed for each trail using Bertin variables. Users' reaction time to this task was registered between the consecutive screens. These trials were embedded in an online questionnaire in which the participants register their reaction time of the label design, and subsequently stored in a database. The result indicated the influence of the typographic design on map readability. Since users are the final destination of the cartographic work. Their perception of the cartographic product is substantial when designing maps. A statistical comparison and analysis between two groups of participant was made considering their level of experience (novices and experts). The performance of each group gave insights of each design efficiency towers different users. Some significant differences were located between novices and experts. Future experiments will include other graphical variables and the influence of dynamic interaction (e.g. panning, zooming) on the map elements.

6A.2 | **Silhouette-Based Label Placement in Interactive 3D Maps** (#1427)

C. Lehmann, J. Döllner
Hasso-Plattner-Institute, University of Potsdam, Computer Graphics Systems, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 177-186

This paper presents a silhouette-based technique for automated, dynamic label placement for objects of 2D and 3D maps. The technique uses visibility detection and analysis to localise unobstructed areas and silhouettes of labeled objects in the viewplane. For each labeled object, visible silhouette points are computed and approximated as a 2D polygon; the associated label is finally rotated and placed along an edge of the polygon in a way that sufficient text legibility is maintained. The technique reduces occlusions of geospatial information and map elements caused by labels, while labels are placed close to labeled objects to avoid time-consuming matching between legend and map view. It ensures full text legibility and unambiguity of label assignments by using actually visible 2D silhouette of objects for label placement. We demonstrate the applicability of our approach by examples of 3D map label placement.

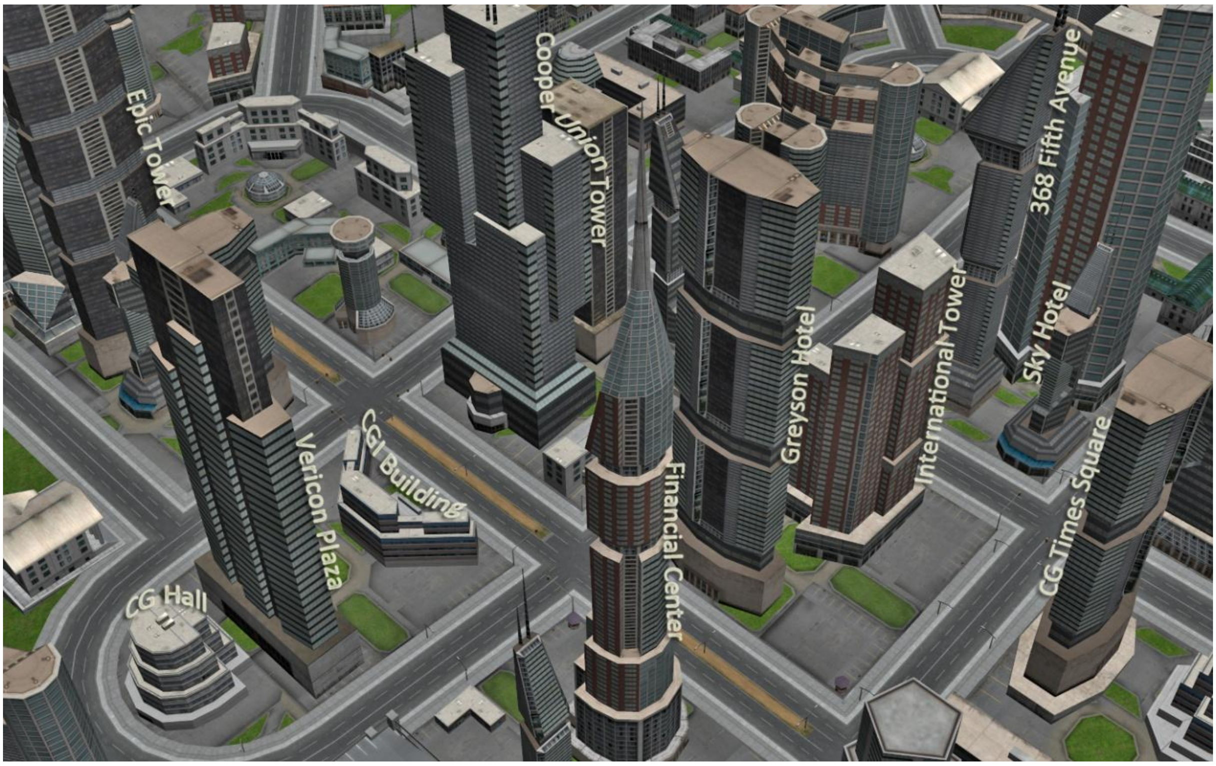


Figure 1: Occlusions of labeled objects caused by labels are reduced to preserve their information, while fast label assignment is enabled.

6A.3 | **Typography in the US Topo redesign** (#853)

E. Guidero

Pennsylvania State University, Geography, Universty Park, United States

A full-length version is available and can be opened here:

_extendedAbstract\394_proceeding.*

At the core of the question of typeface choice in a national map series is the dichotomy of establishing a recognizable national identity through the map series design, while allowing the map elements—in this case, the labels—to be displayed accurately and identically across the various platforms and operating systems of the map userbase. The topographic map redesign team at the United States Geological Survey (USGS) faces the problem of creating a legible map design that establishes a distinct identity, while using typefaces that are widely available. Many national mapping agencies have commissioned custom typefaces, or use uncommon retail typefaces, to create a singular map identity. However, the USGS faces some challenges to creating such a typographic identity. The USGS creates free map products of the United States and its territories, as part of its mission to "provide reliable scientific information to describe the Earth." One of these products is the national topographic 1:24,000 scale map series. Its current form, US Topo, is an all-digital, full-coverage set of 7.5' x 7.5' minute quadrangles as georegistered PDFs (GeoPDFs). The digital series modernized the printed series, last redesigned in the early 1970s. Since the 1970s, the map series has used only two typefaces: ITC Souvenir and Univers, because they were available in a wide range of weights and printed well. However, Souvenir and Univers are proprietary typefaces, and not distributed with Mac OS or Windows. While in the 1970s this was not a relevant concern, widespread desktop cartography has introduced issues of digital map design and display. Moreover, the geological science community, a significant portion of the US Topo user base, uses GeoPDFs as basemaps, in lieu of constructing maps from downloadable data. They layer their own geologic data on top of the GeoPDF, and separate the individual layers of the GeoPDF to add new labels, remove symbols, and perform other modifications. The use of proprietary typefaces is problematic, because while such typefaces can be *viewed* in GeoPDFs, they cannot be used to create new labels in this extended usage. US Topo is currently undergoing a redesign. Our redesign team advocated replacing ITC Souvenir Light/Demi with Georgia, and Univers 55/56 with Trebuchet MS. Georgia and Trebuchet MS provide cross-medium legibility (both for print and on-screen use), support extended character sets for diacritics, and are widely available on Mac OS down to version 9 and Windows down to version XP. Most users will have no trouble displaying labels set in these typefaces, and will not have to confront rights and access issues to install new typefaces. However, this is not an ideal solution. These typefaces are fairly generic and widely distributed, and there are some problems using Georgia at small point sizes. We explore the question of creating a distinct identity in an authoritative national topographic series while simultaneously satisfying the needs of a wide digital product userbase. We discuss both the technical issues and the more social issues that accompany a new choice of typefaces at the USGS, including cost, user issues with custom typefaces, why some simpler solutions (such as font embedding) don't work, and the relevance of these questions as part of the USGS mission of serving the community.

6A.4 | **A Tag Cloud-based Visualization for Geotagged Text Information** (#927)

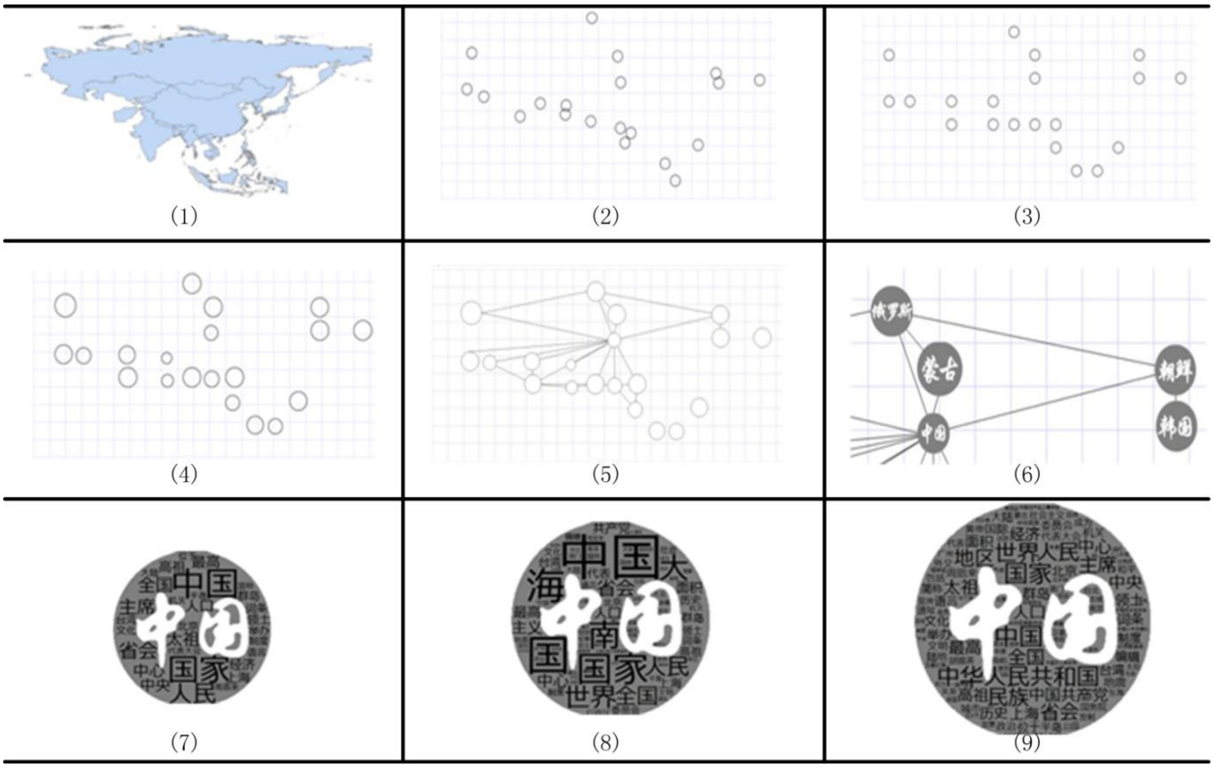
Yi-Xin Hua[1], Xiang Li[1], Jun-Xi Zhao[1], Li-Na Wang[2]

[1]Information Engineering University Cartography and GIS - Zhengzhou, China; [2]Map Institute of Henan Province Geographic Information - Zhengzhou, China

Geotagged text information such as comments on POIs and description of a place are continuously becoming more popular. In a traditional GIS, structured text are stored in tables as a geographical feature's attributes, while unstructured text data stored outside DBs or in DBs as blog fields are linked to geographical features. So browsing such data on a general GIS can be difficult, due to the frequent zoom, pan and click for pop-up dialog operations. Besides, it is difficult to discover knowledge from large text information.

This paper presents a new visualization method based on tag clouds for geotagged text information. Tag Clouds has been known since 2002 through its implementation in Flickr. Since then, there have been many investigations into this kind of visualization. Our approach which creates a tag cloud map from a general map is followed by four steps. Figure 1 illustrates this workflow. Firstly, we change all features into points according to their positions. Secondly, all points are reallocated in an aligned grid and every point's size is set by a different weight. This weight is computed by the amount of text or other factors. Thirdly, we connect points which are exist particular relationships such as adjacent. Lastly, the most popular labels from text information are placed in relevant points.

Two different tasks are designed to evaluate the performance between a tag cloud map and a general digital map. One is searching an interesting point and the other is scanning data quickly. We find that most participants, even upon first using the tag cloud map, can complete tasks effectively. Results suggest that a tag cloud map is faster than a general digital map. Moreover, most users can discover more interesting things from a tag cloud map than a general digital map.



a tag cloud map process:
The figure(1-7) illustrates the whole process of making a tag cloud map. The figure(8-9) illustrates a tag cloud map at large scale

ORAL

Session S6-B

Art and Cartography

Tuesday, 27 August, 2013

16:30 - 17:45

6B.1 | **Geographic Space in Museums – Evaluation and Representation of Geographic Space within a Numismatic Exhibition** (#1080)

A. Pucher, K. Kriz

University of Vienna, Department of Geography and Regional Research, Austria

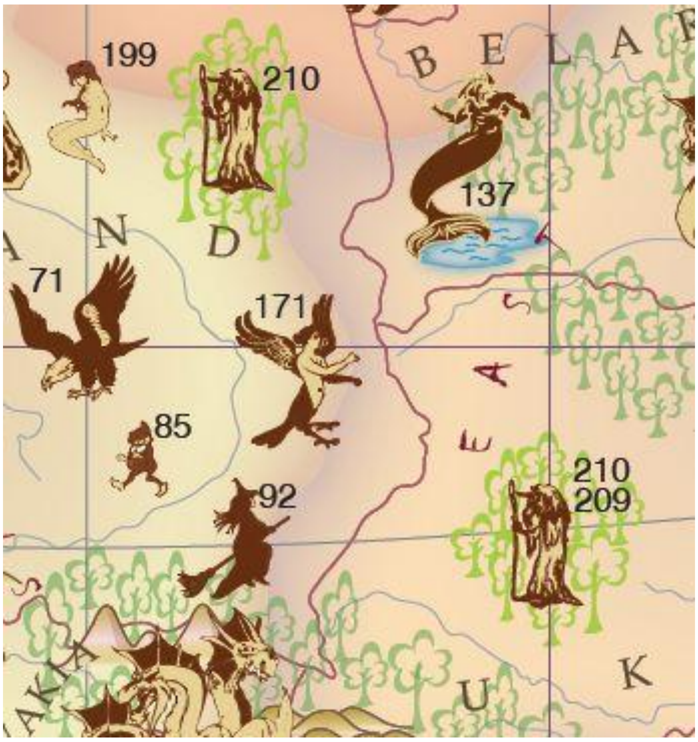
Today, a huge variety of museum exhibitions exist, offering an overwhelming amount of artifacts and information. The presentation methods involved vary from very traditional designs that simply display artifacts behind glass accompanied by a card describing the object to a combination of multimedia and virtual reality installations. Although space and time characteristics are given to all artifacts, regardless their origin or nature, the deliberate use of this information is far from common. This information provides, however, plenty of opportunities to incorporate geographic space within an exhibition concept. During the last decades, technical and telecommunication progress has extended the portfolio of cartographic media. The Web provides a variety of new communication channels, new ways of displaying the real world augmented in 3D and in virtual reality. Geographically enhanced web-portals, instant positioning, hyperglobes and 3D-applications have changed our (spatial) cognition. The integration of these new presentation and communication aspects into museums and exhibitions possess many challenges for curators and exhibition managers that leave room for further research in various scientific areas. Within an ongoing cooperation, cartographers and geographic information scientists from the University of Vienna, Department of Geography and Regional Research as well as numismatic experts from the Art Historical Museum (Kunsthistorisches Museum - KHM) in Vienna, Austria aim at incorporating the geographic information within the available exhibition space into a public numismatic exhibition. The focus of this exhibition is based on three major aspects: The function of the exhibition as a show for the public, the expectations of a visitor to navigate in exhibition space, and the task of maps and spatial representations to act as geo-communicators. In accordance with the most relevant themes a visitor can therefore expect from an exhibition design the following basic principles and conceptual cornerstones: background information (including geography), a continuous ordering principle (thematic, chronological, geographical) and an interesting story told by the artifacts.   Various purposed maps in different scales, among them a 4.0 x 3.6 m floor map were designed and created along with multimedia content embedded in an online exhibition catalogue. Innovative technological solutions, such as the use of QR codes were implemented and introduced into the exhibition space. This contribution will give an overview of the relationship of museums and geographic information, explore the possibilities of geographic space in museums and present a concept as well as the actual implementation of a numismatic exhibition entitled “The Empire of the Huns in Central Asia and India.

6B.2 | **Mapping the unreal: the story of Mythical Creatures in Europe** (#95)

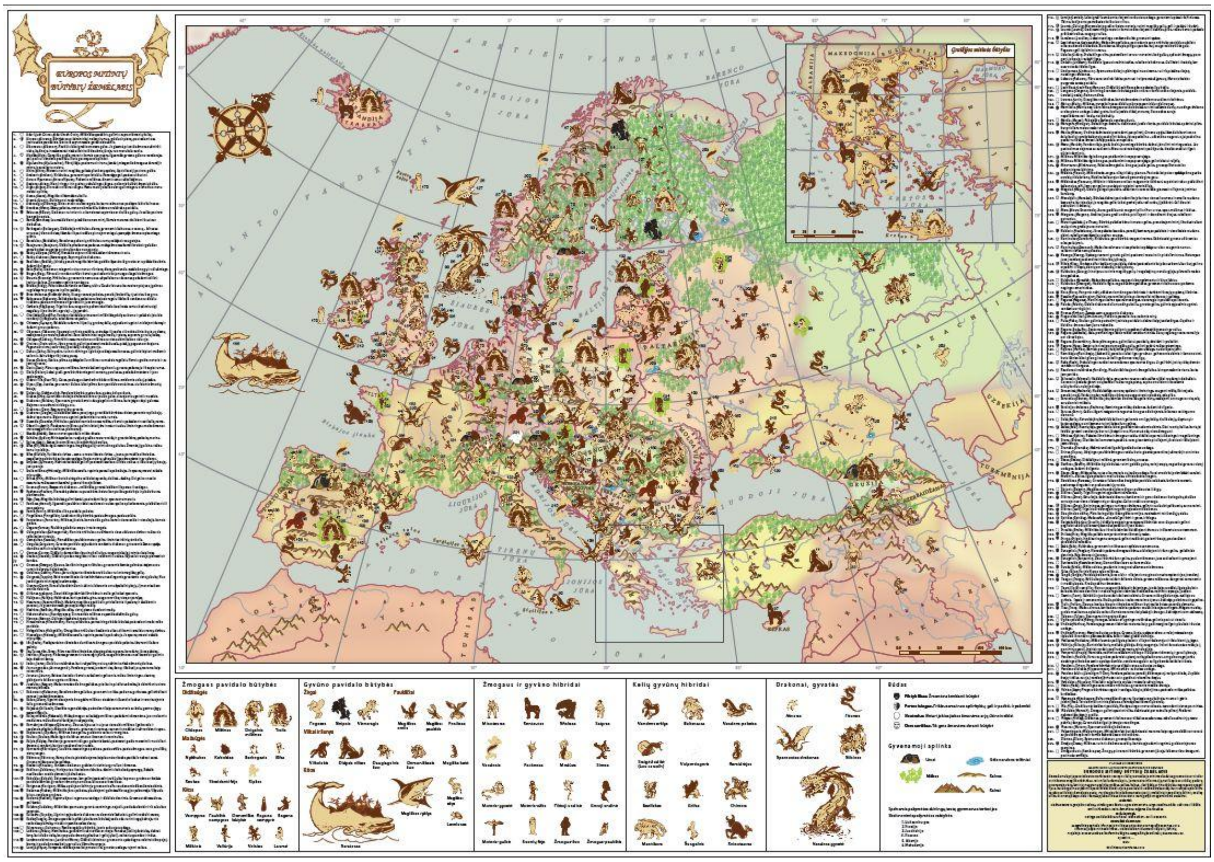
G. Beconyte

Vilnius University, Centre for Cartography, Lithuania

The *Map of Mythical Creatures in Europe* represents information on 213 mythical creatures that are described in folk-lore of European countries has been compiled from data collected by MSc students in Cartography at Vilnius University from various printed and public online sources in 9 languages. Only the most reliable information has been included in the map, more data are stored in a relational database. The creatures have been grouped into 68 types. Attractive pictorial signs have been designed to represent each type. The numbers link to textual descriptions of the particular creatures in the list on both sides of the map image. The map at reference scale of 1:7,200,000 designed for printing on ISO A0 has been submitted for publishing in Journal of Maps in 2012. It is the first map of such theme that we know. The initial aim of the project was to demonstrate the possibility and advantages of a geographic approach in mythology and folk-lore studies. Due to efficient project management it became feasible to carry out the project in just 5 months. In 2012 it gave a start to a large scale mapping of mythical creatures in Lithuania that requires much deeper scientific analysis of folk-lore sources and precise mapping of locations. The paper describes various aspects of project implementation and discusses the value of such students' team projects for cartographic education at Master level.



Fragment of the map:
A fragment of the Eastern European part of the map



Map overview:
General view of entire map

6B.3 | **Smellmap: Glasgow** (#590)

K. McLean

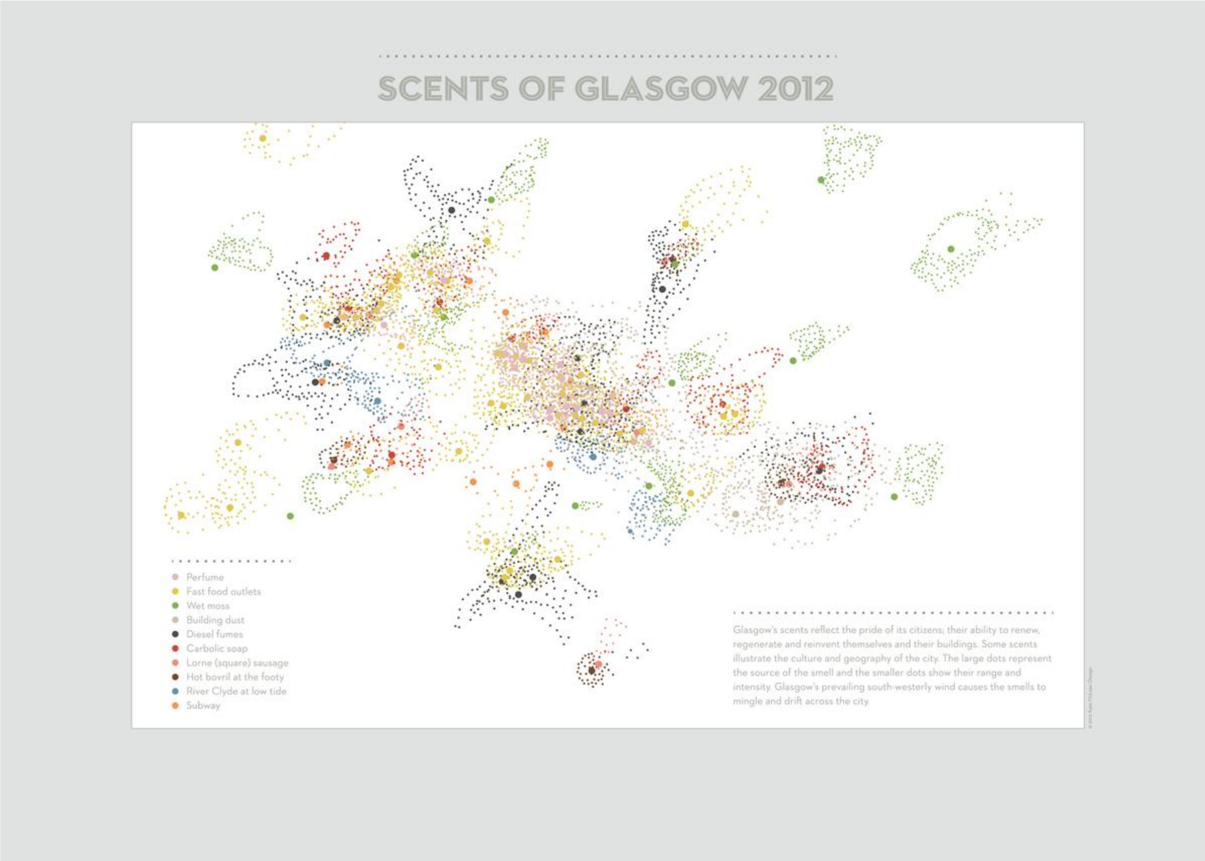
Canterbury Christ Church University, Media, Art & Design, Broadstairs, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\161_proceeding.*

In September 2012 Glasgow Science Museum exhibited Kate McLean's map of the city based solely on its smells. Incorporating visuals of identified city-specific scents and bottled scents (created from natural substances) the map invited the audience to interact with the exhibit and to contribute their own placement of the scents across the city. The function of such smellmaps is to explore new ways to depict cities other than purely visual, encouraging tourists and visitors to explore and find their own city experiences, which thereafter become memorable through a direct link with smell. Sensually-based memory is an area of increasing interest for the tourism industry whose higher-end clients, tiring of activity-based experiences, are seeking to reactivate and relive the good feelings. Mendiratta (2010) suggests that the tiniest aromas and sounds can have a profound emotional effect. Every scent is carefully chosen, by a combination of crowd sourcing and the "weight" of its story. Every smell has a story – the memorability or memory-invoking scale of individual scents and how they work together to form a smell portrait of the city (history, architecture, culture, attractions, people). The maps are designed to be questioned and intended for people intended to ascribe their own smells to places. Smellmaps are intended as a kick starter for personal sensory perception and sensory memories relating to a specific location. My experience of smell walks and smell bike rides is that very often half a metre, a 10 degree angle or 1 minute can make a huge difference in odour perception therefore smell is temporal, geo-specific and also personal. Deliberately omitting spatial indicators is both aesthetic and functional in that it makes the map more personal as people recognise a place from the smell rather than the names. My intent was for the audience to study the map and figure out where they were based on some of the smells. This presentation will depict the methodology used to generate the data, the design considerations and the creation – successful and otherwise of naturally occurring scents for display purposes.

Smellmap: Glasgow:
Detail of smell depiction in Glasgow's city centre



Smellmap: Glasgow:
Map depicting the scents detected in Glasgow in 2012

6B.4 | **The artistic approach of modern Greek Urban Cartography [1840-1940]**

(#349)

M. Myridis, E. Aga, A. Christodoulou, N. Dalakis, B. Filippakopoulou, P. Lafazani, L. Stamou

Aristotle University of Thessaloniki, Department of Cartography, Greece

A full-length version is available and can be opened here:

_extendedAbstract\152_proceeding.*

As an issue, the artistic versus the scientific approach in cartography and cartographic design, has concerned the cartographic community quite seriously; it is definitely included in the objects open to exploration, even though it is not characterized as one of the front line hot research topic. This paper first outlines and examines the occasional debates recorded between those cartographers who claim that art is the major ingredient of the creation of the rules of cartographic design, and the ones who claim that science is instead. The paper proceeds to explore the first urban plans and urban maps of modern Greece as a case study. The production of urban Cartography in modern Greece began with the preparation of the first urban plans, concerning the creation and planning of the first cities of the new country at the beginning of the 19^{th} century signaled. However, the successive expansion of borders in the newly founded Greek state created the need to design the cities of the newly annexed areas. However, each time a map was designed, a different approach of 'cartographic style' was formed in terms of aesthetics and time line. Artistic movements in Art and Civilization like romantisme, neoclassicism, art nouveau, modernism or other "movements" like Bauhaus, seem to influence, among other things, graphic representations like maps and more particularly, urban plans. The maps eventually produced during that time, along with modern, 'evolved' products, pose many challenges for the specialized scientists, in order to extract conclusions concerning the form and the context of the cartographic product, as it is particularly interesting in terms of quantity and quality. The presentation of the 'subject' featured in these designs depict the diachronic evolution of artistic movements of the various eras, which each time differentiated the form and the style of the produced 'map,' while at the same time they definitely comply with the scientific cartographic demands. Varying from simplistic urban plans designed in a subtractive way merely depicting the design, to compound depictions of an extended semiological depiction, these 'plans' are historically categorized in four time periods, each one distinctive in terms of occasional aesthetic movements, and the terms of the development of Urban Planning in Greece, connected also to the historical evolution of the country. This paper is intended to examine the trends depict in plans produced during the first two periods: the urban cartography of the 19^{th} century, going from 1840 to 1920, and the one of the Interwar, going from 1920 to 1940, both considered as the "golden era" of the modern greek urban cartography. The aim of this paper therefore, is to examine the material of maps and diagrams available these two first periods and to detect the stylistic choices of the manufactures of the above-mentioned maps, given the fact that the majority of the choices constituted the personal decisions by Architects, Urban Planners or Engineers who composed the maps. It should be noted that there is no doubt that the final image of the map is the product of more contributors, including carvers, lithographers etc, who imprinted their own special characteristics [A. Benova et alts 2009]. Besides, «The exchange of artistic and scientific approaches might lead to heterogeneous results, but will be an exciting experiment for those who are willing to get involved" [G. Gartner 2009].

ORAL

Session S6-C

Map Perception

Tuesday, 27 August, 2013

16:30 - 17:45

6C.1 | **The Cognitive and Opinion-Forming Role of Geocompositions as Multimedia Presentations** (#12)

Z. Kozieł

Nicolaus Copernicus University Faculty of Earth Sciences, Cartography, Remote Sensing and GIS, Toruń, Poland

Geocomposition, a term which so far has not been used in literature, is a compound noun consisting of the root *composition*, which has a place in cartography, and the prefix *geo*, which is added to differentiate it from the work of a composer of music. Geocomposition is a broad term and thus can be identified with visual, sound or text compositions relating to the surface of the Earth and the entire geosphere. Because cartographers understand the term composition in a number of ways, it is necessary to stress that, in relation to maps, composition implies the maximum clarity and ease of reading, the proper choice of means of expression, and the visual balance of the whole; in other words, the maximum of content. Eduard Imhof (1965) considered the same attributes of composition when he referred to musical compositions. Assuming that geocomposition, like a map, involves the two fields of cartography and art, one can obviously apply aesthetic criteria to them. The design of functional objects, like maps, in contrast to aesthetic objects, that is, works of art, does not imply that the former cannot include aesthetic features (Sheybal 1964, Makowski 1994). As was stated before, a visual composition in the form of a map does not have to be work of art, but it is advisable for it to have the features of one, through a conglomerate of purposefully collected and properly ordered elements (and their attributes), in many other artefacts and geofacts. This statement derives from the fact that the aforementioned attributes that make up given composition patterns are not always known to computer operators, who tend to trust the ‘power’ of their software too much. However, these changing patterns of centuries-long cartographic traditions are perfectly well known to professional cartographers-editors who edit maps every day.

6C.2 | **Influence of graphic design of cartographic symbols on perception structure** (#1187)

Z. Stachon[1], C. Sasinka[1], Z. Sterba[1], J. Zboril[1], S. Brezinova[1], J. Svancara[1,2]

[1]*Masaryk University, Institute of Geography, Brno, Czech Republic;* [2]*Masaryk University, Department of Psychology, Brno, Czech Republic*

A full-length version of this contribution has been published in: KN (Kartographische Nachrichten), Vol. 63, Number 4 (Summer 2013), Pages 216-220

This paper presents a research that was established by interdisciplinary cooperation of psychologists and cartographers. The research is focused on influence of graphic design of map symbols on perceptual structure. Two different sets of map symbols were presented on identical topographic background. Each of the symbol sets was created by different authors and particular symbols vary in size, structure orcolor shades. An influence of cognitive style of respondents was observed too.

6C.3 | **Advanced image processing for maps graphical complexity estimation**

(#796)

A. Ciolkosz-Styk[1], A. Styk[2]

[1]*Institute of Geodesy and Cartography, Warsaw, Poland;* [2]*Institute of Micromechanics and Photonics, Warsaw, Poland*

A full-length version is available and can be opened here:

_extendedAbstract\260_proceeding.*

During the centuries the main problem on mapping was to obtain the sufficient and reliable source data. At present an appropriate selection of the desired information from the deluge of available data is a problem. An availability of large amount of data induces to transfer the possibly rich information by means of map. It often results in overloading the cartographic products, hence they become too complex and therefore less communicative and difficult to read. Complexity exerts an impact on readability and effectiveness of cartographic representations and for this reason has been the cartographers' object of interest for many years. The map complexity is the result of interaction between its elements relating to two fundamental map's aspects – syntactic and semantic. It corresponds to two complexity aspects – visual complexity and intellectual (semantic) complexity. A variety of measures of map complexity were introduced. Each of them addresses different map types and different definitions of complexity, and uses different structures and features of the map. At the initial stage of research on the visual maps' complexity most of the works were concerned with the thematic maps in respect to which it was possible to use a metrics that allowed quantifying their complexity in a simple way. First works on maps visual complexity estimation were carried out utilizing the theory of graphs and based on the weighted number of edges on the map. The measures of graph theory applicable to the elements occurring on the maps allowed developing graphical complexity index for maps in different scales. Further development of computer technologies led to more sophisticated measures. Indices taking into account the spatial distribution of map graphical density (yet providing single value output) were worked up by applying the fractal dimension, methods of spatial autocorrelation and entropy, which is derived directly from the communication theory. At present data compression technique (derived from IT) is a very interesting approach to the problem of estimating map visual complexity. Diversity of the above described measures of map visual complexity is a consequence of diversified applications of individual measures, and a consequence of different understanding of what the complexity is. Therefore, in many cases the measures make use of various totally different characteristics of the investigated map. Moreover, existing methods do not allow for automatic spatial distribution evaluation. Therefore a novel approach was introduced. For that purpose digital image processing techniques have been proposed and successfully applied by the authors. The proposed method of graphical load determination is based on dual stage map image processing utilizing wavelet transform and statistical image filters. As the result the map of graphical load directly corresponding to image complexity is obtained. Selected maps images were processed and the results were compared to the ones obtained using other complexity measures, such as data compression technique. Proposed method provides comparability of the maps, loaded with various elements (point and line signatures, captions, etc). Based on the selected cartographic material analysis, it can be concluded that this method allows the quantitative assessment of maps graphical load with a formal index. The method proposed in this paper refers to all of the elements on the map and, therefore, refers to an analysis on a higher, synthetic level. It should be added that there is a great compatibility between the visual experience and the level of calculated graphical load displayed in the graphical density maps.

6C.4 | **Symbol Considerations for Bivariate Thematic Maps** (#1312)

M. Elmer

Master's Student, Dept of Geography, University of Wisconsin - Madison, United States

A full-length version is available and can be opened here:

_extendedAbstract\278_proceeding.*

BACKGROUND: Bivariate thematic maps are powerful tools for understanding geographic phenomena, making visible spatial associations between them. But bivariate thematic maps are more visually complex than a univariate map, a source of frustration for both map creators and map readers. Despite a variety of visual solutions for bivariate mapping, there exists few 'best practices' for selecting or implementing an appropriate bivariate map type for a given scenario. This results in a need for empirical research examining the perceptual and functional differences among bivariate mapping solutions. **OBJECTIVES:** This research reports on a controlled experiment informed by the theory of **selective attention**, a concept describing the human capacity to tune out unwanted stimuli, and attend specifically to the information desired. Research in Psychology suggests there are four conditions of selectivity, determined by the visual variables combined in an image: **separable** (the viewer can attend to either visual variable), **integral** (the visual combination forms a gestalt visual dimension, but this inhibits attention to the individual visual variables), **configural** (emergent dimensions exist without fully impeding attention to individual variables), and **asymmetrical** (an unequal ability to attend to the individual variables). The goal of this research is to examine if and how these conditions of selectivity impact the ability of map readers to extract information from different bivariate map types. **METHODS**: 55 participants completed a controlled experiment in which they had to answer close-ended questions using bivariate maps. Eight bivariate map types were tested (shaded cartogram, choropleth with overlaid graduated symbols, bivariate choropleth, rectangle map, bar chart, spoke glyph, value-by-alpha, and shaded texture); with these maps each of the four conditions of selectivity is represented twice (***figure 1***). Participants were asked to answer eight different questions for each map type (64 questions total); map questions varied on search level (elementary vs. general) and search axis (X and Y variables individually, and their positive and negative correlation). Accuracy and response time were recorded for each question. The experiment also opened with biographical questions to determine participant expertise and finished with a Likert-based survey to determine participant preference of the different map types. **RESULTS:** Accuracy results showed a small amount of variation across the eight tested map types (the most common mistakes involved the spoke glyph and shaded texture maps). The results in response time showed a substantial variation both within the eight tested map types and across the 64 questions (***figure 2***). Certain map types successfully supported all eight tasks, while others performed worse overall (namely, the choropleth/graduated symbols and the rectangle map performed better than the spoke glyph). Map types with strong gestalt dimensions (integral) enhanced readers' ability to extract correlational information. Performance at the different map reading levels (elementary vs general) varied most in the configural map types, especially when analyzing the negative correlation between the variables. Based on the Likert scales, participants showed a consistent preference for the same maps that performed well in response time: choropleth with graduated symbols, rectangle map, and bivariate choropleth. **CONCLUSION:** The results of this experiment demonstrate the importance of selection attention in thematic cartography. The intellectual contributions of this research include a framework organizing existing bivariate map types and evidence regarding which map types better support different map reading tasks. This experiment represents an initial effort in a larger process to translate insights on selective attention derived in Psychology into best practices for bivariate mapping.

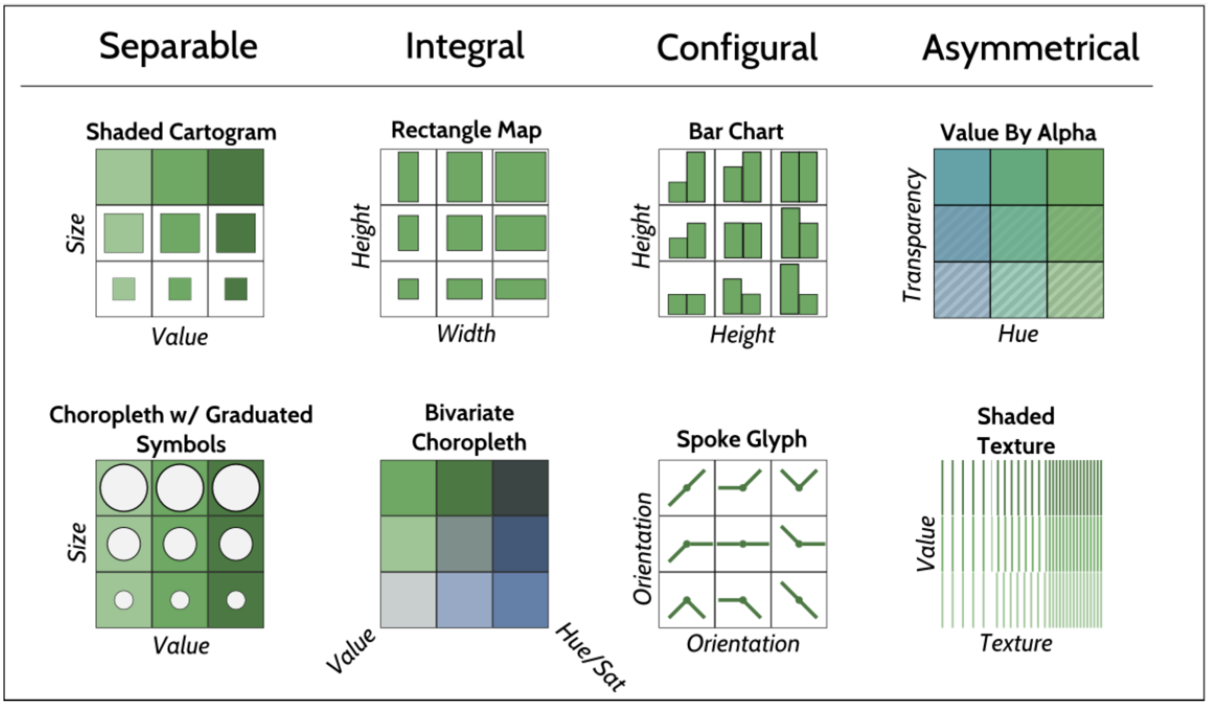


Figure 1.
The eight bivariate map types tested, organized by selectivity.

Figure 1:
The eight bivariate map types tested, organized by selectivity.

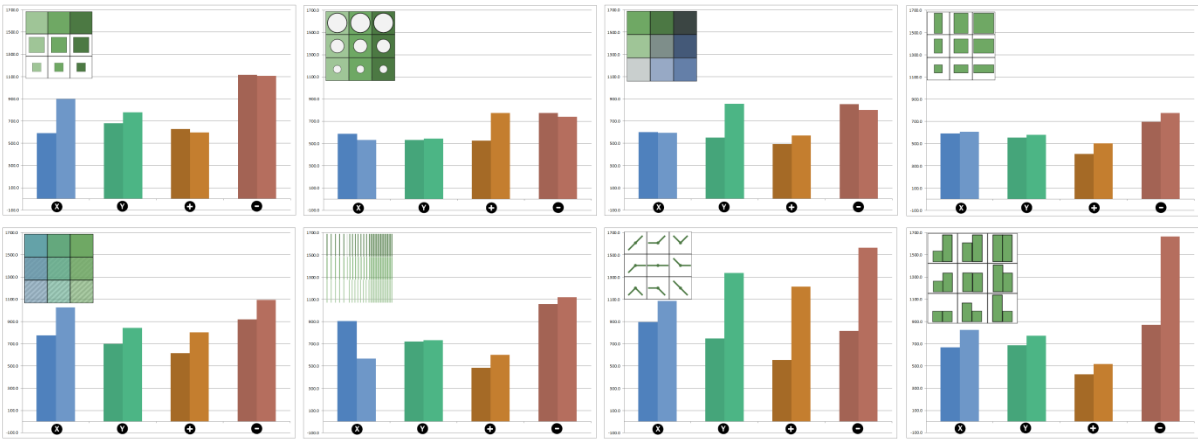


Figure 2. Average response time in frames (1/24 sec).

8 tasks represented: extracting information about the two individual data variables (X, Y), their positive correlation (+) and their negative correlation (-). The left/right sides of each bar represent elementary and general-level reading, respectively.

Figure 2:
Reaction Time (RT) across the 64 trials, by information axes (the original data variables [X,Y], their positive correlation [+], and their negative correlation [-]). The left/right sides of each bar represent elementary/general tasks, respectively.

ORAL

Session S6-D

SDI

Tuesday, 27 August, 2013

16:30 - 17:45

6D.1 | **Sharing and Coordinating SDIs in the Age of Crowdsourcing and Mobile Technologies** (#1213)

S. Coetzee[1], F. Harvey[2], A. Iwaniak[3], A. K. Cooper[4,1]

[1]University of Pretoria, Centre for Geoinformation Science, South Africa; [2]University of Minnesota, Minneapolis, United States; [3]Wroclaw University of Environmental and Life Sciences, Poland; [4]CSIR, Built Environment, Pretoria, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\56_proceeding.*

6D.2 | **Towards a Knowledge Reference System for the Domain of Geographic Information Science and Technology** (#985)

A. Skupin[1], M. Stowell[1], F. Du[1], B. Plewe[2], M. Demers[3], S. Ahearn[4]

[1]San Diego State University, Department of Geography, United States; [2]Brigham Young University, Department of Geography, Provo, United States; [3]New Mexico State University, Department of Geography, Las Cruces, United States; [4]Hunter College - CUNY, Department of Geography, New York, United States

The Geographic Information Science and Technology Body of Knowledge (GIS&T BoK) can be conceptualized as the driving force behind a knowledge reference system in which all knowledge artifacts can be located that are produced and consumed by domain actors in the course of their domain-related activities. These actors and activities encompass the full breadth of the GIS&T domain, including research, education, and professional practice. This presentation will discuss approaches to leveraging this integrative potential of a domain-specific BoK. First, a series of computational transformations involving natural language processing and topic modeling approaches is used to let the GIS&T BoK generate a high-dimensional reference space. Second, that reference space becomes the central element of a platform through which any BoK element as well as any text-based domain artifact can be located in absolute and relative terms, through topic inference and similarity computation, respectively. Third, dimensionality reduction provides for the creation of a stable base map of the domain onto which BoK elements and domain artifacts can be overlaid and visually examined. This combination of computational and visual approaches enables novel forms of knowledge domain analysis, ranging from comparative analysis of individual artifacts (e.g., juxtaposition of job postings and job applicants) to large-scale investigation of domain trends. It also supports introspective domain analysis, that can guide the future evolution of the GIS&T BoK, as demonstrated in an analysis of CyberGIS-related research publications.

ORAL

Session S6-E

Cartography for People with Disabilities

Tuesday, 27 August, 2013

16:30 - 17:45

6E.1 | **Crowdsourcing techniques for augmenting traditional accessibility maps with transitory obstacle information** (#292)

M. Rice[1], R. D. Jacobson[2], S. Mcdermott[3], A. Aburizaiza[3], F. Paez[3]

[1]Assistant Professor, George Mason University, Geography & Geoinformation Science, Fairfax, United States; [2]Associate Professor, University of Calgary, Geography, Canada; [3]George Mason Univeersity, Geography & Geoinformation Science, Fairfax, United States

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 210-219

One of the most scrutinized contemporary techniques for geospatial data collection and production is crowdsourcing. This inverts the traditional top-down geospatial data production and distribution methods by emphasizing participation of the end-user or community. The technique has excellent application in the domain of accessibility mapping, where it can augment traditional mapping methods and systems by providing information about transitory obstacles in the built environment. This research paper presents details of techniques and applications of crowdsourcing and related methods for improving the presence of transitory obstacles in accessibility mapping systems. The obstacles are very difficult to incorporate with any other traditional mapping workflow because they typically appear in an unplanned manner and disappear just as quickly. Nevertheless, these obstacles present a major impediment to navigating an unfamiliar environment. Fortunately, these obstacles can be reported, defined, and captured through a variety of crowdsourcing techniques, including gazetteer- based geoparsing, active social media harvesting, and referencing in a crowdsourced mapping system. These techniques are presented, along with context from the research in tactile cartography and geo-enabled accessibility systems.

6E.2 | **An Information Model for Pedestrian Routing and Navigation Databases Supporting Universal Accessibility** (#670)

M. Laakso, T. Sarjakoski, L. Lehto, L. T. Sarjakoski
Finnish Geodetic Institute, Geoinformatics and Cartography, Masala, Finland

A full-length version of this contribution has been published in: Cartographica, Vol. 48, Number 2 (Summer 2013, Title:"Selected Papers from the 26th International Cartographic Conference, Dresden, Aug., 25-30: The Challenges of Visualization"), Pages 089-099

The study focuses on the information content of the geospatial databases guiding pedestrians, as well as those with disabilities. In this paper we introduce an information model for describing this content. The model covers the physical environment faced by a person moving on foot. We have used the UML class diagrams to formalize the information model on a conceptual level. The features are divided into two abstract top-level classes: the one granting pedestrian access and the one hindering it. A consistent and comprehensive pedestrian network is at the core of the model. The model also covers other geographic information in order to increase the accessibility. The aim of the created information model is to help data providers to collect and store appropriate data in an appropriate manner.

6E.3 | **AN ATLAS OF BRNO CITY CENTRE FOR WHEELCHAIR USERS: CONCEPT, PRODUCTION AND BEYOND** (#687)

J. Otrusinová, **T. Rezník**

Masaryk University, Faculty of Science, Department of Geography, Brno, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\59_proceeding.*

This paper deals with the accessibility mapping of Brno city centre for wheelchair users, which resulted in the production of an accessibility atlas printed in 2012. User requirements, the concept of the atlas, and its production as well evaluation are the main subjects of this paper. The primary motivation for conducting accessibility mapping in Brno arose from the fact that there was a lack of information on accessibility for people with impaired mobility. First, the target group of users of the accessibility atlas had to be defined. Among people with impaired mobility, wheelchair users have the most demanding requirements. Those requirements were based on discussions with potential users. The atlas consists of two sections – a map section and a text section with additional information on accessibility at the selected locations. This allows the incorporation of additional explanations that could not be placed on the map, but which are of fundamental importance for wheelchair users. The main goal of our work was to identify locations of everyday life in the city centre of Brno that are accessible to wheelchair users. Public institutions and cultural institutions such as museums and theatres were mapped completely, even those which are not barrier-free. We collaborated with several institutions to propose standardized map symbols that may be re-used in maps and atlases for wheelchair users. Two kinds of information were assigned to each individual symbol: qualitative information, i.e. the type of object; and quantitative information, i.e. the degree of accessibility. The results of the accessibility mapping of Brno city centre are stored in a geodatabase. This contains geographical coordinates and all attributes related to accessibility. Detailed accessibility data presented in the text section extends the information given by the map. Masaryk University, Brno City Municipality, and two organisations representing the interests of wheelchair users contributed to the creation of the atlas. Masaryk University and Brno City Municipality prepared the map and text parts, while the organisations for wheelchair users provided feedback from the users. The printed atlas reflects the work undertaken by the above-mentioned organisations over the last three years. It is available to all wheelchair users free of charge through Brno City Municipality contact points. Discussion on the advantages and disadvantages of the created atlas can be found at the end of this paper.

6E.4 | **Design and production of a paper printed and a digital - interactive accessibility map of the Aristotle University of Thessaloniki campus, Greece, for People with Disabilities** (#993)

C. Boutoura[1], K. Papadopoulos[2], A. Tsorlini[3,1], C. Dadala[1]

[1]Aristotle University of Thessaloniki, Department of Cadastre, Photogrammetry and Cartography, School of Rural and Surveying Engineering, Greece; [2]University of Macedonia, Department of Educational and Social Policy, Thessaloniki, Greece; [3]ETH Zurich, Institute of Cartography and Geoinformation, Department of Civil, Environmental and Geomatic Engineering, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\405_proceeding.*

People with Disabilities (PWD) are considered to be a sensitive group of people, demanding specific requirements on their mobility. According to the relevant law, the construction and modulation of public areas should fulfill the requirements which allow these people to have access to any public place. However, this is not the case. There are often permanent or temporary obstacles interrupting their route, or the access points are not easily approachable so that it is not possible for them to move around completely freely without obstructions. This is very important for a university campus, where a lot of people move every day, using different routes sometimes more than once a day, covering their needs of parking their cars, working, teaching, studying, eating and sometimes living inside it. Many universities around the world have published detailed maps which help people with permanent or temporary disabilities to move and work without problems in the campus. The aim of this paper is the design and production of an accessibility printed paper map, as well as its digital - interactive counterpart, based on data collected by fieldwork taken place in the Aristotle University of Thessaloniki - Greece, concerning particular spots in the open space of the University Campus, where people with disabilities will encounter difficulties to move freely or to have access to the buildings. These difficulties come up due to obstacles existing in the surroundings, or due to the bad construction of roads or pavements which can additionally, cause safety problems to them. Moreover, four categories of disabled people are taken into account for this study: blind people, visually impaired, people with mobility problems and people having difficulties in moving in particular places, such as old people, pregnant ladies, children or people carrying huge objects. The paper printed map created for this reason, both in Greek and in English language, depicts the “problematic” areas existed in the University using the appropriate symbols, which give information about the nature of the obstacle, the kind of people’s disability influenced by it, as well as the degree of difficulty for people to overcome this particular obstacle. In this way, through this map, anybody having a kind of disability or helping a disabled person can find the best way to access the desired place. More detailed and efficacious, the digital interactive counterpart of the map gives information to the user about the exact obstacles he will face in his route, their description and images of them. In this way, the user can also estimate by himself if a place is easily approachable or not and finally he can make his own plan for going there. Maps like these created in this study can be really useful to many people, since they describe the accessibility problems of an area, helping on one hand the disabled people to find the best way to their destinations but also emphasizing that measures should be taken by the responsible service, in order to make an area like the University campus accessible to all people.

map_disabl_en.jpg:
Aristotle University of Thessaloniki Access Map for People with Disabilities

ORAL

Session S6-F

Mobile Tasks and Applications

Tuesday, 27 August, 2013

16:30 - 17:45

6F.1 | **Learning from location history for context-aware location recommendation in LBS** (#587)

H. Huang, G. Gartner

Vienna University of Technology, Research Group Cartography, Austria

A full-length version is available and can be opened here:

_extendedAbstract\230_proceeding.*

Location Based Services (LBS) are very popular in recent years. Location recommendation is one of the most important components in many LBS applications, especially in mobile guides. Location recommendation in LBS should be personalized and context-aware. Currently, providing context-aware location recommendation is still very challenging. In order to achieve context-awareness, LBS applications mostly rely on an adaptation engine to determine the appropriateness of locations (Points of Interest, POIs) for satisfying users' needs and context. However, building the adaptation engine has to undergo a long process of knowledge acquisition, which is very time-consuming and impractical for many LBS applications. Collaborative filtering (CF) is a promising solution for the above problem. It uses "opinions" of similar users in similar contexts to help the current user efficiently identify information of interest. As a result, by incorporating CF into LBS, relevant information (e.g. POIs) matching the user's current situation can be identified (by aggregating "opinions" from similar users in similar contexts). On the other hand, the increasing ubiquity of tracking technologies (e.g., GPS loggers) has led to the accumulation of large spatio-temporal datasets, such as GPS trajectories and Foursquare checkins. These location history data may reflect users' spatial experiences in the environment. They provide a non-intrusive way for user profiling. Therefore, by applying CF on these highly available location histories, context-aware location recommendation can be non-intrusively made. However, little research has addressed these considerations. The goal of this paper is to investigate how CF and individual location histories can be used for context-aware location recommendation in LBS. With this, smart services like "in similar contexts, other people similar to you often went to …" can be provided in LBS. In this paper, we mainly focus on three issues:

1. **Contextual user profiling from location history:** We develop a time-threshold-free approach for semantically processing of each user's location history. With this, a set of POIs she/he has visited together with the context of visit can be extracted, which can be viewed as his/her profiles.
2. **Measuring user similarity and context similarity:** In order to locate other users whose opinions can be used for making recommendation for the current user, a novel user similarity measure based on preferences and spatio-temporal motion behavior (e.g., the way in which POIs were visited) is developed. We also explore two context similarity measures for measuring the similarity between different contexts: a local-global approach, and a statistic-based approach.
3. **Making recommendation:** Three approaches (contextual pre-filtering, modeling and post-filtering) are developed to integrate user similarity and context similarity for identifying users who have similar preferences to the current user in similar contexts. By aggregating (e.g., weighted sum or adjusted weighted sum) "opinions" (i.e., which POIs they visited next) from these users, context-aware location recommendation can be provided in LBS.

Finally, in order to test the effectiveness in providing context-aware location recommendation, these proposed solutions are comprehensively evaluated with four real-world location history datasets, which are of different types (GPS vs. Bluetooth vs. Foursquare checkins), and reflect different scales of application scenarios (zoo vs. city-center vs. city-wide).

6F.2 | **Location-Based Illustration Mapping Applications and Editing Tools**

(#1376)

M. Lu, M. Arikawa
The University of Tokyo, Center for Spatial Information Science, Kashiwa, Japan

A full-length version of this contribution has been published in: Cartographica, Vol. 48, Number 2 (Summer 2013, Title:"Selected Papers from the 26th International Cartographic Conference, Dresden, Aug., 25-30: The Challenges of Visualization"), Pages 100-112

Although commercial Web mappings are popular now, illustrated maps are widely used in printed media, and have advantages. The immeasurable distortions of illustrated maps bring difficulties to applying them in LBS. Based on the previous research, the authors proposed an improved framework for supporting illustrated maps to be integrated with GPS functions in smartphones, and positioning methods are discussed. Mobile tools and applications have been developed, with the purpose of easiness for creating and appreciating digital content based on illustrated maps for walking tours. The usability and effectiveness are tested in experiments and practical use.

6F.3 | **Developing Interactive Cross-Platform Mobile Applications for Apple iOS (iPhone/iPad/iPod) and Google Android (Phone and Tablets) with Adobe Flash Builder and CartoVista Mobile** (#334)

D. Bouchard

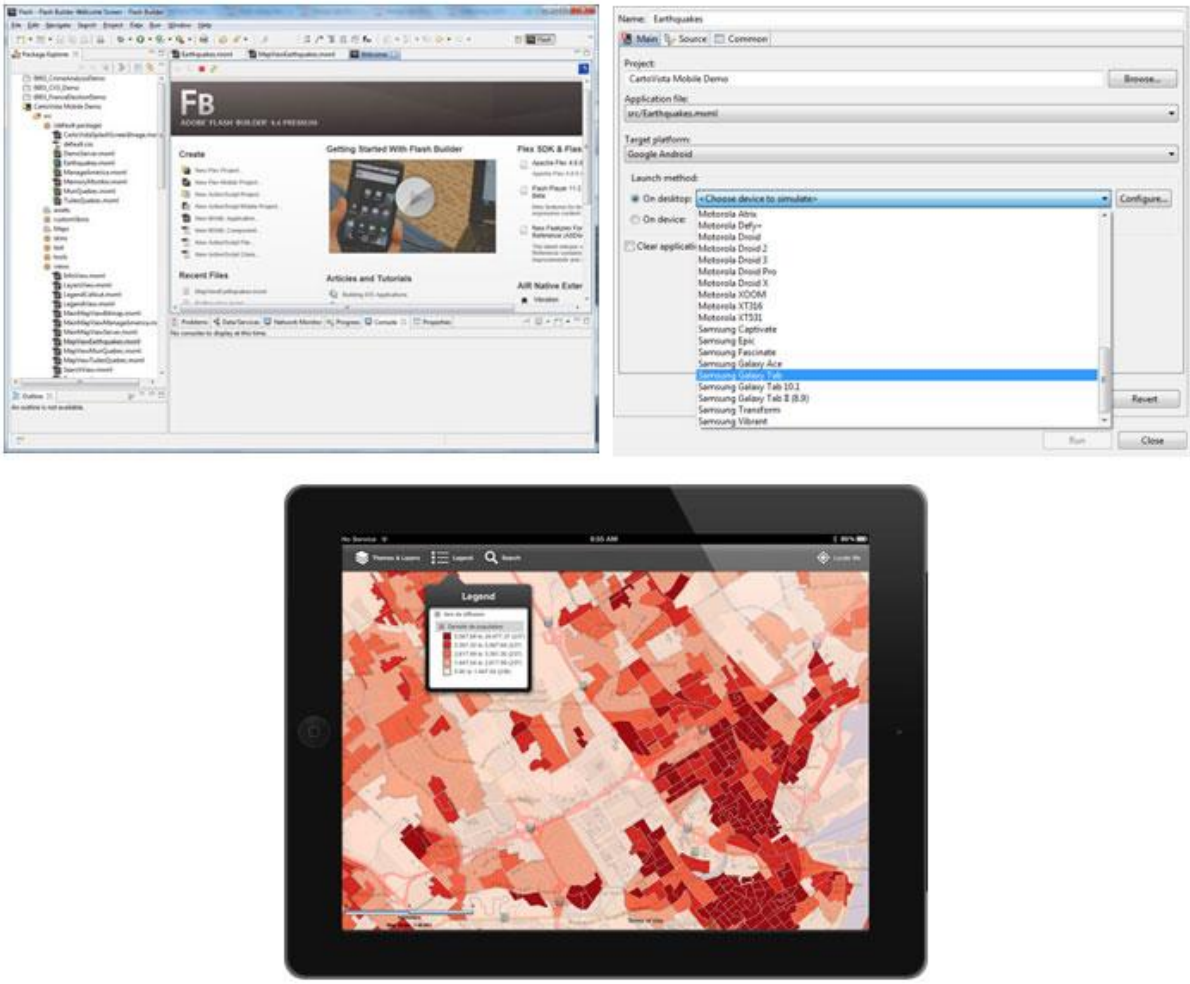
DBx GEOMATICS inc., Engineering, Gatineau, Canada

A full-length version is available and can be opened here:

_extendedAbstract\235_proceeding.*

1. Introduction You might be surprised when you attempt to access your browser-based web mapping site on a smart phone and discover that your content is not laid out or perform as you had envisioned; and as you try to alter your content so that it's displayed equally well on the desktop as it is on a smart phone or tablet, you will discover that there are some important challenges to overcome. With the proliferation of smartphones and tablets, mobile applications provide an opportunity to deliver the richness of an immersive mapping experience, similar to the desktop, with the addition of GPS-enabled functionality. **1.1. The Mobile Application Design Challenge** Making your map application device-friendly is quite challenging when you take into consideration performance, screen size and interaction.

Smartphones and tablets have fewer hardware resources than desktop computers today—less RAM, CPU power, GPU resources, etc. As the mobile applications continue to proliferate and reach more devices, developers need to adopt techniques for authoring with multiple screen sizes and resolutions in mind. The application user interface should anticipate touch-based input, accelerometers, screen orientation, etc. and shouldn't assume the presence of a physical keyboard or mouse. Several techniques within Adobe Flash Builder and AIR can help developers author content that will render properly on any device, regardless of its screen resolution and pixel density. As an open source framework, Adobe Flex offers a very rich environment to help developer design their user interface with ease, with a high quality application debugger and profiler. This paper provides step by step examples of how to build mobile mapping application with Adobe Flash Builder and CartoVista, targeting Apple iOS (iPad/iPod/iPhone), Google Android and Blackberry devices. The presentation will first introduce the design patterns differences between mobile and browser-based applications while reviewing the challenges to create a seamless, predictable experience between the end users and the cartographic content. **1.2. Map Navigation and Basic User Controls** Today's smartphones and tablets are becoming predominantly touch-screen devices for any native applications. The Adobe AIR gesture support allows zooming and panning the map while taking advantage of the direct tactile experience that touch screens enables. **1.3. Searching and Querying** When working with the map, mobile end users are expecting to be able to tap on map features to retrieve attribute information. Callout components are available in the Adobe Mobile framework to provide rich data tips while views can be used to layout detailed information about map features. **1.4. Using Local Data & Accessing the GPS on the Device** Being able to work with a mapping application without relying on a network connection is an important advantage, especially for data entry related operations in the field or disconnected data querying. Packaging data locally is possible in Adobe AIR using a SQLite database. Map tiles can also be installed in a SQLite database that is packaged with an application to run locally without a network connection. The Geolocation API in Adobe AIR provides a high-level interface to access the geographical location information of the device. When the location of the device changes, your application can receive updates, including information on the altitude, accuracy, heading, speed, and timestamp. **2. Conclusion** This presentation has walked through the steps necessary to eliminate the various potential points of variation so that you can create a mobile mapping experience that is similar to the desktop, while leveraging the innovative capabilities of mobile devices. The methods and code samples in this presentation will help developers and cartographers understand how to build map applications that are well-suited for mobile and tablet devices while leveraging the benefits of today's mobility.



iPad Application Design:

Adobe Flash Builder Interface – Development environment and Desktop Device Emulation, CartoVista Mobile Sample Map: Range Thematic Analysis – iPad Device – Gesture-based map navigation and use of icons for menus and actions

iPhone Application Design:
CartoVista Mobile Sample Map on iPhone Device: Range Thematic Analysis – Legend / Theme Selection, DataTip, Detailed Info Window, Layer Control, Search and GPS Button

6F.4 | **Web-based Real-time Mapping of Fine Particulate Matter Pollution** (#778)

X. Liu, H. Zhang

Nanjing Normal University, Geography, China

Particles less than 2.5 micrometers in diameter (PM2.5) are referred to as "fine" particles and are believed to pose the largest health risks. Health studies have shown a significant association between exposure to fine particles and premature mortality (EPA). Concern over ambient fine particulate matter (PM) pollution is becoming more prevalent in the modern world due to its potentially harmful effects on the human health and the environment (Wang *et al*., 2009). Canadian researchers created a PM2.5 concentration distribution map from two NASA satellite instruments with information about the vertical distribution of aerosols from a computer model. The map shows very high levels of PM2.5 in Eastern Asia (NASA). In China, Ministry of Environmental Protection published new version of Ambient Air Quality Standards in 2012, firstly setting the level of PM2.5 at annual 35μg/m3 and 24-hour 75μg/m3. The standard is planned to implement from 2016. At present, only several big cities in China, such as Beijing, Shanghai, Guangzhou, etc., built round based monitoring system for PM2.5 measurement. The prime goal of the present study are to develop a web-based mapping system to store, access and display on-site measurement data sources of PM2.5 pollution near real time, and to provide intuitive visual interface for local government and public administration in air quality control to better meet the expectation of the public and policy makers. In this work, the study area is Jiangsu province (Eastern China). Jiangsu province has a latitudinal span from 30°46' to 35°08' N and a longitudinal span from 116°21' to 121°54' E. Jiangsu is very flat and low-lying, with plains covering 68 percent of its total area. Its southeastern and northern parts are surrounded by mountains, and a vast plain spreads across the center of the prefecture. It’s an economically developed area in China. Consequently, Jiangsu province is one of the highest regions in PM2.5 pollution. PM2.5 data were acquired from 72 PM2.5 monitoring stations geographically distributed throughout the study area (Figure 1). The time duration of data collection was one hour in real time. Data updated automatically every hour. The relevant dataset column fields which were used in preprocessing included the latitude and longitude coordinates of monitoring location, date, hour, measurement value and corresponding air quality category. The air quality was classified into six categories based upon PM2.5 values, indexed as in table 1.

PM2.5(μg/m3) 24-hour	Air Quality Category	Color description
0-34.9	Good	Green
35-74.9	Moderate	Yellow
75-114.9	Unhealthy for sensitive Groups	Orange
115-149.9	Unhealthy	Red
149.9-249.9	Very unhealthy	Purple
>250	Hazardous	Maroon

This work made use of Kriging regression method to study PM2.5 patterns, with spatial resolution at 1x1 km2. The air quality maps were produced based on air quality categories, and dynamic rendering with time series vary. See Figure 2. This study proposed an approach to provide real-time air quality information in Jiangsu province by using web-mapping techniques. We developed a web-based mapping platform for PM2.5 visibility every one hour by using continuously updating measurement data on-site. In the future study, we aim to explore advanced spatial and temporal interpolation techniques for more promising estimation of PM2.5 pollution through incorporating satellite data, meteorological data by heterogeneous data sources integration techniques. References http://www.epa.gov/ttn/naaqs/pm/pm25_index.html http://www.nasa.gov/topics/earth/features/health-sapping.html W. Pang, G. Christakos1, J-F Wang. 2009. *Comparative spatiotemporal analysis of fine particulate matter pollution. Environmetrics*, Published online in Wiley InterScience. Ministry of Environmental Protection. 2012. Ambient Air Quality Standards. GB3095-2012: 9.

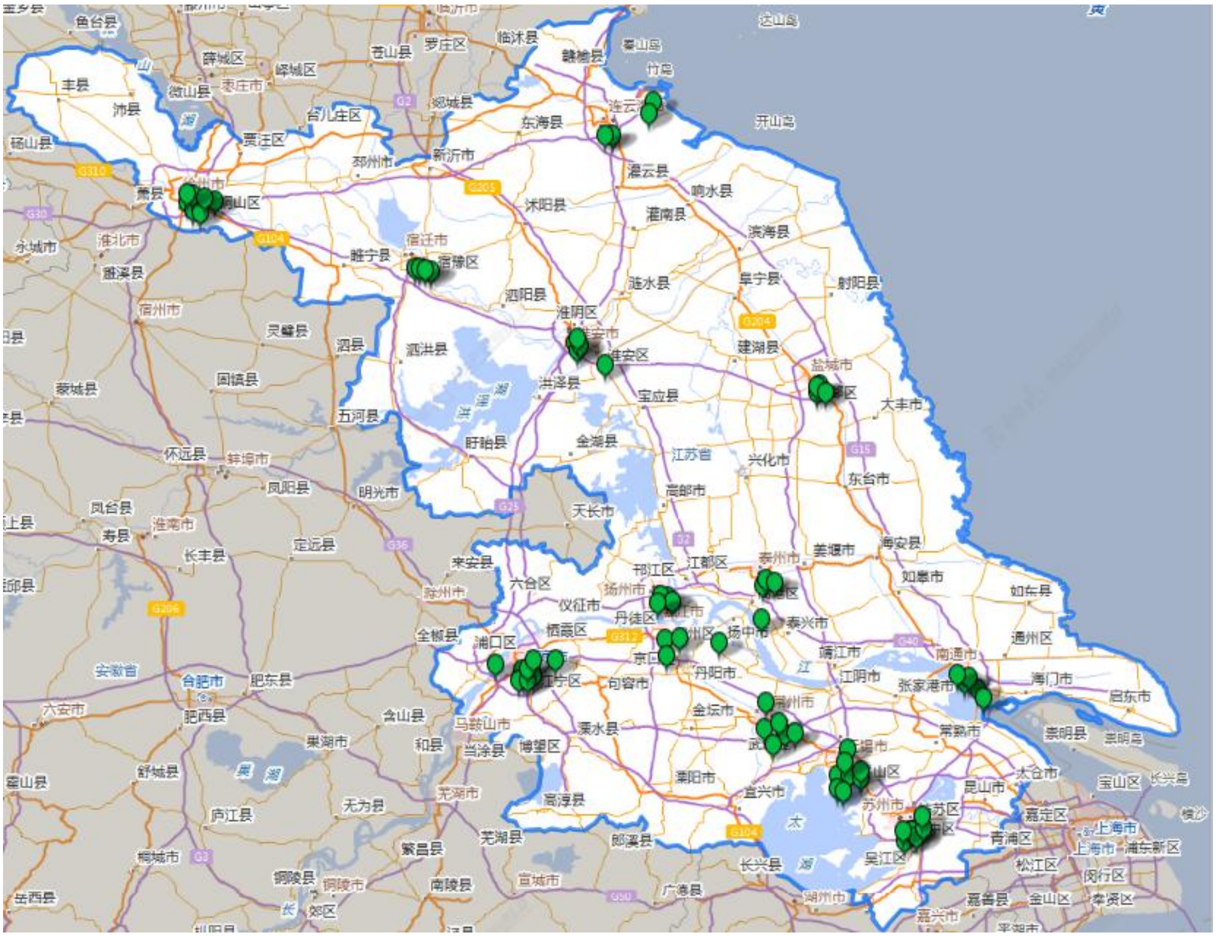


Figure 1:
Geographical distribution of the PM2.5 monitoring stations in Jiangsu province

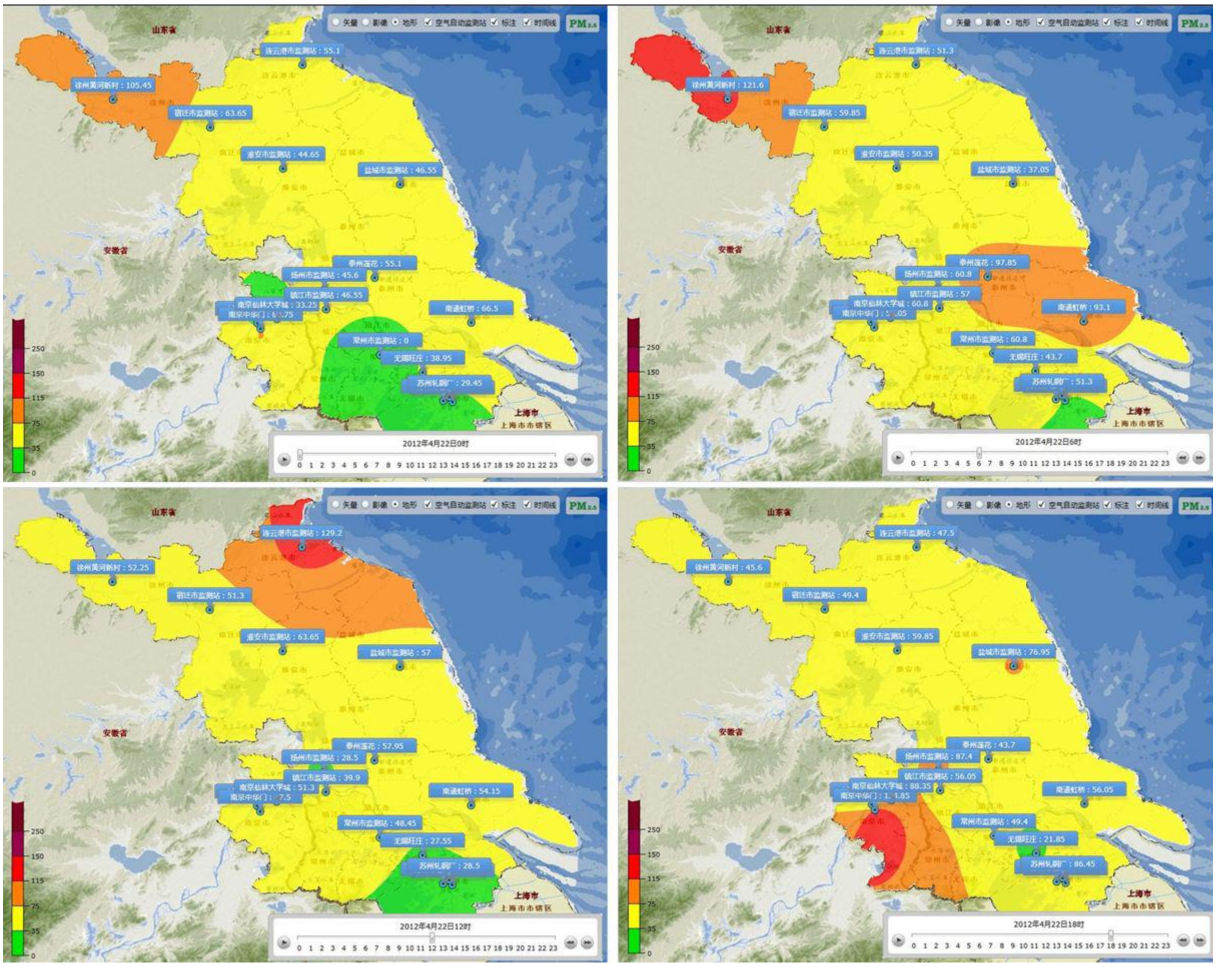


Figure 2:
Subset of air quality maps at different times

ORAL

Session S6-G

History on Maps

Tuesday, 27 August, 2013

16:30 - 17:45

6G.1 | **PARADIGMATIC TENDENCIES IN CARTOGRAPHY AND MAPPING DURING THE SCIENTIFIC AND POSTMODERN PERIODS** (#1069)

D. P. Azócar Fernández

Universidad Tecnológica Metropolitana, Cartografía, Santiago, Chile

A full-length version is available and can be opened here:

_extendedAbstract\340_proceeding.*

A theoretical revision in cartography and mapping since 1950s until today demonstrates many tendencies which can be considered as paradigmatic in Kuhnian terminology. This study incorporates the idea or concept of paradigm which has been taken from epistemology of sciences and consequently this concept opens a space to analyze cartography in terms of a paradigm shift. Inside of the contemporary cartography this study covers from traditional until post-modernist cartography. The first period includes a scientific cartography (from A. Robinson until A. MacEachren) which presents the following cartographic tendencies: cartographic language, cartographic communication, analytical cartography, cartographic visualization and cyber-cartography (D. Fraser Taylor). These mentioned tendencies have their own study object, methods and techniques (or approaches) and specific cartographic products as results. Linguistic-semiotics, perceptual-cognitive, analytical-mathematical and cognitive-semiotics approaches have prevailed during the development of the scientific cartography. On the other hand, in a second period alternative tendencies have been established especially since 1980s which are framed in a post-modernist context. Critical cartography arises with J. B. Harley and his successors offering an optional cartography and mapping in comparison with the scientific point of view. Also in this so-called postmodern period, post-representational cartography is presented as another alternative trend to the scientific perspective of the discipline. In this way, approaches such as hermeneutic-deconstructivist and ethnographical-processual are risen. According to the difference of the approaches, study objects, research aims and results, all these tendencies can be considered as paradigmatic shifts during the developing of the discipline.

6G.2 | **Visualizing in historical context: the study of the Dresden map of Hungary from the 1570s** (#1091)

Z. Török

Associate Professor, Cartography and Geoinformatics, Budapest, Hungary

A unique geographical map of Hungary, made by Italian military architect in Vienna in the 1580s, is preserved in the Dresden copy of the fortification atlases in the Saxonian State Archives. This paper introduces its historic, social and cartographic contexts, and demonstrates its relation to other contemporary maps, including works that have not been survived. Beyond the study of the content and geometric structure of this remarkable map, we also explore the ways how this early map can be visualized by using modern cartographic and media technologies. The presentation first explores the contexts of the plans, views and maps made in the sixteenth century by a group of Italian military architects, scholars and painters in the Habsburg court in Vienna. We focus specifically on the fortification atlases produced in the 1560s and 1570s by the Angelini family, to study how their work relates to traditional and contemporary Italian art and architecture and also to Northern European Renaissance cosmography and mapping paradigms. These systematic collections integrate conventions of pictorial and mathematical representation, ichnographic and perspective city plans, as well as chorographic and geographic maps in attempts to achieve comprehensive vision of the Habsburg-Ottoman military border zone. In particular, the depiction of fortified cities and their environment on chorographical maps requires the reconsideration of the integration of Italian and Northern visual traditions within mapping practices and in different cultural and social contexts. The title of the manuscript map of Hungary — Superior Vngaria - Nicolo Angielini — identifies the original mapmaker, and this is the evidence that it is directly related to the Italian master builders, who worked on the modernization of the medieval border fortresses in Hungary, Austria, Croatia, Slovakia. Natale and Nicolo Angielini, who were commissioned to undertake this grand cartographic enterprise, were master builders and worked closely together with other Italians. They responded to the challenge with exceptionally productive and original mapping activity. Documents of the cartographic output of this family workshop are preserved mainly in the form of five manuscript atlases in Vienna (two copies), Dresden (two copies) and Karlsruhe. The Italian master builders worked in the context of the Habsburg imperial cosmography, a tradition going back to the late-fifteenth-century mathematical-astronomical school in Vienna. Although neither scholars nor artists but master builders (Paumeister), they nonetheless adapted the conventions of architectural surveying and drawing and of pictorial art to their own imagery. Similarly, the graphic representations of the fortifications do not follow the principles of leading Renaissance architects or artists. The large map by Angielini is a detailed and accurate depiction of the topography of Hungary. However, as an early map it does not readily fit into the standards of modern cartography (eg. The geographical grid is missing and this makes georeferencing especially problematic.) The analysis and interpretation of its content is possible only by the historical approach suggested in this paper. The map is interpreted in the technical and historical contexts of its making, especially regarding the contemporary mapmaking practices. To visualize the data base a series of historical visualizations were created, each of them facilitating interactive visual exploration of the maps' information and data content in a cognitively relevant spatio-temporal context. The novel visualization methodology, rarely used in conjunction with historical maps, provides new possibilities for the interpretation of early maps by both specialists and novice users.

The Dresden map of Hungar:
Angielini's manuscript map of Hungary c. 1578

6G.3 | **Atlas of Fortresses of the Russian Empire in the Map Collection of the Russian State Library** (#1070)

L. Zinchuk[1], L. Zinchuk[2], L. Zinchuk[3]

[1]Russian State Library, Map Department, Moscow, Russia; [2]Russian State Library, Map Department, Moscow, Russia; [3]Russian State Library, Map Department, Moscow, Russia

The history of map collection in the Russian State Library is closely tied with the history of the Moscow Public Library of Rumyantsev Museum that was opened in 1862. Maps and atlases have been stored in the Library since its opening. Maps, plans and atlases along with books and journals formed the core of the library collection of Count Rumyantsev. Later on, his collection was complemented with several dozens of private collections which belonged to the Russian statesmen, diplomats, enlighteners, patrons of arts and literature, scholars and geographers. At present time, the collection of the Russian and foreign map and atlases comprises about 200,000 specimens. Its content is unique and illustrates the entire history of the Russian cartography. Russian military topographers made a great input into a development of the Russian cartography. Their work resulted in releasing of such masterpieces as ‘A Detailed Map of the Russian Empire’ more widely known as ‘The Hundred-Page Map’, a magnificent ‘Military Topographical Map of the Peninsula of Crimea… Compiled by Major-General Mukhin’, the ten-verst maps of F.F. Shubert, ‘The Special Map of the European Russia’ developed under the supervision of I.A. Strelbitsky, maps of general land survey issued under the guidance of General-Lieutenant Mende, and finally, the famous ‘verst-maps’, i.e. large scale topographic maps. Manuscript plans of fortresses issued in a single copy form a specific category of military maps. Several unique sets of such documents stored in the libraries and archives in this country were described in scientific publications. Among these rarities ‘An Atlas of Fortresses of the Russian Empire (Sankt Petersburg, [183.])’ could undoubtedly be mentioned. The ‘Atlas’ is stored in the Map Collection of the Russian State Library. The ‘Atlas’ consists of 60 standalone sheets of a small format grouped in 11 books per military districts. The books are kept in a leather folder decorated with a gold lettering. Each sheet is a manuscript water-colour plan of a Russian fortress. All the sheets are glued to a calico and accompanied with labels to indicate a fortress name and class. All the plans are developed at the same scale of 200 sazhens to an inch (168m: 1cm). The relief is portrayed by shading and the cardinal points - by arrows. The ‘Atlas’ was compiled for Tzar Nikolay I and was passed on to the Library together with his private collection. The Romanovs’ dynasty was an official patron of the Library and its members were regularly donating their private collections to it. The materials from these collections became true treasures of the Library.

6G.4 | **The contentious border between Padua territory and Venice as represented by the cartography of 16th-18th century** (#962)

S. Piovan[1], F. Benucci[2]

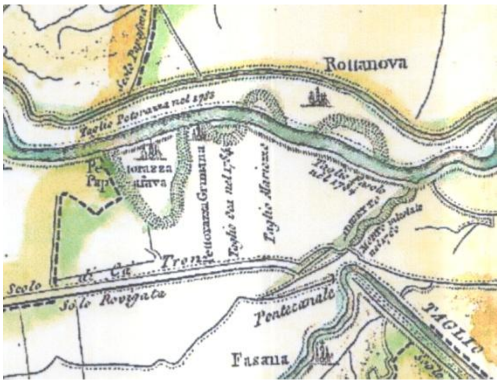
[1]*University of Padova, Department of Historical Geographical and Antiquity Sciences - Geography Section, Italy;* [2]*University of Padova, Department of Historical Geographical and Antiquity Sciences - History Section, Italy*

A full-length version is available and can be opened here:

_extendedAbstract\311_proceeding.*

Padua was ruled by the powerful Da Carrara family from 1318, after many territorial conflicts passed under Venetian rule in 1405 and so mostly remained until the fall of the Venetian Republic in 1797. The conflicts between Padua and Venice continued between private landowners and the State. The study area, located around Volta Pettorazza, about 40 km southwest of Venice, is of particular interest because, during the time, was claimed by several contenders due to its strategic proximity to Adige River and the salt flats located behind the southern Venice Lagoon. This work presents how the diachronical analysis of historical maps provides an important contribution in a geo-historical reconstruction of the contentious border and the frontier area with examples from 15th-18th centuries. The map of Squarcione (15th century), published by Sertorius Orsato in 1678, represents the fortifications along the Adige River constructed by Venice in order to defend the salt trade and to prevent the southeastern spread of Padua, already dominating the Rovigo area. The contention fell into the "Borders War" (1373): the map of Ottavio Fabris (1587) represents the border traced in 1374 by the winner (Venice). The border was moved again, this time in favor of Padua, after the War of Chioggia. After the inclusion of Padua territory within the Venice Republic, the Benedictine monks of Corte di Correzzola, that reclaimed a big part of the Paduan lands between Bacchiglione and Adige Rivers, were continuously in civil judgement on their boundary. In 1513, upon the payment of a large sum of money, needed by Venice for the war against the League of Cambrai, the monks legitimized their land holdings in Dogado. In 1519, conversely, the agreement was revoked and the Council of Ten established a commission to redefine the boundary that was named "Malipiero line" after the member of the commission senator Alvise Gasparo Malipiero. It mainly recovered the border of 1374 but the dynamics of the fluvial processes related to the Adige River mandated some modifications in the position of the border stones in Volta Pettorazza and elsewhere. The map of Fabris (1587) shows also the "Malipiero line" of 1519 that reduced significantly the monks' properties, increasing the Venice Republic amount of reclaimed lands. In 1539, the Venetian Senate forced the monks to build a moat that was running along the edge of the "Malipiera line": this channel, called Rebosola, nowadays signs most of the present border between the provinces of Padua and Venice. Nevertheless, the comparison between the Formaloni Map (1776), drawing Pettorazza as the first village of Dogado (Dorsoduro district, Podestaria of Cavarzere) and that of Valle (1784) representing it as the last of "Padovano" territory (Vicariate of Anguillara), endures the ambiguity in the definition of the border. Milanovich (1786) and Valle (1801) maps show Volta Pettorazza also as an emblematic case of river regulation. In 1783, the government of the Venetian Republic performed here the largest ever meander cut-off on Adige River to preserve the surrounding area by the floods. Before the meander cut-off, the current village of Pettorazza Grimani was divided by Adige River into two distinct parts: Ca' Grimani on the right bank and proper Pettorazza (Papafava), on the other. The two villages take their name from the noble families (Grimani and Papafava, Venetian and Paduan respectively) who had estates in those areas. The municipalities merged together in 1807 and became part of the province of Rovigo in 1815. Thus, the lands in Volta Pettorazza that once upon a time were nominally part of the city of Venice (Dorsoduro district), fell in a territory considered marginal: geomorphological and economical depressed. The discussion about reorganizing province borders is a current affair in Italian politics. The cartographical representation of Venice Region provinces on popular media recalls the ancient disputes treated in this abstract.

Map of Fabris (1587):
Excerpt of a copy (1661) of Fabris Map (1587). In orange is represented the border of 1374 whereas in yellow that of 1519 “Malipiero line”. North is below.



Map of Valle (1801):
Excerpt of the Giovanni Valle map (1801). The meander cut offs on Adige River around Pettorazza Grimani are shown. The border between Venice and Padua is also represented with the dotted line coloured in yellow and green.

ORAL

Session S6-H

Mixed Session

Tuesday, 27 August, 2013

16:30 - 17:45

6H.1 | **Geospatial Service Web: Sharing More Than Geospatial Data for Education and Collaborative Research** (#750)

J. Gong, H. Wu

Wuhan University, LIESMARS, China

The past decade witnessed a great data explosion in geospatial information science. As data size increases, it become a critical issue to share data between scientists either within a research group or with wide-area distributed scientists all over the world. Now, the development of the Internet, Web services, high-performance computing, networking, and other distributed technologies make it possible for us to go further. While data, hardware, software are still major resources that scientist can share with each other, scientific knowledge and processing models can also shared through the Internet. What's more, it may become a new pattern of scientific research collaboration that research works are mostly done through service-oriented mechanism. These services include but not limited to data acquisition, data processing, model creating, model combination and sharing of research findings. Based on the above idea, this paper presents a prototype platform of geospatial Cyberinfrastructure, Geospatial Service Web (GSW). GSW integrates various geospatial-related resources through the Internet and Web Service technologies. GSW supports live and visual sharing of geospatial data, information, knowledge and processing models. What's more, GSW provides online tools for editing, validating, deploying and executing geospatial web service chains (GWSC), so that end users can design specific domain-related models by using available online web services and share the models with other end users. GSW is based on Service-Oriented Architecture (SOA) with three layers. The back layer consists of all geospatial resources available on the Internet. These resources include geospatial data, information, processing functions, geospatial sensors etc. All these resources are provided through web service technology with standard interfaces such as OGC Web Map Service (WMS), Web Processing Service (WPS) etc. The middle layer is a registry center. A catalogue of web service resources are maintained in a database. Geospatial resources on the Internet are either passively crawled to this center or actively registered by service providers. This center not only supports real instances of web processing services, but also supports abstract services such as complex models combined from web services. These abstract services can be executed by being instantiated on run-time. The front layer is a portal consisting of a series of client tools for browsing resources, editing and deploying GWSC, sharing resources by uploading resources or registering services, user accounts management etc. The kernel of this portal is the GWSC tool – GeoChaining, which provides a visual user-interface for end users to edit, validate, deploy and execute GWSC by drag-and-drop operations. Any validated and deployed GWSC can be further registered to the center so that the GWSC can be either run by other end users or embedded in other even more complicated GWSC when created. This actually provides an essential mechanism for GSW to grow up. When more GCWSs are available in GSW, the geoprocessing models will grow not only in the number of models, but also in the complexity of models.

6H.2 | **Structural Analysis of Urban Areas in Germany from the Perspective of Sustainable Compactness - Representation in a Map Series** (#742)

U. Schumacher, A. Bräuer, M. Behnisch

Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

Within the actual debate on sustainable development of cities the general concept of resource efficiency (enhancing the quality of life while minimizing resource consumption) revives the discussion on density and urban form. Urban compactness is often discussed as a key indicator of resource efficiency. On closer examination this opens a door to a much more diverse and controversial debate, which includes aspects of environmental quality and quality of life. The research described in this paper has the objective of producing a series of maps of a comprehensive settlement structure analysis making use of analytical tools originally developed in landscape ecology. To undertake the analysis a matrix was created which combines objectives of “good” urban development and physiognomic characteristics of settlement structures. The principles are formulated as theses which are underpinned by an indicator based approach to analyse the physiognomy of settlement structures. The principles of urban development included in the matrix and their relationship to physiognomic aspects of settlement structures were discussed in detail in an interdisciplinary team of architects and urban planners. The accessibility of recreational areas and open green spaces, the concentration of industrial areas, the identification of urban sub-centres, the density of built-up area and shading are examples for the touched aspects. The matrix is used to derive relevant indicators, such as the jaggedness of the urban area to describe the complexity of shape. The urban area as generalized shape of built-up areas is an important part of the analysis of cities. By applying spatial metrics techniques (landscape indices) on the urban environments these indices help to bring out the spatial characteristics in urban structures. In order to describe the spatial characteristics of settlement structures at first indicators need to be examined regarding their suitability to explore the physiognomy of settlement structures. Later on the following categories of indicators are considered to be relevant: complexity of shape, heterogeneity, core areas, proximity, diversity, edge ratio and splitting. In addition, principles of urban development concerning buildings are included in the thesis, using parameters such as heights, distance, proportion of built-up surface area etc. Other important aspects included in the analysis are building types used to examine correlations between certain physiognomic aspects and characteristic urban forms. All indicators derived in the project are tested using geo-information systems and official spatial base data. As area of investigation selected German urban municipalities contrasting settlement structures were chosen. Important results of the theses (principles of urban development) will be represented in a map series together with the relevant geometric data on settlement structures for all examined urban municipalities. A uniform map layout was designed according to the demands of urban planners and architects. Results on city level are represented in a 1:100.000 scale, details on the level of city districts are visualized in a 1:25.000 scale. Future research orientates on the assessment and evaluation of urban form in the light of “sustainable compactness”.

6H.3 | **HOLOGRAM : THE FUTURE OF THE CARTOGRAPHIC PUBLISHING** (#514)

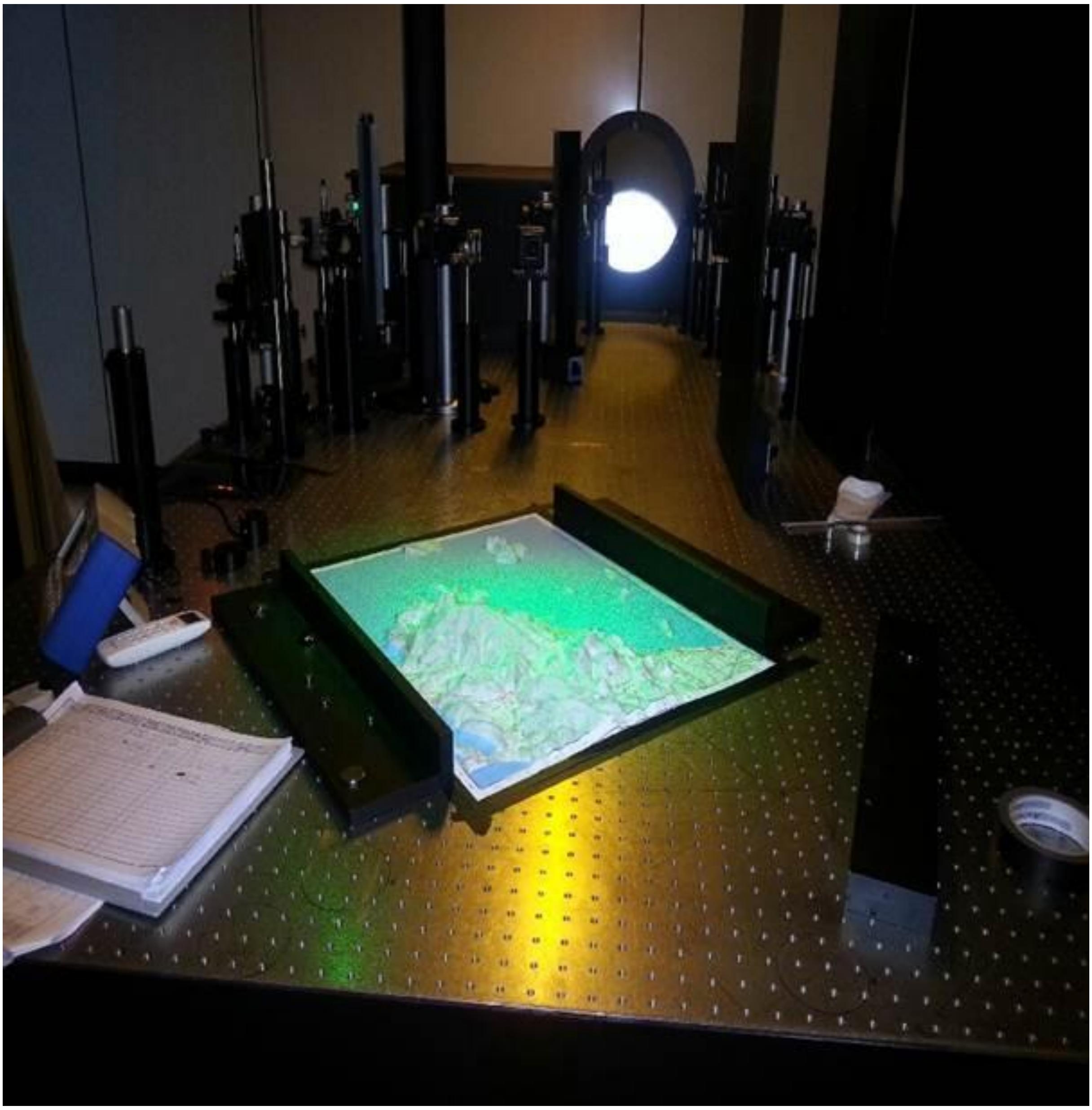
P. Dalkiran[1], S. Lee[2], S. C. Park[3]

[1]General Command of Mapping Turkey, Cartography Department, ANKARA, Turkey; [2]Kwangwoon University, Dept. of Holography and 3D Contents, Seoul, Korea Republic (South); [3]Hangyo International Corp., R&D Center, Seoul, Korea Republic (South)

A full-length version is available and can be opened here:

_extendedAbstract\254_proceeding.*

Dr. Denis Gabor most probably could not think of every usage of the hologram when he invented, but he might have a strong feeling that he opened a new window for human being. History shown that it was not only a scientific discovery, but also it led to a new philosophical explanation of the universe. Although it has not been a century, the technology of the holography already passed the horizon of his vision. Countless invention and application on holography have had remarkable influence on our daily lives. We have been using holograms in many places such as security, entertainment, measurement, training and so on. Why wouldn't we use it for our most essential need which was map? As a cartographer we have been discussing this question for more than ten years. Finally, we could achieve to find a new way of presentation of cartographic productions. The restrictions of the conventional medium, the paper, have not obstructed the cartographers to manufacture more visual contents and cognitive products, by using the power of the computers which is unquestionable. The rise of Paper-Era is reaching the saturation point and has been limiting the artists, publishers and cartographers. In this article, we will discuss the usage of holography in a cartographic perspective; interrogate the advantages and disadvantages of the hologram as a hard copy medium, evaluate a prototype of holographic map which is developed by General Command of Mapping,Turkey and finally what we suggest the future of cartographic publishing.



Hologram Map Producing:
Holographic Process of a Raised Relief Map

6H.4 | **BTN100/BCN200: Collaborative framework for cost optimization** (#1173)

J. A. Merino Martín[1,2], J. González-Matesanz[1,3], T. Gullón Muñoz-Repiso[1], Á. D. C. Ruiz Ramírez[1], J. L. Sánchez Tello[4]

[1]*MINISTERIO DE FOMENTO, INSTITUTO GEOGRÁFICO NACIONAL, Madrid, Spain;* [2]*UNIVERSIDAD POLITÉCNICA DE MADRID, E.T.S.I. CAMINOS, CANALES Y PUERTOS, Madrid, Spain;* [3]*UNIVERSIDAD DE ALCALÁ, MATEMÁTICAS, Alcalá de Henares, Spain;* [4]*MINISTERIO DE DEFENSA, CENTRO GEOGRÁFICO DEL EJÉRCITO DE TIERRA, Madrid, Spain*

A full-length version is available and can be opened here:

_extendedAbstract\398_proceeding.*

This article offers a global view of the geospatial production in a collaborative framework between the National Geographic Institute (IGN) and the Geographic Center of the Army (CEGET). This is a multipurpose environment that pursues the production of printed and digital cartographic products at small scales (1:100.000 to 1:400.000). This agreement was signed on the 25th of November 2010 establishing a collaborative approach for harmonized production of official series produced by the National Geographic Institute of Spain (IGN-E) and the Army Geographical Centre (CEGET). It should be noted that this project is an explicit statement of the National Cartographic System by the agencies assigned to both Ministry Departments, Public Works and Defense, nowadays incorporated into the 14/2010 law of July the 5th about Infrastructure and Geographic Information Services in Spain. This law transposes part of the INSPIRE Directive. Consequently this collaborative agreement intends to adapt their production systems for Spatial Data Infrastructure (SDI), Geographic Information Systems (GIS), as well as a printed cartography to ensure a better organization of public services and geographic information mapping on the basic principles of cooperation and coordination between authorities in the matter. Within this environment and in a cooperative way, a common topographic database will be produced and it will be the basis to obtain the different series and specific cartographic databases for each institution directly. This common core is known as the National Topographic Data Base at 1:100.000 scale (BTN100). The collaborative framework does not present a single database, since there are a wide range of scales involved, and its purposes are many. For this reason we decided to get a new National Cartographic Data Base at 1:200,000 scale (BCN200) obtained from generalization and edition of the BTN100. Thus BTN100 is eminently topographic; their applications are mainly for GIS, like the National Geographic Information System (SIGNA), or SDI, like the Spanish Spatial Data Infrastructure (IDEE). Furthermore BCN200 aims cartographic tasks since it is the basis for the production of the Thematic and Derived Mapping Plan series produced by the IGN or the NATO series produced by the CEGET: The Province Map at 200k (MP200), the NATO Serie 250C, the Spanish Map at 500k (ME500). In order to crystallize the INSPIRE values, BTN100/BCN200 have incorporated information from several sources: Boundary Data Base managed by the Mapping Central Registry, the Geodetic Data Server by the Geodetic Observation Center, the Interactive Official Road Map by the Public Works Ministry and some information from the Corine Land Cover project by the Land Observatory. The rest of the information has been obtained by re-engineering processes from the old data model.

ORAL

Session S6-I

Mixed Session

Tuesday, 27 August, 2013

16:30 - 17:45

6I.1 | **Methodological approach for the development of an Algerian NSDI according to international standards (ISO, W3C, OGC, OMG) enriched by a spatial dictionary adapted.** (#198)

T. Aouameur[1], A. Benahmed Daho[2]

[1]National Institute of Cartography and Remote Sensing, Defence Ministery, Algiers, Algeria; [2]National Institut of Cartography and Remote Sensing, Defence Ministery, Algiers, Algeria

A full-length version is available and can be opened here:

_extendedAbstract\30_proceeding.*

The establishment of a National Spatial Data Infrastructure represent significant added value as leader initiative, to facilitate access to spatial data beyond the boundaries between organizations (public and private); ensure the diffusion and promotion of geographic information; sharing of expertise; acquisition and provision of geographic products and databases; the identification of existing spatial data and metadata; and improving accessibility and interoperability ...etc. Beyond the inescapable statutory definition, this approach is part of a dynamic pooling, which will have a significant impact on the way will be used geographic information systems identified within the producer organisms of geospatial data. The National Institute of Cartography and Remote Sensing (INCT) as the largest producer of Geographic Information in Algeria, has initiated a national reflection around the NSDI through the organization of the first National Conference in October 2012. Many recommendations were adopted, of which the necessity of establishing a National Spatial Data Infrastructure was strongly solicited. To consolidate this initiative, an ambitious project on the definition of a methodological approach of the development of Algerian NSDI, was recently launched and registered as a research project in the INCT. This research presents the results of works on the definition of a methodological approach for the development of a NSDI according to international standards (ISO, W3C, OGC, OMG) enriched by a space dictionary adapted and the establishment of a geoportal around the open source software as (Easy SDI, Geoserver and Geonetwork). The work was carried out in two phases: the first phase is to understand the anatomy of the SDI and adapted it by creating an Algerian profile based on an architecture which defines a full life cycle of a project including all phases and activities according the unified process (UP) using the metamodel SPEM (Software Process Systems & Engineering Metamodel) and UML. The second phase has led to the development of an application using the Open source software.

Algerian NSDI Architectur:
Methodological approach for the development of an Algerian NSDI according to international standards enriched by aspatial dictionary

adapted

6I.3 | **A Hierarchical Random Graph based Selection Method for Road Network Generalization** (#1414)

<u>M. Li</u>
1308, Southwest Jiaotong University, Chengdu, China

[A full-length version is available and can be opened here:](_extendedAbstract\119_proceeding.*)

_extendedAbstract\119_proceeding.*

6I.4 | **GIS mapping and analysis for landing sites of Soviet spacecraft on the Moon** (#715)

M. Baskakova, E. Gusakova, I. Karachevtseva, K. Shingareva

MIIGAiK Extraterrestrial laboratory (MExLAb), Moscow state University of Geodesy and Cartography (MIIGAiK), Russia

We have carried out mapping and GIS-analysis for areas of the landing sites of the Soviet “Luna-16”, “Luna-17”, “Luna-18”, “Luna-20”, “Luna-21”, “Luna- 23”, and “Luna-24” missions, conducted from 1957 to 1975. **1. Introduction** We have used images and DEMs of the Moon, which were obtained from two spacecraft: NASA’s Lunar Reconnaissance Orbiter (LRO) (Robinson et al., 2010) and the Japanese Kaguya (Japan Aerospace Exploration Agency…) to map landing areas of Soviet lunar missions. **2. Mapping results** Using LRO NAC images (LROC…) of resolution 0,5 m/pixel we created maps of selected landing site areas of the Soviet lunar missions at high level of details *(Figure 1).* Then we chose areas measuring on each landing sites and have digitized craters with diameter more than 10 meters. The results of this work will form a catalogue of small lunar craters in selected areas of the lunar surface. For geomorphology analysis we created maps of these areas showing crater spatial densities (Baskakova M. et al. 2012). **Figure 1.** Maps of Soviet landing sites Using the Kaguya DEM of 7 m/pixel resolution we have developed large-scale hypsometric maps of Soviet landing sites (*Figure 2).* **Figure 2.** Hypsometric map of the Soviet landing sites **3. Automatization of mapping process:** We have applied the Kaguya DEM for calculation of surface roughness by means of 5 complementary techniques (Baskakova M. et al. 2012). We used the ModelBuilder ArcGIS application, where roughness models are computed together in one step. A sample of a roughness map is shown on *Figure 3*. **4. New names of lunar objects** Also we have produced thematic maps of the Lunokhod-1 area: a hypsometric map, a map of slopes, a map of spatial craters density, a roughness map, and others (Gusakova et al. 2012). We have used results of GIS mapping and analysis for naming of objects of the lunar surface. Names of craters were selected by Russian names. On June 14, 2012, the new names were included in the Gazetteer of Lunar Names (Gazetteer...). **5. Conclusion** Our work includes several different approaches to the study of Soviet landing sites. Now we are collecting the database of small craters for all landing sites of Soviet lunar missions. In our future work we plan to develop the new high resolution DEMs based on LRO NAC image processing using Photomod software (Zubarev A. E. et. al. 2012) to estimate different parameters of lunar surface of landing sites for more detailed geomorphology analysis. **6. Acknowledgements** This work has been supported by a grant from the Ministry of Education and Science of the Russian Federation (Agreement № 11.G34.31.0021 dd. 30/11/2010) and partly supported by a grant № 14.B37.21.1204 «Develop-ment of an integrated technology of determination the relief statistical cha-racteristics of the planets and moons in the solar system based on DEM derived photogrammetric methods». **References** Baskakova M. et al. (2012) GIS mapping of the territory of the Soviet lunar missions, 3M-S3 Symposium, Moscow Gusakova E. et al. (2012) Mapping and GIS-Analyses of the Lunokhod-1 Landing Site. Abstract of 43-th LPSC Lunar Planetary Science Conference Robinson M. et al., (2010) Lunar Reconnaissance Orbiter Camera (LROC) Instrument Overview. Space Science Reviews, Volume 150, Issue 1-4, pp. 81-124 Zubarev A. E. et. al. (2012), Features of creating DTM for Luna-Glob landing sites, this issiues LROC Lunar Reconnaissance Orbiter Camera. http://wms.lroc.asu.edu/lroc/ rdr_product_select . Accessed 24 October 2012 PDS Geosciences Node Lunar Orbital Data Explorer. http://ode.rsl.wustl.edu/moon/indextools.aspx. Accessed 24 October 2012 Japan Aerospace Exploration Agency. http://www.jspec.jaxa.jp/e/ hottopics/20110908.html. Accessed 24 October 2012 Gazetteer of Planetary Nomenclature International Astronomical Union (IAU) http://planetarynames.wr.usgs.gov/Page/MOON/target. Accessed 24 October 2012

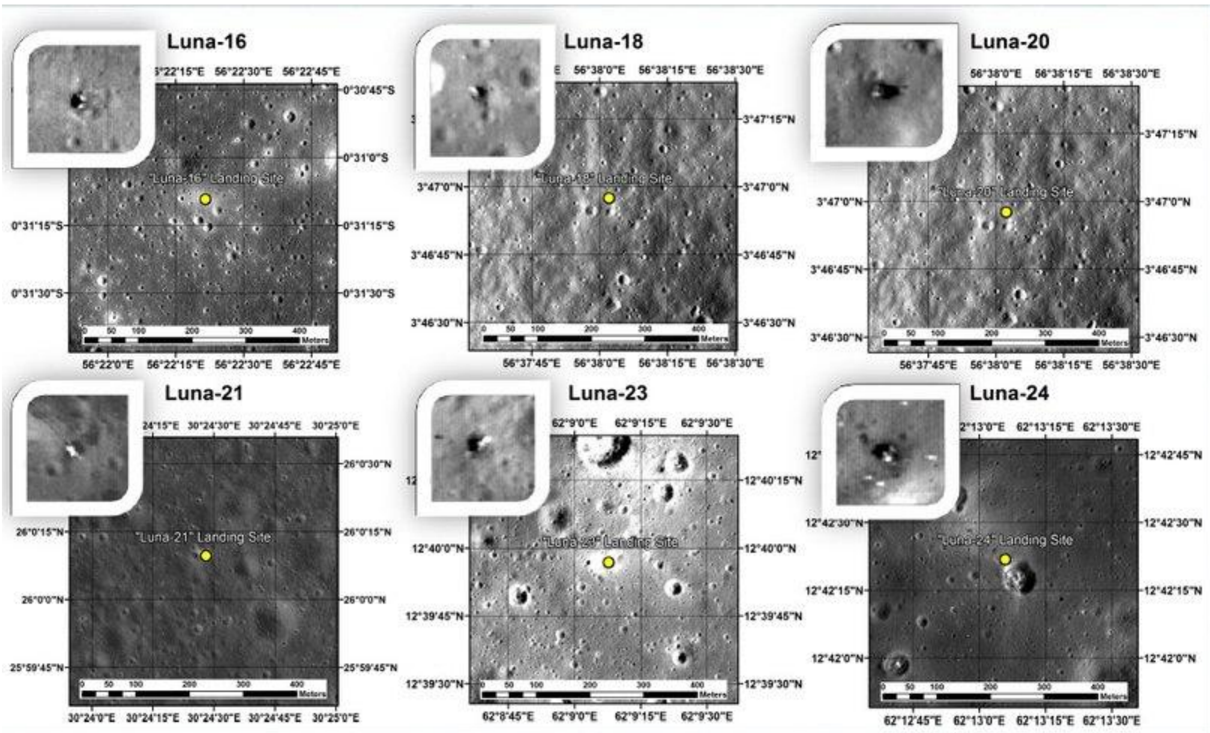


Figure 1:
Maps of Soviet landing sites

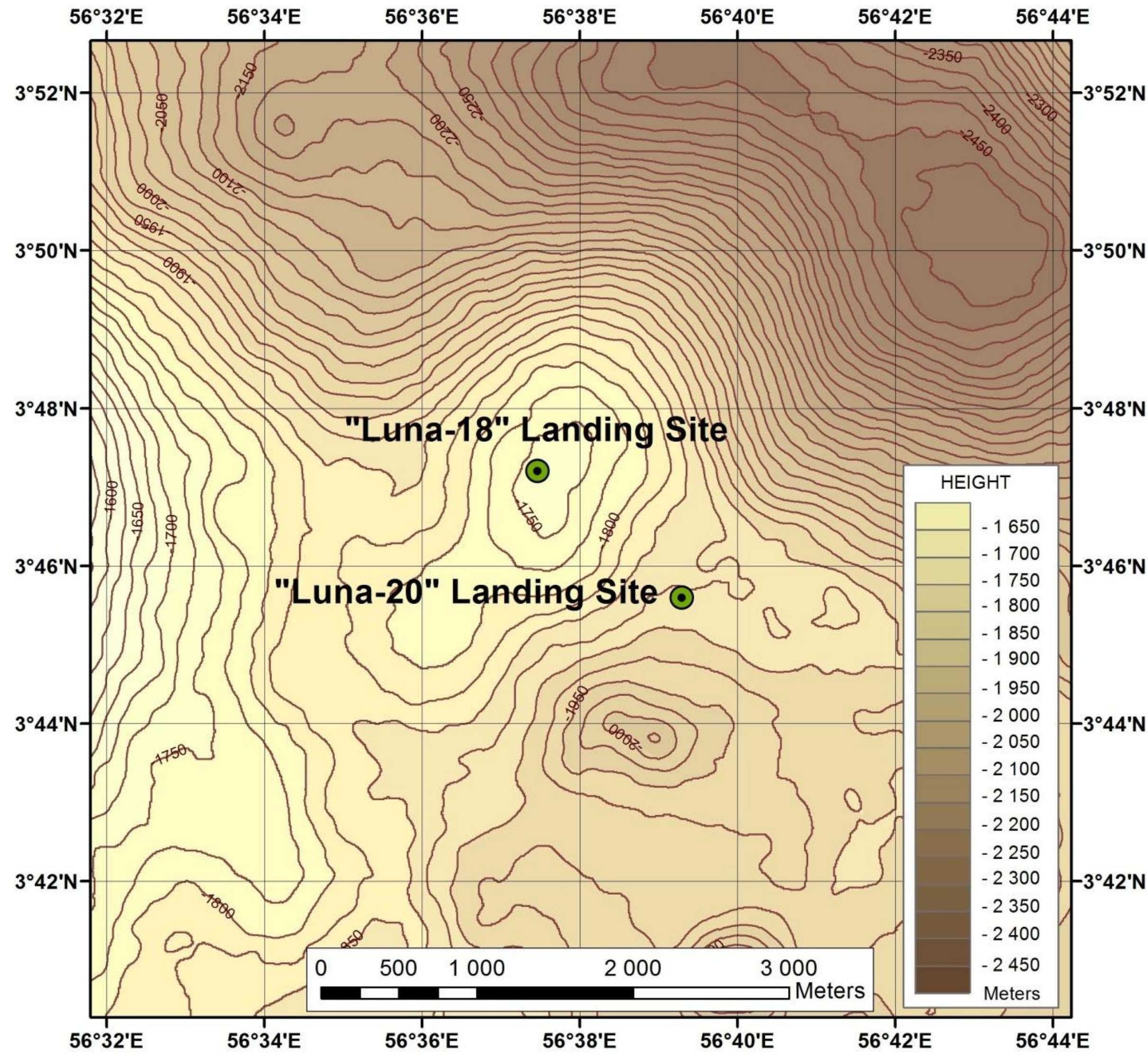


Figure 2:
Hypsometric map of Soviet landing sites

PLENARY

Session KN-4

Transformation of National Mapping Approaches in the Context of Geomatics Democratization

Wednesday, 28 August, 2013

08:30 - 09:15

KN-4 | **Transformation of National Mapping Approaches in the Context of Geomatics Democratization** (#1504)

<u>É. Loubier</u>

Natural Resources Canada, GeoData Acquisition & Management, Sherbrooke, Canada

No abstract or full paper available

ORAL

Session S7-A

Geospatial Analytics 1

Wednesday, 28 August, 2013

09:15 - 10:30

7A.1 | **Land-use monitoring by topographic data analysis** (#1033)

T. Krüger, G. Meinel, U. Schumacher

Leibniz Institute for Ecological Urban and Regional Development, Monitoring of Settlement and Open Space Development, Dresden, Germany

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 220-228

Land consumption is one of the most important problems conflicting with sustainable land use policies aiming in a reduction of the area demand for settlement and traffic. As expression of the political will for a sustainable development the German government stated to reducing the land transition from open space into settlement or transportation infrastructure to the value of 30 hectares per day by 2020. Due to the fact that planning authorities are in the need of correct information on land use, an approach for the calculation of land use by geoprocessing topographical base data is presented in this paper. Since the automation for spatial analysis is on a high level the geoprocessing procedures can repeated regularly in order to realise time series. As a result, the Monitor for Settlement and Open Space Development (IOER Monitor) has been established providing land use information for the whole of Germany.

7A.2 | **CAN ANALYTICAL CARTOGRAPHY SERVE AS A LINK BETWEEN CARTOGRAPHY AND GISCIENCE?** (#1199)

H. Moellering

Ohio State University, Geography Department, Columbus, United States

A full-length version is available and can be opened here:

_extendedAbstract\71_proceeding.*

In recent years some in the ICA have looked at the stated body of knowledge in GIScience, and have seen a need to link to that work closer to the field of Cartography. This is because they see a need to link to such spatial theory and utilize it in the field of Cartography. It turns out that since the 1960s Tobler and many colleagues have developed the area of Analytical Cartography which includes many of these topics in spatial science: * Geographic Map Transformations * Real/Virtual Map Transformations * Deep/Surface Structure * Spatial Primitive Objects * Spatial Data Structures * Spatial Sampling Theory * Map Generalization - 1, 2, 3-D * Spatial Neighborhood Operators * Spatial Frequencies * Spatial Information Theory * Spatial Fractal Operators * Warntz Networks * Irregular Neighborhood Operators * Volumetric Transformations * Shape Analysis * Spatial Semantics and Ontology * Analytical Visualization During the 1990s Goodchild and colleagues led an effort to expand the conceptual base of GIS into what is now called GIScience. After many years of development they have published a Body of Knowledge for GIScience that now includes: * Analytical Methods * Conceptual Foundations * Cartography and Visualization * Design Aspects * Data Mining * Data Manipulation * Geocomputation * Geospatial Data This paper will explore these areas and identify commonalities between them. This will form a basis for the discussion of how Analytical Cartography can serve as a vital link between the fields of Cartography and GIScience that some in the ICA see as a way of enhancing the field of Cartography and facilitating cooperation between the two fields in the future.

7A.3 | **Maps as Research Tools Within a Virtual Research Environment.** (#641)

C. Hanewinkel, **S. Specht**

Leibniz-Institute for Regional Geography, Leipzig, Germany

A full-length version is available and can be opened here:

_extendedAbstract\32_proceeding.*

The Tambora.org Virtual Research Environment (VRE) provides scientists with an IT infrastructure that supports research processes at the junction of historical sciences and climatology. The online environment enables researchers to record quotes and media artifacts from historical sources in an online repository. These texts and elements are then augmented using a system-wide spatial, temporal and semantic event coding system that is shared between all users of the research environment. Collections of sources can be assembled and may pass a peer-review by other users. Researchers can finally obtain a Document Object Identifier (DOI) and publish the collection, for example to satisfy the requirements of an Open Access policy. According to Fraser (2005) a Virtual Research Environments has to meet the demands of researchers throughout the whole life cycle of scientific research projects. In this sense Tambora.org has to serve the purpose of a digital data archive and a publication platform. At the same time it serves as a framework for analysis and exploration of spatial and temporal data. Maps and cartographic visualizations play a crucial role in some of these aspects. This paper will describe the work flow of historical climatology research and will focus on the spatial aspects of the coding process of historical texts. At this stage of research historians add spatial information to the digitized source text. This process is supported by the Geographic Names Component of the system which serves as a repository of geocoded historical and contemporary names of geographic locations. The use of maps for the geocoding process of historical names is most obvious and seems trivial, but if spatial uncertainties and ambiguities of historical texts are considered such a simple task poses a serious cartographic challenge. The paper will elaborate on the more complex scientific tasks of historical climatology that are in need of cartographic visualizations that consider space as well as time. These visualizations serve the purpose of a heuristic analysis of the collected data. Researchers can generate theories and discover spatial and temporal patterns. Temporal clusters of weather events, for example, may validate a single ambiguous event or point a to larger relationship with inter-connected social or economic impact events. Additionally, scientists may as well identify areas with sparse data and inform their decisions and priorities regarding the progression of data collection efforts. The project was funded by the DFG (Deutsche Forschungsgemeinschaft) and enabled the Library and the Department of Physical Geography at the University of Freiburg, the Departement of Physical Geography at the University of Augsburg as well as the Institute for Regional Geography (Leipzig) to create this virtual research environment. It has reached a state of maturity where it is already used by a number of projects. M. Fraser (2005) Virtual Research Environments: Overview and Activity. In: Ariadne. Web Magazine for Information Professionals. Issue 44. Accessed 2012-11-12. http://www.ariadne.ac.uk/issue44/fraser

7A.4 | **Designing Origin-Destination flow matrices from individual mobile phone paths - The effect of spatial filters on flow measurement** (#569)

F. Bahoken[1,2], A. - M. Olteanu-Raimond[3]

[1]Paris-Est University / IFSTTAR, Splott, Noisy-le-Grand, France; [2]UMR 8504 Géographie-Cités, Paris, France; [3]OrangeLabs, Sense, Issy-les-Moulineaux, France

A full-length version is available and can be opened here:

_extendedAbstract\393_proceeding.*

Origin-Destination (OD) matrices are traditionally used in transportation, urban planning engineering and human migration studies. They result from the sum of individual movements which are produced in a time interval on a given space. Their design has been estimated using a wide range of different approaches which can be grouped into three categories: directed, undirected and alternative methods. The statistics obtained within directed or undirected methods are very sensitive to errors due to the adopted methodology. That is why alternative methods have been developed, focused on the use of markers of migrations, such as GPS data, mobile phones data. In this paper, we are interesting in designing OD flows matrix using mobile phone data[1] as an alternative of traditional data. In recent years, data from mobiles phones are become one on the main sensor of human mobility (Reades & al., 2007; Gonzalez & al., 2008; Sevtsuk & Ratti, 2010; Oltenanu-Raimond & al., 2012). We assume here that individual daily movements can be captured from spatiotemporal traces of mobile phones. The traces are not the exact path of the user, but an estimation of it, derived from the mobiles phones' defined positions in space and time. We focus here on the question of the spatial filtering of such paths which occurs after time[2] filtering, in order to design OD flows. This question interest the spatial zoning system from flow data methodology. We present a new approach for designing OD flows matrix from mobile phone paths. Our method consists on taking into account their inherent spatiotemporal heterogeneities. Combining "morning" and “evening" flows sub-matrices at several spatial levels allows us to generate a complete matrix (morning*evening) which represents daily flows. Both inter zonal and intra zonal flows are then analyzed in order to describe the flows variation according to spatial scale and therefore the change in the zones' attractiveness. We finally present the application of spatial filters and their consequences in the resulting migration map. In order to deal with the so-called “spaghetti-effect” of movement mapping when the N places involved are huge (Tobler, 1987), our method should be considered as one of the several solutions available based on flow aggregation procedure (Bahoken, 2011).
[1] Mobile phone data are spatiotemporal records when an event (e.g. call, SMS) occurs.
[2] We use two defined temporal filters that allows us to select individual paths focused firstly, on "morning rush hour" and secondly, on "evening rush hour". References: -Bahoken, F., 2011, Cartographie des flux et effets-frontières/Flow mapping and boundaries-effects, *Colloque international "Les frontières mobiles"/ Mobiles borders*, Session Spéciale "Cartographie des transfrontières"/ Transboundaries mapping, XIème rencontres du réseau BRIT, Genève-Grenoble, 6-9 septembre. -González, MC., Hidalgo, CA., Barabási, AL., 2008, Understanding individual human mobility patterns, Nature 453: 779–782. -Olteanu Raimond, AM., Couronne, T., Fen-Chong, J., Smoreda, Z., 2012: Le Paris des visiteurs, qu'en disent les telphones mobiles ? Inference des pratiques spatiales et frquentations des sites touristiques en Ile-de-France. Revue Internationale de la Géomantique , 3, 413-437. - Reades, J., Calabrese, F., Sevtsuk, A., Ratti, C., 2007 Cellular Census: Explorations in Urban Data Collection. IEEE Pervasive Computing 6, 30-38. - Sevtsuk, A., Ratti, C., 2010, Does Urban Mobility Have a Daily Routine? Learning from the Aggregate Data of Mobile Networks. Journal of Urban Technology, 17, 41-60. - Tobler, W., R., 1987, Experiments in migration mapping by computer, American Cartographer, n°14, pp. 155-163.

ORAL

Session S7-B

Environmental Monitoring

Wednesday, 28 August, 2013

09:15 - 10:30

7B.1 | **Activities for developing Global Map Version 3 data** (#373)

Y. Fukushima, M. Koarai

Geospatial Information Authority of Japan, Geocartgraphic Department, Tsukuba city, Japan

A full-length version is available and can be opened here:

_extendedAbstract\75_proceeding.*

Global Mapping Project aims to develop basic geospatial data covering the whole land area of the globe through international cooperation of National Mapping Organizations (NMOs) around the world. As of 1 November 2012, 166 countries and 16 regions participate in the project, which collectively covers 97% of the whole land area. The objectives of the project are to contribute to solving global environmental issues, achieving sustainable development and mitigating large-scale disasters. Global Map consists of eight thematic layers: boundaries, drainage, population centers, transportation, elevation, land use, land cover and vegetation. Global Map is to be updated once every five years to monitor global environment. Global Map Version 1 which includes Global Land Cover and Vegetation (Percent Tree Cover) data was released in 2008. Currently, Global Map Version 2 data development is underway with the collaboration of the project participating NMOs aiming to be completed in March 2013. From April 2013, development of Global Map Version 3 will be started. Global Map was proposed by Japan in 1992 in the wake of the United Nations Conference on Environment and Development (Earth Summit) held in Rio de Janeiro, Brazil, and the Global Mapping Project was started. As a follow-up for 20 years to the Earth Summit and to discuss the way forward of 10 years to come for achieving sustainable development, the United Nations Conference on Sustainable Development (Rio+20) was held in Rio de Janeiro in June 2012. Rio+20 outcome document “The future we want” adopted at this conference includes description on relevance of global mapping. Global Map is used as data which represent the status of global environment for climate change simulation, and grasping the progress of deforestation and desertification, in a global level; and infrastructure development, understanding the outline of land use and flood analysis, in a national level. However, the existing data at a scale equivalent to 1 to 1 million do not include detailed road and village information, which as a result were deemed not to be sufficient enough for a use in individual and concrete matter, such as recovery support in a large-scale disaster, climate change vulnerability assessment, and understanding the land use change in urban area. In order to solve this situation, in Global Map Version 3, data development at a scale equivalent to 1 to 1 million will be continued, and at the same time, data of areas which especially have high demand such as urban area, where population is concentrated, will be developed in larger scales such as 1 to 250,000 scale to enable detailed survey and analysis. Currently, specifications are under discussion for the development of Global Map Version 3 data by incorporating user needs to make Global Map data more usable. In parallel with this work, an error analysis was made on Global Map data of respective countries which have been released, by validating their accuracy with a use of satellite imagery. In order for countries, when they update the data, to create data with better accuracy for areas which have less accuracy, preparation of a manual is being considered which describes ways to increase accuracy by using satellite imagery and other materials. These efforts are considered to also help improve mapping technologies of developing and other countries.

7B.2 | **Spatial representation of natural and anthropogenic factors influencing chimpanzee repartition in Sebitoli (Kibale National Park, Uganda): conservation and research applications.** (#40)

S. Bortolamiol[1,2], M. Cohen[1,3], S. Krief[2]

[1]Université Paris Diderot - Paris 7, Geography (GHSS), France; [2]Museum National d'Histoire Naturelle, UMR 7206 - Eco-antropologie et ethnobiologie, Paris cedex 5, France; [3]UMR Ladyss, Nanterre cedex, France

A full-length version is available and can be opened here:

_extendedAbstract\364_proceeding.*

Using a combination of geographical data, spatial analysis is a precious tool in environmental sciences. Landscapes are made up of many processes, which interact together and have different impacts. For example, a road can be seen as a barrier to wildlife dispersal, but also as an easier way for humans to travel and to exchange. It is possible to include this form of spatial relationship in thematic layers using GIS and remote sensing. Mapping animal movements is a strategic approach in most management and conservation plans. Studies using GIS and/or remote sensing have demonstrated the importance of landscape structure in animal movements. Some focus on anthropogenic factors such as human activities (agriculture), fragmentation, roads or noise perturbations and others insist on natural factors such as topography, exposition, river streams and food density. Sebitoli, North of Kibale National Park (Western Uganda), is a privileged site to study factors influencing chimpanzee repartition. About a thousand Eastern Chimpanzees (*Pan troglodytes schweinfurthii*) live in Kibale, experiencing the highest chimpanzee density known in the world. Now protected by National Park status, Kibale forest was commercially logged in the 60's. Human activities are frequent at the edge of the forest and the demographic density can reach 335 inhabitants/km2 in a 5 kilometers zone around the park. A tarmac road cuts through the park, while tea and eucalyptus plantations are located at the forest edge. There are also many crop gardens at the extreme north of the park which experience crop-raiding by wild animals. Therefore, representing geographically the chimpanzee repartition in function of human activities is a major issue in order to better understand the stakes of their conservation. Considering the Sebitoli region as a forested park surrounded by human activities, our first goal was to characterize the landscape of the study area. Sebitoli landscape was mapped using remote sensing. We analyzed GPS data and observation data sheets collected during the first steps of chimpanzee habituation (2009 to 2011). With GIS we determine the core area of the chimpanzee community (25 km2 with a more frequented area of 4,5 km2), as well as the influence of natural and anthropogenic elements that explain chimpanzee concentration. Despite anthropogenic perturbations, Sebitoli chimpanzee community is estimated to be about 100 individuals, and is hence the densest of the park. MaxEnt model showed that chimpanzees do not avoid areas at the forest edge, currently in contact with human activities, and that they are most likely to be found occupying high relief areas (around 1515 meters) and river banks. With time, we are adding more data to our GIS databases and improving satellite image treatments. We got precise information on Sebitoli botanical status by censuring vegetation in about seventy 50x50 meter plots located inside and outside the protected area (georeferenced and located in different habitats classified with SPOT Image 2,5m). We counted 26155 stems of 348 species. So far after 3 years, 68 plant items have been recorded to be consumed by chimpanzees. This allows us to determine if food availability and diversity has an impact on chimpanzee density. Also, we conducted interviews in local communities to understand uses and practices of people living around the park. To perform our objective, this study uses multi–scale methods. By implementing these geomatic analyses with field research, we are able to confirm, correct and add data (supervised classification) with more precise scale. We propose an original and multi-factor analysis of elements influencing the repartition of Sebitoli chimpanzees. The study of chimpanzee use of space coupled with social (geo-anthropology), spatial (GIS, remote sensing) and environmental (biogeography) approaches is a way to better understand interactions between space and humans, and links between the landscape and chimpanzees.

7B.3 | **Cartographic challenges in Antarctica:Mapping in support of environmental management in the US Antarctic Program** (#1132)

K. Lorenz, C. Harris

Environmental Research & Assessment, Cambridge, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\411_proceeding.*

Protecting the environment is a key principle in Antarctica, with protective measures agreed under the Antarctic Treaty System. A network of over 70 'Antarctic Specially Protected Areas' (ASPAs) and seven 'Antarctic Specially Managed Areas' (ASMAs) have been adopted within the region. Maps are an essential tool for environmental protection and management, and in Antarctica every ASPA and ASMA is required to have clear maps accompanying their Management Plans setting out the rules for activities. These maps need to locate the site unambiguously, demarcate site boundaries clearly, show important features in need of protection, and communicate to the user any key restrictions that apply (e.g. aircraft landing sites). Different countries take responsibility for preparing maps and plans for the protected sites, and the United States is solely or jointly responsible for 14 ASPAs and 5 ASMAs throughout the Antarctic region. Mapping these remote sites in severe Antarctic conditions presents a number of challenges for the cartographer. This paper reviews how the US Antarctic Program has been addressing some of these cartographic challenges to meet environmental management needs. The first challenge is the inaccuracy of spatial frameworks. Digital spatial data available continent-wide, such as the Antarctic Digital Database (ADD), is only suitable for mapping projects at scales of ~ 1:200,000 or above. Accuracy comparisons against large-scale orthophotos and recent satellite imagery reveals spatial errors of up to several hundred m or more. Larger mapping scales (e.g. 1:5000 through to 1:50,000) are generally required to meet environmental management needs, so errors of this magnitude need to be addressed when preparing maps for the management plans. This is being achieved through a combination of GPS ground control acquisition and use of new and better aerial and satellite imagery such as Digital Globe's WorldView 2. The dynamic landscape presents a second significant challenge. 99.6 % of the Antarctic continent is covered by a constantly moving ice sheet. As a result, features situated on the surface of the ice sheet are constantly moving at rates which vary from place to place, depending on underlying topographic and glacial characteristics. For example, glacial movement at the South Pole is in the order of around 10 m per year. This presents the challenge that all of the facilities at the Amundsen-Scott South Pole Station shift by this amount relative to the South Pole every year. To address this problem, a local grid is used. The local grid also addresses another unusual cartographic problem unique to mapping the South Pole – every direction on the map from the pole points north! Where the ice sheet margin meets the sea, the coastline is in a constant state of flux. Recently, rapid climate changes have led to the dramatic collapse of a number of ice shelves, and glacier front positions are generally in recession. Another challenge related to the dynamic landscape is the distinction between permanent ice and seasonal snow cover. In areas of ambiguity this problem can be addressed by comparing a time series of satellite images. Misinterpretation of sea ice as permanent ice sheet can also lead some cartographers to define spurious coastlines. A further challenge is the paucity of cartographic detail. Considerable detail on site features is needed in Management Plan maps for environmental protection to be effective. Features often need to be mapped by precise ground based GPS surveys, since some features such as areas of vegetation, frequently comprised of sparse communities of sensitive mosses and lichens, are difficult to map from imagery. Precise mapping of coastlines can prove especially problematic, because data on tidal ranges are usually not available. This paper presents examples of these problems as experienced when preparing maps for environmental management plans in support of the United States Antarctic Program.

7B.4 | **Geoinformation landscape-geochemical mapping of city territories (the case study of Eastern District of Moscow)** (#391)

E. Nikiforova, N. Kosheleva, I. Labutina, T. Khaybrakhmanov
Lomonosov Moscow State University, Faculty of Geography, Russia

A full-length version is available and can be opened here:

_extendedAbstract\139_proceeding.*

The ecological and geochemical mapping is becoming very actual field of activity due to the high level of urban pollution. This research suggests methodical approach and practical methods for creating such maps. They were tested in the Eastern Administrative District of Moscow. A landscape-functional zoning of the District territory was made and a synthetic landscape-geochemical map 1:50 000 M, which reflects the differentiation of landscapes in terms of accumulation and the risk of contamination with heavy metals was compiled. The geochemical taxonomy of urban landscapes (Perelman, Kasimov, 1999) was used as a mapping basis; it takes into account two main aspects: the level of anthropogenic impact in different functional zones and landscape-geochemical features of the environment that affects the fate (accumulation or dispersion) of pollutants. The anthropogenic and natural factors are presented by two blocks of cartographic materials. The first group includes the maps of functional zones and geochemical structure of the study area. The map of functional zones contains some important characteristics of city environment such as building density and structure, soil sealing, green plantings, water bodies and etc. It was derived from multispectral high (2.4 and 10 m) resolution satellite images from QuickBird and SPOT-5 and thermal infrared images (60 m) from Landsat 7 for the Eastern District of Moscow using methods of automated and visual interpretation. The ecological backlash of industrial and traffic impact were shown on the geochemical maps of the city territory based on field data received in 2010-2011. These maps display the content and distribution of heavy metals in soils and snow cover. The second group contains the component maps including landscape, soil, geomorphological, soil pH, areas of water-logging, elementary landscapes and others which highlight natural conditions and factors controlling migration and accumulation of pollutants in urban landscapes. These maps were created by analysis and assessment of different cartographic materials, and scientific literature sources. For the Eastern District of Moscow the set includes the maps of unconsolidated sediments and soils, native and elementary geochemical landscapes, conditions of heavy metal migration in water. All maps were organized into personal geodatabase operated by DBMS ArcGIS 10 and were allocated on University geoportal (www.geogr.msu.ru) using web-technology solutions. The synthetic landscape-geochemical map was created by comparing of all presented geoinformation data using GIS overlay of layers and geostatistical analysis in the program package ArcGIS-ArcInfo 10. Generalization of the final map was accomplished on the basis of the contours of functional zones because the technogenic factors which affect the ecological situation prevail over natural factors in present-day urban environment. Twenty landscape-geochemical complexes were identified on this map, which natural and technogenic status determines the ecological risks of contamination of landscape components by heavy metals and the quality of urban environment. The relationship between various geochemical positions, functional zones and sites of high, very high, maximum levels of soil and snow pollution was analyzed by comparing squares of contaminated areas.

ORAL

Session S7-C

Change Detection

Wednesday, 28 August, 2013

09:15 - 10:30

7C.1 | **Urban Areas Change Mapping of the Black Sea coastal zone in Bulgaria for the Period 1990 - 2006 Based on Remote Sensing Data** (#1347)

R. Vatseva

Bulgarian Academy of Sciences, National Institute of Geophysics, Geodesy and Geography, Sofia, Bulgaria

A full-length version is available and can be opened here:

_extendedAbstract\193_proceeding.*

7C.2 | **Urban Expansion and Population Growth in Ras Sudr city Using Remotely Sensed Imagery Urban Expansion and Population Growth in Ras Sudr city Using Remotely Sensed Imagery** (#378)

A. Ramzi Ibrahim

National Authority of Remote Sensing and Space Science (NARSS), Cairo, Egypt

A full-length version is available and can be opened here:

_extendedAbstract\78_proceeding.*

Remote sensing and geographic information systems are considered as the most efficient techniques for detection and analysis of land use changes in the urban studies. Population growth is useful information necessary for management and development of any city. The main objective of this research is to predict and analyze the future urban growth, to define the boundaries of urban growth and to link urban growth with population of Ras Sudr city, Sinai, Egypt within the period of study using the satellite images. In this study, ETM+, aerial photos, Quickbird images and spot 4 images acquired in 2000, 2002, 2004 and 2012, 11 years time interval, were used to monitor urban growth in Ras Sudr city. The rectified images were classified into urban and non-urban using visual interpretation. Two land-use maps were produced for each date. The classified maps were compared to locate and quantify changes of urban land use during the selected period. The satellite images were rectified, classified, analyzed and compared using Envi 4.8 and ARCGIS 10 software's. The obtained results from this application of aerial photos and satellite images indicate that the use of this type of remotely sensed data are very useful for urban expansion and population growth analysis. The study has demonstrated potential as a means to detect, identify, map and monitor the changes. One can concluded that the expansion of Ras Sudr city is compared to the first date image; and the expansion is mainly due to the lands changed from bare land around the city to built-up areas. The increase in urban area or overall expansion of built-up land in the region may be considered as a good indicator for population growth.

7C.3 | **The Image Map: from Broad Practical Use towards Cartographic Concept**

(#1134)

B. Luboš[1], V. Voženílek[2]

[1]*Military Geographic and Hydrometeorologic Office, Dobruška, Czech Republic;* [2]*Palacky University, Olomouc, Dept. of Geoinformatics, Czech Republic*

A full-length version of this contribution has been published in: KN (Kartographische Nachrichten), Vol. 63, Number 4 (Summer 2013), Pages 196-204

Image maps have become very popular and frequently produced cartographical outputs during recent years. However, the unambiguous terminology, definitions, content and appearance specification have not been widely researched. The paper deals with the new definition of image map, its component delineation, and basic classification. The authors present aspects of topographic and thematic image maps. The main theoretical achievement of the authors' research is the determining of the image component and the symbol component of image map content. Finally, several examples of topographic and thematic image maps are presented. They differ according to the relationship between topographic background and thematic content, and between image and symbol component. The image component can be a carrier of thematic information, or it can be used as topographic background. The image map examples were compiled for use by the military, urban planners and natural risk emergency services etc. All examples demonstrate how to design, complete and use image-based cartographical products. Those variants might be used as guidelines for future image map production, especially for governmental and research purposes.

7C.4 | **Methodology to analyse multi-temporal planimetric changes of river channels** (#398)

A. Mozas-Calvache, M. A. Ureña-Cámara, F. J. Ariza-López

University of Jaén, Department of Cartographic, Geodetic Engineering and Photogrammetry, Spain

A full-length version is available and can be opened here:

_extendedAbstract\110_proceeding.*

In this study we describe a methodology to quantify planimetric changes of river channels between two epochs. We propose to use different cartographic, photogrammetric or remote sensing products capable of measuring distances in a CRS such as orthoimages, maps, etc. The main constraint is derived of the accuracy and the good identification of the boundaries of the river. The methodology includes: (i) the digitalization or vectorization of the boundaries of the river in order to determine 2 linestrings; (ii) the determination of the axis from both linestrings; (iii) the segmentation of the axis taking into account some criteria such as the location of the main affluents, dams, etc.: (iv) the transformation of the axes to the same CRS; (v) the quantification of the planimetric displacement between both axes related with both epochs. This methodology also includes the positional quality control of both spatial data sources using a set of control points and the calculation of the planimetric RMSE. This control provides the relative positional accuracy between both data sources determining the minimum displacement value to be significant.   The main contribution of the proposed methodology is related to the quantification of the displacement between both axes of the river channels in two epochs. For this purpose we determine the minimum Euclidean distances between the vertexes of one axis to the other axis linestring. After this we weight these distances by the length of the adjacent segments to the vertex in order to obtain a mean value of displacement. Because the methodology is partially based on the quantity of vertexes, we recommend the use of the linestring having the greater number of vertexes. The distances determination also provides us a map of displacement vectors per vertex and per each part of the axis of the linestring. These maps allow the analysis of global and local displacements and their orientations.   The methodology has been applied to the Guadalquivir River (main river of Andalusia in southern Spain) using more than 470 km for each epoch. We have used two sets of orthoimages (composed of more than 80 mosaicked images) produced by the Instituto de Estadística y Cartografía de Andalucía (Spain) corresponding to flights developed in the years 1956 and 2007. Both sets of orthoimages have a spatial resolution of 1 metre and are referenced in the same CRS (EPSG 23030). Following the proposed methodology the boundaries of the river channel are digitized on both sets of orthoimages by the same operator. Furthermore a set of 74 control points was captured in order to determine the relative positional accuracy between both spatial data sources. After this process we obtained the axes and trimmed the ends of the axes in order to obtain the same part of the river channel (no vertex displacement has been applied). Finally, the axes were segmented in 60 parts following the criteria explained in the methodology.   The result of the relative positional accuracy shows a RMSE value of 12.32 metres (8.1m for Easting and 9.3m for Northing). So we establish this distance as the threshold of significant value for this case. The 18.93% of the length of the linestring is below the threshold. Consequently these mean displacements can not be determined using these data sources. The 49.19%, 88.53% and 97.33% of the length of the linestring has a displacement lower than 25m, 50m and 100m respectively. Only some parts of the river close to the mouth have higher mean displacements than 100m.   This study shows that the proposed methodology quantifies displacements between axes of a river in two epochs and determines a minimum significant value for these displacements. The results can be used to determine local and global displacements of the river to analyse its hydrological behaviour or determine changes due to infrastructures built by man.

ORAL

Session S7-D

Visualising Time (Animations)

Wednesday, 28 August, 2013

09:15 - 10:30

7D.1 | **Guidelines for the effective design of spatio-temporal maps** (#803)

A. Buckley

Esri, Inc., Redlands, United States

A full-length version is available and can be opened here:

_extendedAbstract\443_proceeding.*

Animated spatial-temporal maps are used to show change in feature properties, location, or both. Map readers are more challenged when attempting to comprehend these maps because of the increased complexity that is inherent with dynamic displays. We know that we can help readers by following some map design guidelines for animations and the display of spatio-temporal data. For example, these maps are best used to show 1) data that have “micro time steps” rather than data with gaps between time steps, and/or 2) data that have a “forced” neighborhood (e.g., isopleth, not choropleth). Limiting the complexity of the visualization and the length of time that is displayed will result in better understanding. In addition, map comprehension can often be improved by allowing readers a level of interactivity (e.g., playback controls). It is also possible to help map readers gain better understanding of animated spatial-temporal maps using some of the same marginalia that are used for static maps, such as titles, legends, and charts. This presentation pays particular attention to guidelines for the use of map surrounds that are specific to spatial-temporal maps. Appropriate selection, design, and layout of these map elements can improve map readers’ ability to better comprehend more complex animated spatio-temporal displays. Through a variety of examples, I demonstrate that the judicious use of marginalia on dynamic map displays can provide greater clarity of the mapped subject and more aesthetically pleasing visualizations. Together with the first set of guidelines, map makers have a set of starting points for better design and compilation of animated maps for visualizing spatio-temporal data.

7D.2 | **Understanding Soil Acidification Process Using Animation and Text: An Empirical User Evaluation With Eye Tracking** (#1128)

P. Russo[1], C. Pettit[1], M. Imhof[2], M. Cox[2], A. Coltekin[3], C. Bayliss[1]

[1]University of Melbourne, Architecture Building and Planning, Australia; [2]Department of Primary Industries, Spatial Information Sciences, Melbourne, Australia; [3]University of Zurich, Depatment of Geography, Switzerland

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 431-448

This paper presents a user study in which the participant performance is comparatively measured using two ways of presenting information: animation versus text. The stimuli contain equivalent information, but use fundamentally different ways of communicating this information. We designed a workplace to simulate the process as it may occur in the real world. A representative task from an actual website was selected (i.e., understanding the soil acidification process) and 50 participants took a multiple choice test using the animation or text in an “open book” setting. The tested media have been assessed through the classical measures of error rate (accuracy, effectiveness) and the required time to complete the multiple choice test (efficiency). While not statistically significant, text users achieved a slightly higher score and required less time compared to animation users. In contradiction, more animation users considered the tasks “easy”. This result is interesting, because against all intuition (yet in agreement with previous findings in literature) animation is not necessarily more effective. An eye tracking study was also conducted with animation users for a more in-depth effort to identify possible causes.

7D.3 | **Enhancing Cartographic Time-series Animation** (#1278)

H. Jenny[1], J. Liem[1], R. Scheller[2], M. Lucash[2]

[1]*Oregon State University, College of Earth, Ocean and Atmospheric Sciences, Corvallis, United States;* [2]*Portland State University, School of the Environment: Environmental Science and Management, United States*

A full-length version is available and can be opened here:

_extendedAbstract\25_proceeding.*

Recent research in cartographic animation has focused on comparing animated time-series to series of static small-multiples providing a very heterogeneous picture. Some studies describe cognitive and perceptual limits of time series animation, e.g. limited visual detection of change and complex spatial patterns and high cognitive load for making comparisons. Also, the efficiency of cartographic animation has been criticized, as watching a non-interactive animation as well as interactively exploring animations can be relatively time-consuming. Other studies describe better and faster performance of test persons with animation when data patterns are strong and simple and viewing speed is adapted. Some authors have also pointed out the suitability of animated maps to show micro-change and motion or trajectories. While basic research is still trying to figure out for which tasks animation and for which tasks series of static maps are better suited, the enthusiasm of users for cartographic animation has been noted in almost all studies. As a consequence of this enthusiasm, cartographic animation as a means to visualize dynamic phenomena in time-series may be explicitly requested by project partners, and the question to use or not to use animation may not even be considered. In such a case, the cartographer is confronted with the task of improving and adapting cartographic animation so that known and assumed short-comings are leveraged and full use is made of the strengths of time-series animation. While the design of time-series animation has been a research topic in information visualization, digital education and human computer interaction, research contributions describing design improvements of time-series animation from a cartographic point of view are still rare. This paper describes a design study of an animated cartographic time-series visualization that was enhanced in different ways to help the user exploit the full potential of the medium, taking the state-of-research on strengths and weaknesses of cartographic animation into account. The web-based visualization was created in collaboration with ecology modelers and forest managers with the goal of representing alternative futures of forest ecosystems based on a forest landscape disturbance and succession model. The authors explore how animation can be enhanced and combined with other representations in a meaningful way to allow the user to interactively explore the time-series and to identify sudden changes, cycles, trends and constants. Design to facilitate comparisons between different points in time as well as comparisons between alternative futures e.g. scenarios based on different harvest regimes is also discussed. Explanations of the design considerations as well as a prototypical implementation of the visualization are presented.

ORAL

Session S7-E

NSDI 1

Wednesday, 28 August, 2013

09:15 - 10:30

7E.2 | **Facilitating the exchange of marine spatial data through a Marine Data Infrastructure for Germany (MDI-DE)** (#1197)

T. Lübker[1], P. Hübner[1], C. Rüh[2], P. Korduan[2]

[1]German Federal Agency for Nature Conservation, Marine and Coastal Nature Conservation, Putbus, Germany; [2]University of Rostock, Faculty of Agricultural and Environmental Sciences, Germany

A full-length version is available and can be opened here:

_extendedAbstract\268_proceeding.*

The Marine Data Infrastructure Germany (MDI-DE) has the aim to facilitate the exchange of spatial information on the sea and the costal areas. Fields covered include coastal engineering, the protection of coastal waters, marine environmental protection, marine nature conservation, and related topics. The MDI-DE comprises nine federal and state agencies at the level of partners and seven further cooperating partners, all of which provide and/or use marine spatial data. The establishment of an infrastructure for marine data across multiple public authorities was considered necessary because a) reporting obligations such as the Marine Strategy Framework Directive (MSFD, 2008/56/EG) require the composition of geodata maintained by different agencies and b) tasks to be completed by the agencies increase in complexity and require inter-disciplinary collaboration, also at the level of geodata. In addition, the European INSPIRE directive (2007/2/EC) and national laws such as the law on access to spatial data (GeoZG of 2009, 2129-52), and the Environmental Information Act (UIG of 1994, 2129-42) as well as according state laws require the supply of the data to the public. As an important component of the infrastructure an internet portal was established (www.mdi-de.org) that serves as central access point to the manifold marine geodata. Following the concept of a spatial data infrastructure (SDI), MDI-DE is based on a service-oriented architecture (SOA). This means that spatially distributed infrastructure nodes are connected via the internet and offer their geodata by means of standardised web-services. In contrast to a centralized database system, this concept has the advantage that the data is kept and maintained at the source and tailored applications can be developed upon the distributed geodata. The internet portal works according to the publish-find-bind principal: while the infrastructure nodes function as service providers and publish their metadata via the catalogue service web (CS-W) gateway, the MDI-DE internet portal functions as broker that harvests the metadata and enables distributed search queries sent by a client. Sine the partners have agreed to used standardised OGC-compliant WMS and WFS web-services, the metadata query results can directly be visualized in the map viewer. As an additional functionality, sensor observation services (SOS) are being integrated into the infrastructure that can be explored via a special plug-in to the map viewer. As a result of the federal system of Germany, marine data of the same topic is often maintained at several sources. The structure of these data sets is rarely homogeneous and data is thus not interoperable. However, especially behind the background of national reporting obligations, such as required by the MSFD, there is a need to harmonize these data. The harmonization is here suggested to be located at the level of web-services in order to prevent interference with existing database structures and comprises agreements on e.g. the structure of attributes, units and code lists to be used, time intervals for aggregation, naming conventions, and cartographic visualization. Within the MDI-DE research project, concepts for congruent harmonized web-services have been developed and applied to exemplary data sets. Using centrally maintained structured layer descriptors (SLD), these web-services appear uniformly in the map view, regardless the source they originate from. The establishment of such 'national' web-services presents a case study for a successful application of Germany's Marine Data Infrastructure and an example of use for SDIs in general.

7E.3 | **BRAZILIAN NATIONAL SPATIAL DATA INFRASTRUCTURE (INDE): applicability for large scale data** (#1055)

A. L. Iescheck[1,2], M. A. Dornelles[1,2]

[1]Federal University of Rio Grande do Sul, Geodesy, Porto Alegre, Brazil; [2]PETROBRAS, Geodesy, Salvador, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\342_proceeding.*

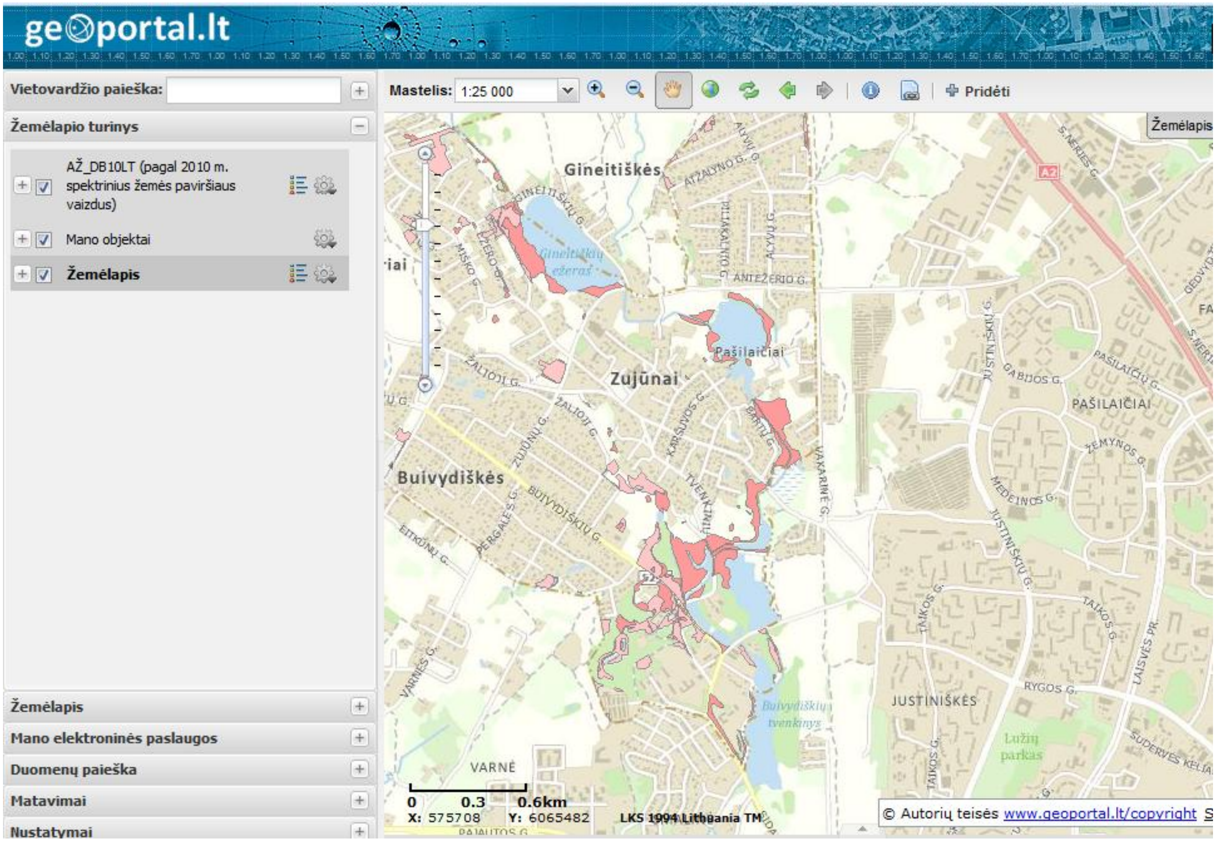
This work is part of a research on Spatial Data Infrastructure and aims to analyze the applicability of spatial data and metadata standards proposed by the Brazilian Spatial Data Infrastructure. In order to avoid duplication of effort and expense in acquiring spatial data, the Brazilian Government started systematic studies aiming at the integration and standardization of spatial data produced by various federal institutions in 2003. The Decree 6666, approved on November 27th 2008, set up the National Spatial Data Infrastructure (INDE). This decree is mandatory for National Government institutions, but not for the other producers of spatial data. Once the standardization of spatial data and metadata proposed by INDE meets the standard scales covered by the Brazilian Mapping System, and this official mapping system represents the national territory by a series of adjacent and homogenous quadrangle maps at the standard scales 1:25000, 1:50000, 1:100000, 1:250000 and 1:1000000, topographic mapping at scales larger than 1:25000 still demands a normalization. The use of spatial data and metadata rules promoted by INDE for cartographic design on large scales represents a step forward in this direction and is in line with the INDE Action Plan recommendation. Considering the importance of large scale data for the different segments of Brazilian society that use spatial information, our main research objective is to analyze the applicability of spatial data and metadata standards proposed by the INDE for large scale topographic maps. In order to perform the intended analyzes, we established some procedures that entails the mapped features analysis, to define their types and representation; the relation of these features with the categories, classes, sub-classes and attributes of objects, in accordance with the INDE standards; the implementation of a spatial database; and the association of metadata. Data used in the development of this work refer to 123 topographic maps at scale 1:2000. The implementation of the spatial database was done using the software ArcGIS, 9.2 version, and for metadata we used the Geonetwork, in accordance with the national metadata standards. The results confirm the applicability of spatial data and metadata standards proposed by INDE for large scale data. However, because of the levels of detail inherent to 1:2000 representations, some adjustments were necessary. Consequently new classes, attributes and attribute domains were created.

7E.4 | **Lithuanian spatial information portal for national mapping** (#646)

G. Beconyte[1], A. Balciunas[2], L. Papsiene[3], K. Papsys[2], J. Spuraite[4], T. Ladukas[4]

[1]SE "GIS-Centras", Vilnius, Lithuania; [2]Vilnius University, Centre for Cartography, Lithuania; [3]Vilnius Gediminas Technical University, Lithuania; [4]National Land Service, Vilnius, Lithuania

The official spatial information portal of Lithuania www.geoportal.lt was launched in 2009. Lithuanian NMA has played an important role in its development. Therefore the portal is not only the technological platform for implementation of the INSPIRE directive but also the official geographic data and services' sharing environment, very much orientated to the country needs. The multi-scale vector background map is compiled from the official reference database GDB10LT that is continuously updated by the portal manager State Enterprise "GIS-Centras". It is designed for browsing at twelve scales from 1:2500 to 1:10Mio. The user can report on map errors – for identification and input purpose orthophotographic map is provided. User groups can input and download their data online. The geoportal map browser is continuously extended with new features, such as indexed map archives, land information module, new thematic and analytical map services. Since 2010 the set of primary geographic reference data was conferred the status of state cadastre. In order to facilitate the process of validation of the surveyor's data against the cadastre and the process of integration of necessary corrections of the cadastre information, new public service has been planned. It will provide online tools for surveyors to validate the measurement against particular cadastre data class. Lithuanian NMA encourages development of other geography-based public services.



geoportal.lt:
National reference bace data and unused land parcels viewable at Lithuanian spatial information portal

ORAL

Session S7-F

Technical Issues in Map Production

Wednesday, 28 August, 2013

09:15 - 10:30

7F.1 | **Backend architectures for modern cartography** (#1233)

M. Jobst[1,2]

[1]Vienna University of Technology, Departement for Geodesy and Geoinformation, Austria; [2]Austrian Federal Office for Metrology and Surveying, Informationmanagement, Vienna, Austria

A full-length version is available and can be opened here:

_extendedAbstract\296_proceeding.*

Maps become the central communication medium for the public when exchanging geospatial information and moving through space. The pragmatic dimension for modern maps increasingly evolves - the use of maps is appropriate to many real-life situations and accessible with modern communication devices like smartphones and tablets/pads. As cartographers the refinement of applications, the impact of interactive codings and multimodal information presentation are the main key aspects to establish and develop high end map products. But one main question arises: are these aspects enough in a geospatial world of service-oriented infrastructures and backend architectures on which the modern map products depend on? In fact service-oriented architectures in use for modern cartography offer an additional paradigm: distributed competencies and focused resources. This paradigm describes the distributed storage and maintenance of geospatial information and its focused combination for pragmatic applications. Of course we can guess that a lot of things for high-end maps cannot be automatized nor are homogeneous enough to be combined. There are plenty of problems that need to be solved in order to combine different geospatial infrastructures for a cartographic application in an automated way. However the paradigm sounds great for high automatization and realtime mapping, but beyond the cartographic problems of the front-end (the perception of the user-interface) there are also several requirements for SOA that have to be fulfilled in order to establish the pragmatic dimension for a client. A pragmatic dimension in this approach means that a client can rely on data quality, application performance and availability or even situation awareness. This paper explores the offers and needs of service-oriented architectures (SOA) for modern cartography. Beside the overall concept of SOA its benefit for map production should be highlighted. At the same time the requirements and drawbacks will be considered which allow for an objective assessment of applicable technologies. This back-end point of view on the IT architectural framework simultaneously delivers specific insight to the possible technical impact of SOA for an interactive map. It will show how minimum standards for the existence and performance influence the pragmatic dimension of a front-end map application and therefore will lead to the topic of quality of services. The authors conclude their paper with the proof that SOA as back-end technology supports modern cartography, especially the pragmatic dimension, and indicate further developments for a SOA based map production.

7F.2 | **Map Folding Techniques in the Digital Age** (#1348)

S. Angsüsser

Wuhan University, School of Resource and Environmental Science, Department of Geographical Information Science, China

A full-length version is available and can be opened here:

_extendedAbstract\431_proceeding.*

This paper tries to improve our general knowledge about folding techniques of paper maps. It addresses which kind of foldings are used today, which have been developed since the digital age began, and which could be applied in future folding displays and e-paper solutions. Since the advent of the digital age it has often been stated that paper - including paper maps - will be substituted by other materials or electronic devices. But although paper maps are on the decline, they still exist for various reasons. Folding techniques are an inherent aspect of most paper maps. Interestingly enough this topic was only marginally treated in the past and seems to be hardly ever included at all in recent cartographic literature. This stands in sharp contrast to newly developed and applied folding techniques during the digital age. One reason why paper maps still exist is their foldability. This helps them to keep an advantage over small scale displays. But on the other hand we have to fold paper maps to overcome their disadvantage of being too big to be handled easily in plain form. Despite the easiness of shifting between scales in electronic devices, they usually fail to provide an overview at a convenient large scale. With new technological developments like e-paper it might be possible to overcome this problem in the future - but then map folding could also become a more important topic in the digital age compared with the last decade. Besides well known folding techniques like the "Leporello fold," many other techniques and/or sometimes also their names are quite unfamiliar. The "Turkish map fold" or the "Miura map fold" (although the last one has been described by its inventor Koryo Miura at ICC 2001) are such examples. Additionally some sophisticated solutions like "the zoomable map" (Figure 1, Anne Stauche) or the "MountMap" (Figure 2, Stephen Brittan and Fletcher Morgan) have been introduced. While the first idea is obviously inspired by zooming techniques in digital media, the second is about representing the mountainous landscape of a ski resort in a 3D model which is build every time the map is unfolded. At least in design studies and first prototypes e-paper and foldable or flexible displays have been presented (e.g. Samsung's "Youm"). It seems only to be a question of time before the first products are ready for the market. Will this lead to new folding techniques as well? Such predictions are of course difficult. But taking into consideration the differences in material properties, new developments seem to be more likely than just a kind of modernization of paper folding schemes. Experiments with programmable self-folding sheets allow the assumption that future displays might be unfold and fold automatically.

Figure 1:
The zoomable map on paper (Stauche, www.thezoomablemap.com, 2012-10-14)

Figure 2:
MountMap (Brittan and Morgan, www.snowgo.com, 2012-10-21)

7F.3 | **A Propagating Update Method of Multi-Represented Vector Map Data Based on Spatial Objective Similarity and Unified Geographic Entity Code** (#617)

Y. Wang[1,2], Q. Du[1,2], F. Ren[1,2], Z. Zhao[1,2]

[1]Wuhan University, School of Resource and Environmental Science, China; [2]Wuhan University, Key Laboratory of GIS, Ministry of Education, China

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 139-153

In recent years the propagating update of multi-represented datasets has become a crucial issue for maintaining geographic data, especially since National Spatial Data Infrastructure (NSDI) appeared. The key to propagating update is building the mappings between the datasets. Usually the traditional approaches of building the mappings don’t consider the attributive similarity and often use object IDs to build the mappings which may differ with the variation of data storage. Accordingly, a comprehensive similarity computing method is proposed and unified geographic entity code (UGEC) is put forwards to build the mappings in this paper. A workflow of propagating update, which mainly consists of data preprocessing, changes detecting, changes extracting, master dataset updating, and target dataset updating, is presented on the basis of objects mappings. An experiment on implementation of this method demonstrates its viability at the end.

ORAL

Session S7-G

NMCA - National Mapping and Cadastral Authorities: Germany

Wednesday, 28 August, 2013

09:15 - 10:30

7G.1 | **Organisation and Strategy of the Official Surveying and Mapping Authorities of Germany** (#1461)

U. Püß

Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany, Dresden, Germany

7G.2 | **The WebAtlasDE - An Example of the Collaboration in Official Surveying and Mapping in Germany** (#1462)

M. Wandinger

Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany, Dresden, Germany

7G.3 | **Digital Land Cover Model for Germany – Next update cycle for the Year 2012** (#1169)

F. Emig, **M. Hovenbitzer**, C. Wende

Federal Agency for Cartography and Geodesy, Geoinformation, Frankfurt, Germany

Within the surrounding frameworks of the Directive for the Infrastructure for Spatial Information in the European Community (INSPIRE) and European land monitoring activities like CORINE Land Cover (CLC) the Digital Land Cover Model for Germany´s Federal Purpose (DLM-DE) can be seen as a contribution on the way to interoperability between national and pan-European geoinformation datasets. The concept of the DLM-DE embodies the integration of topographic reference data with thematic land cover information through remote sensing methods. It was developed by the German Federal Agency for Cartography and Geodesy (Bundesamt für Kartographie und Geodäsie - BKG) in cooperation with the Federal Environmental Agency (Umweltbundesamt – UBA). This contribution aims at pointing out the potential benefits and constraints of the deriving of land cover datasets according to European nomenclatures such as CLC data from the DLM-DE as an enhanced alternative bottom-up approach to the conventional method proposed by the European Environmental Agency (EEA). Selected feature types of the authoritative topographic reference data ATKIS®Basis-DLM serve as the basic working dataset. As the land cover model applies to a certain reference year (2012), the working dataset has to be updated and verified by adding land cover information through semi-automated analysis and interpretation of multitemporal mid to high resolution satellite imagery of this reference year. In preparation of deriving the CLC data, the ATKIS feature type catalogue was compared with the CLC nomenclature by forming a semantic transformation table, suggesting either unique or multiple transformations from ATKIS to CLC. To decrease the number of multiple assignments, a special nomenclature is used, that distinguishes between land cover and land use information. With this nomenclature it will be possible to transform the resulting dataset to CLC and (partly) back to ATKIS®Basis-DLM. After preliminary coding all DLM-DE features according to the semantic transformation table (look-up table), they will be updated or verified using remote sensing methods. The result is a high resolution vector data set with a minimum mapping unit of 1 ha, which is capable to map the land cover and land use information of Germany very detailed. For the next phase of CLC2012 update, the DLM-DE2012 will help to derive the CLC data as part of the environmental reporting duty of Germany as an EU member state.

Session S7-H

Business Meeting of the Commission on Maps and the Internet

Wednesday, 28 August, 2013

09:15 - 10:30

Session S7-I

Business Meeting of the Commission on Generalisation and Multiple Representation

Wednesday, 28 August, 2013

09:15 - 10:30

Session S7-J

Business Meeting of the Commission on Planetary Cartography

Wednesday, 28 August, 2013

09:15 - 10:30

ORAL

Session S8-A

Colours in Map Design

Wednesday, 28 August, 2013

11:00 - 12:15

8A.1 | **Exploring the Influence of the Color Distance on the Map Legibility** (#446)

A. Brychtová, S. Popelka
Palacký University in Olomouc, Faculty of Science, Department of Geoinformatics, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\374_proceeding.*

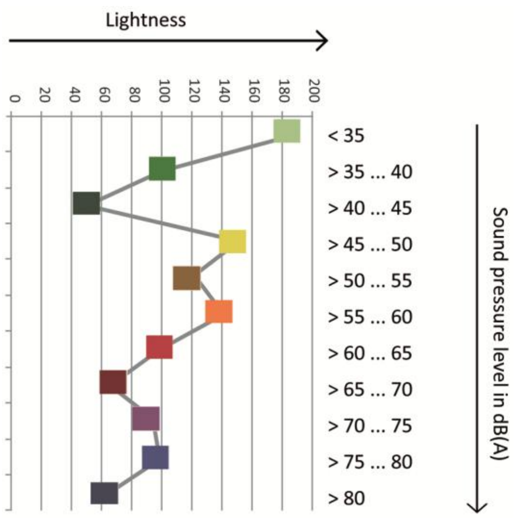
8A.2 | **The Influence of Colour on the Interpretation of Official Noise Maps** (#656)

B. Weninger
HafenCity University Hamburg, Lab for Geoinformatics and Geovisualization, Germany

A full-length version is available and can be opened here:

_extendedAbstract\285_proceeding.*

Noise mapping has been obligatory in Europe since the year 2002, when the European Union adopted the Environmental Noise Directive (END). Since then noise maps have to be produced by the member states every five years. Noise maps are the main source for informing the public about environmental noise and are also the basis for noise action plans. According to the END noise maps have to be in a suitable format to be used by the general public. Anyhow, examples throughout Europe lack appropriate and satisfactory cartographic presentation. Especially the colour scheme used for the noise pressure level is object of discussion (e.g. Alberts and Alférez 2012, Schiewe and Weninger 2012). It is based on the ISO 1996:2 from 1987. Although the description of colours was cancelled in the second version (2007) without an explanatory statement, variations of the original scheme are still in use. The problem of the scheme is that the colours cannot be intuitively put in order because seven different hues are used differing strongly in lightness. Different hues should rather be used for qualitative scales (Brewer 1994). Because colour is the major graphical variable for displaying noise pressure levels in maps, our research aims at creating and testing an alternative colour scheme. Fundamental requirements for the creation of a new scheme are that the scheme should facilitate an intuitive mapping of the colours to the values and their referring qualities. The colours should not lead to an under- or overestimation of the presented traffic noise situation. Especially signal colours like red and green might influence the perception. Therefore the hypothesis is that noise situations in maps are rated less disturbing if green tones and pastel colours are used for the presentation of the sound pressure level. Hence we will conduct experiments to explore the influence of colour schemes on the interpretation of presented noise maps. They will be organized as online questionnaires with the general public as target group. The participants will be provided with a set of around 35 noise map clippings that are shown one after another in a randomised order. The clippings show equal-loudness contours (isophones) for five test areas in around 7 colour schemes. To gain results the participants have to rate the expected noise nuisance for each clipping on an ordinal scale. For the evaluation of the ratings the area with a noise pressure level over 55 dB(A) was calculated for each map. Thereby an objective reference was built to assess the represented nuisance. On this basis the users' interpretation of the individual clippings can be evaluated and compared among each other. The results will be useful for understanding the influence of colour on the interpretation of thematic layers and for the creation of a colour scheme for noise maps. **References** Alberts, W. and Alferéz, J.R. (2012). The use of colours in END noise mapping for major roads. In: European Acoustic Association, EURONOISE 2012. Brewer, C.A. (1994). Color Use Guidelines for mapping and visualization. In: MacEachren, A.M. & Taylor, D.R.F (Hrsg.) Visualization in modern Cartography, S. 123-147. International Organization for Standardization (1987). ISO 1996: 2, Acoustics – Description and measurement of environmental noise, Part 2: Acquisition of data pertinent to land use. International Organization for Standardization (2007). ISO 1996: 2, Acoustics – Description, measurement and assessment of environmental noise, Part 2: Determination of environmental noise levels. Schiewe, J. und Weninger, B. (2012, accepted). Visual Encoding of acoustic parameters – framework and application to noise mapping. In: The Cartographic Journal.



ISO color scheme:

Colour scheme as proposed by ISO 1996:2 (1987): colours cannot be intuitively ranked (Schiewe and Weninger 2012)

8A.3 | **Analysis and improvement of the OpenStreetMap street color scheme for users with color vision deficiencies** (#1042)

J. Kröger, J. Schiewe, B. Weninger
HafenCity University Hamburg, Lab for Geoinformatics and Geovisualization, Germany

A full-length version is available and can be opened here:

_extendedAbstract\357_proceeding.*

Human vision can be affected by color vision impairments. These occur in various forms, with slight deficiencies being more common than severe forms. About 8 % of men and 0.4 % of women are suffering from red-green confusing vision (Birch, 1993; according to Jenny and Kelso, 2007). With an impaired color vision, a carefully designed quantitative color scheme in maps might be confusing or even unreadable. A qualitative color scheme might be perceived with confusable classes or the false impression of a ranking between them. First **goal** of this contribution is to analyze the color scheme of streets in the so-called *Mapnik* map style by the OpenStreetMap (OSM) project (www.openstreetmap.org), which is also used in many third-party implementations. Based on this, as a second goal, this color scheme shall be improved and empirically tested with respect to its usability. The **analysis** of the existing OSM color scheme shows that color identification depends on the distance between observed objects as well as on the cartographic scale. For example, in higher zoom-in levels (i.e. in large scales) critical street classes (like “trunk” in greenish and “primary” in reddish tones) can still be differentiated by affected users. When displayed separately however, the absolute identification is a problem. In lower zoom-in levels even the relative differentiation is difficult due to the small line width used there. Further complications arise through color changes within certain classes (“secondary”, “tertiary”) based on the zoom-in level. Previous research and developments aiming at an **improvement** of color schemes for affected users mostly change the lightness and hue of colors. In our case the primary hue components of the existing color scheme were preserved in order to keep the map's general look for normal-sighted people. The final definition of color values was designed by introducing minor changes in hue and changes of varying amounts in saturation and lightness. The mutual appearance of classes was considered. The geometric properties of the streets were not altered in any way. For the **evaluation** of the changed color scheme an experimental test setup was designed and carried out as an online survey. Here, several tasks had to be performed by the participants: Street classes were to be identified in a map image showing a single instance of a class. Combinations of streets were shown in an intersection, having no direct connections between them, but being connected via a neutrally colored circular street. Also a highly connected street network was tested, each street class touching at least one instance of each other class. The classes of marked streets in the map images were to be identified using a legend at the side of the screen. To account for contrast effects, participants were also asked to subjectively rate the visibility of streets within greenish vegetation areas. Finally, the time that the participants took to answer each test question was also recorded. **Results** of the study were derived from the answers of 129 participants who completed the entire catalog of questions and described themselves as being affected by color vision deficiencies. In general, it could be shown that the new color scheme can be highly recommended for high zoom-in levels, for lower levels it shows at least an improvement. Considering all tested map images, the overall rate of correct street class identification of 76 % using the original colors could be increased to 90 % with the new scheme. Detailed results of this completed study and aspects of further research will be presented in the full version of this contribution. Reference: Jenny, B. & Kelso, N.V. (2007): Color design for the color vision impaired. In: Cartographic Perspectives, (58): 61-67.

Figure 1:
Example of the original (left) and improved (right) street color scheme in simulated green-blind vision

ORAL

Session S8-B

Maps and the Internet: General Tasks 2

Wednesday, 28 August, 2013

11:00 - 12:15

8B.1 | **A systematic comparison of map design for print and web-based technologies** (#868)

K. Field

Esri Inc, Redlands, United States

Much has been made about web maps being a new map-making medium even to the extent that they're often referred to as a whole new breed of maps (e.g. intelligent web maps) or that they define a new paradigm in cartography. The democratization of map-making has certainly been pivotal in developing new ways of publishing maps and by new map-makers but cartography has always been a milieu defined by the varying dimensions of science, art and technology. The last of these has always been hugely defining and has gone a long way to determining how a map appears. Trends in ornate lettering were largely brought about by the skill of the copperplate engraver. Full colour map production was underpinned by developments in printing and digital map production technologies. Now, barriers to online map production have diminished; data has never been more easily gathered using mobile devices or acquired through online sources so making a map has never been easier in terms of their construction. This is of huge consequence to the art of cartography. Technological development has been so rapid due to the perceived need to create a framework that allows anyone to make a map. What this has resulted in is more maps and, consequently, more bad maps. This paper does not seek to simply shine a light on the widespread abuse of maps brought about by recent change but, rather, to focus on an assessment of the way in which web mapping is both redefining and challenging cartography. I use a case study approach based on the parallel print and web production of a map designed to tell the story of deaths in Grand Canyon. The Death in Grand Canyon map is the first of its kind to depict over 700 known deaths in the Grand Canyon. The purpose of the map was to catalogue the deaths spatially; to give them a locational context and to display the thematic information of the nature of the events of each death ranging from falls and drownings to snake bites, suicides and murders. Each death has a very individual story but collectively, they tell a bigger story of the danger that such a magnificent but dangerous environment poses to humans. The map was used as a vehicle to explicitly explore the differences between print and web as a publication medium and how the medium affects the design process. The print map was designed as a large format poster; the web map as a multiscale information product for viewing on screen and mobile devices. Each was treated as a separate product and designed within the constraints and opportunities afforded by the two different production technologies. This paper explores how design principles and the use of different cartographic methods were largely driven by the different technologies of production and what they meant for how the story was to be communicated by each. In systematically comparing the design and production of each of the maps, the focus here is to establish a framework for map-makers which begins to encourage them to consider the impact of the technology they are using. Evaluating the two approaches in this way gives rise to a better understanding of design decisions that take account of the impact of the technology so we can build maps that reduce the plethora of cartographic errors that we see in so many of today's web maps.

8B.2 | **Web map-based POI visualization for spatial decision support** (#690)

C. Yu[1,2], F. Ren[1,2], Q. Du[1,2], Z. Zhao[1,2], K. Nie[1,2]

[1]*School of Resources and Environment Science, Wuhan University, China;* [2]*Key Laboratory of Geographic Information System, Ministry of Education, Wuhan Univeristy, China*

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 172-182

Today, how to discover useful information and knowledge from mass data is a research hotspot, especially when organizing POI information containing lots of attributes and business data. Facing intuitionistic results based on traditional relational databases, low efficiency using traditional scientific visualization approaches for multi-dimensional data (e.g. Visualization in Scientific Computing) and deficiencies when organizing multi-dimensional POIs using current online mapping tools (e.g. Google Map), a new kind of web visualization strategy combining the tile base map and POI symbols is proposed.

In this strategy, the web map is used as the background, and POI symbols are overlaid above the geographical base map through web visualization. And how to design and implement the variable model of the POI symbol is elaborated based on principles of cognitive psychology. In the end, taking information management system of welfare lottery terminals in Hubei Province as an example, the system architecture and functions are elaborated obeying principles of the hypermedia model, and detailed spatial decision support is given based on such an integrated visual environment.

8B.3 | **Integrated Cartographic and Programmatic Access to Spatial Data using Object-Oriented Databases in an online Web GIS** (#362)

I. Iosifescu, L. Hurni

Institute of Cartography and Geoinformation, ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\148_proceeding.*

The use of geospatial information has expanded in many domains where the traditional use of cartographic and GIS software for visualizing spatial data often meets with custom application development. During the development of these custom Web-based mapping applications, the efficient and programmer-friendly access and handling of spatial data is equally important to visualization. The premise of this research is that current handling of geospatial data based on relational concepts and relational database technologies is often a burden in the current programming environment where object-orientation is the norm for software development. This research promotes integrated cartographic and programmatic application development from geodatabases based upon the concept of using object orientation for handling geospatial data access and visualization over the Internet. Although the object-oriented (OO) approach is a natural fit for spatial data, in the existing geospatial data management systems real world objects are ultimately flattened in table records managed by a spatially-enabled database management system (DBMS). As a consequence, there are two major impediments when working with spatial data in a custom online GIS application. First, many conversion steps are necessary for accessing the data and mapping it to objects in a programming language. The second disadvantage is the total absence of compile safety, in which some small typing mistakes may cause errors that are only discovered at run-time.   With this research we will demonstrate that it is possible to achieve spatial data access and conversions in a completely transparent and object-oriented manner over the Internet. This concept will be illustrated with the development of a Web-based GIS application, that allows the users to upload data, change the symbology interactively and finally to access, edit and analyse the geodata with a programmer-friendly Application Programming Interface designed for the Java programming language. These integrated cartographic and programmatic functionalities of the Web GIS are possible because, on one hand, the map representation is separated from the GIS data, and on the other hand, the relational spatial data is automatically transformed in java objects for programmer-friendly development.   In this paper we will also detail the implementation design of the WebGIS prototype, which follows a three-tier architecture. In particular, we are using the db4o Object-Oriented DBMS for storing geospatial objects that are kept synchronized with their relational counterparts from a ProsgreSQL/PostGIS relational geodatabase. Furthermore, the application layer was implemented using Java technology for generating a programmer-friendly API and the QGIS mapserver for the interactive visualization of spatial data over the Internet.   Finally, we will present several ideas about how object oriented handling of spatial data can influence the cartographic realm and the future map application development for the Internet.

8B.4 | **Challenges in creating web base maps from distributed datasets** (#1402)

M. Schmidt[1], W. Jörg[2], G. Gartner[1]

[1]Vienna University of Technology, Department of Geodesy and Geoinformation, Austria; [2]Municipality of Vienna, ViennaGIS Coordination, Wien, Austria

Web base maps distributed as raster tiles and published as web services became very popular over the last seven years. While the first and still common base maps are tiles provided by large corporate web mapping services such as Google Maps or Bing Maps, base maps nowadays come in a broad range of types, content, styles and licenses, facilitated by the availability of open data (e.g. OpenStreetMap) as well as software and hardware specialized on the creation and distribution of base maps. In Austria, an initiative by the Austrian province governments is working on a base map for the state of Austria, which uses the data created by the Austrian administrations. This paper deals with the cartographic (and partly also technical) challenges in creating such a base map from distributed, administrative datasets. The administrative structure of Austria (state, provinces, municipalities) is reflected in the way geodata are created, managed and updated. Federal provinces are required by law to create and manage geo data in certain fields. Some of the provinces already produce province-specific renderings of their data. However, until now these services are restricted to each province territory; data and styles between the province versions are not mandatorily harmonized. Also, some of the services use different projections and zoom levels than Google Maps and similar services. The new project is aiming at offering the locally created geodata in a joint view for the user, which is implemented as a WMTS in Web Mercator Auxiliary Sphere (EPSG:3857), to ensure compatibility to existing web base maps. The final product (tile cache) is published under the Open Government Data license CC-BY 3.0 AT - a widely known and easily understandable license with clear conditions for the users, as well as the data contributing institutions. Apart from the technical implementation, there are two main challenges from a cartographic point of view: data harmonization and generalization. Even though there are major efforts for standards in data creation (e.g. GIP – an intermodal transportation graph of the Austrian administrations and centralized transportation infrastructure organizations), a standardized visualization revealed province-specific differences in the data sets. Harmonization is also needed in terms of naming conventions, data formats and projections to ensure fast rendering. The need for generalization becomes apparent when considering the scale range of base maps; in this case approximately 1:400 to 1:3,000,000. However, the data from the contributors are usually created in one defined level of detail, fitting a certain scale. To ensure a legible and aesthetically pleasing result on all the other zoom levels, generalization is needed. Of course, this is not a new topic in cartography. However, it is still a challenge to implement generalization in an automated visualization environment, which allows incremental updates. Similar to harmonization, this is not just a technical issue; it also identifies requirements for the data. For example, in order to make a useful selection of features of a river network for different zoom levels, the initial geodatabase must include relevant metadata for this purpose. This is not available for some of the data sets yet. In the initial version, two zoom levels will be manually harmonized and generalized for all provinces. All other zoom levels will only use basic generalization methods – including a careful selection of features for each zoom level, appropriate symbolization and smoothing. While the first prototype does not meet all cartographic requirements yet, the project is working on methods for improving the cartographic quality of the final product in the next several months. The experiences from this project will be helpful for other organizations aiming at creating and delivering web base maps from distributed datasets on the basis of an open standard.

ORAL

Session S8-C

Map Classification

Wednesday, 28 August, 2013

11:00 - 12:15

8C.1 | **Opinions on the development of theoretical mapping** (#1428)

P. Nikolli[1], F. Gashi[2], B. Idrizi[3]
[1]Tirana University, Geography, Albania; [2]Tirana University, Geography, Prishtina, Kosovo (Republik Kosovo); [3]State University of Tetova, Geography, Skopje, Macedonia

A full-length version is available and can be opened here:

_extendedAbstract\95_proceeding.*

8C.2 | **Understanding Mental Categorization on VGI Systems to Improve Data Management** (#1183)

J. V. M. Bravo[1,2], C. R. Sluter[1,3], F. L. D. P. Santil[4], L. S. Delazari[1,2], M. C. Castro[1,2]

[1]Federal University of Parana, Postgraduate Program on Geodetic Science, Curitiba, Brazil; [2]CNPq - National Counsel of Technological and Scientific Development, Brasilia, Brazil; [3]CAPES – Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior, Brasilia, Brazil; [4]State University of Maringá, Departament of Geography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\209_proceeding.*

8C.3 | **Map classification according to their visual global properties** (#1103)

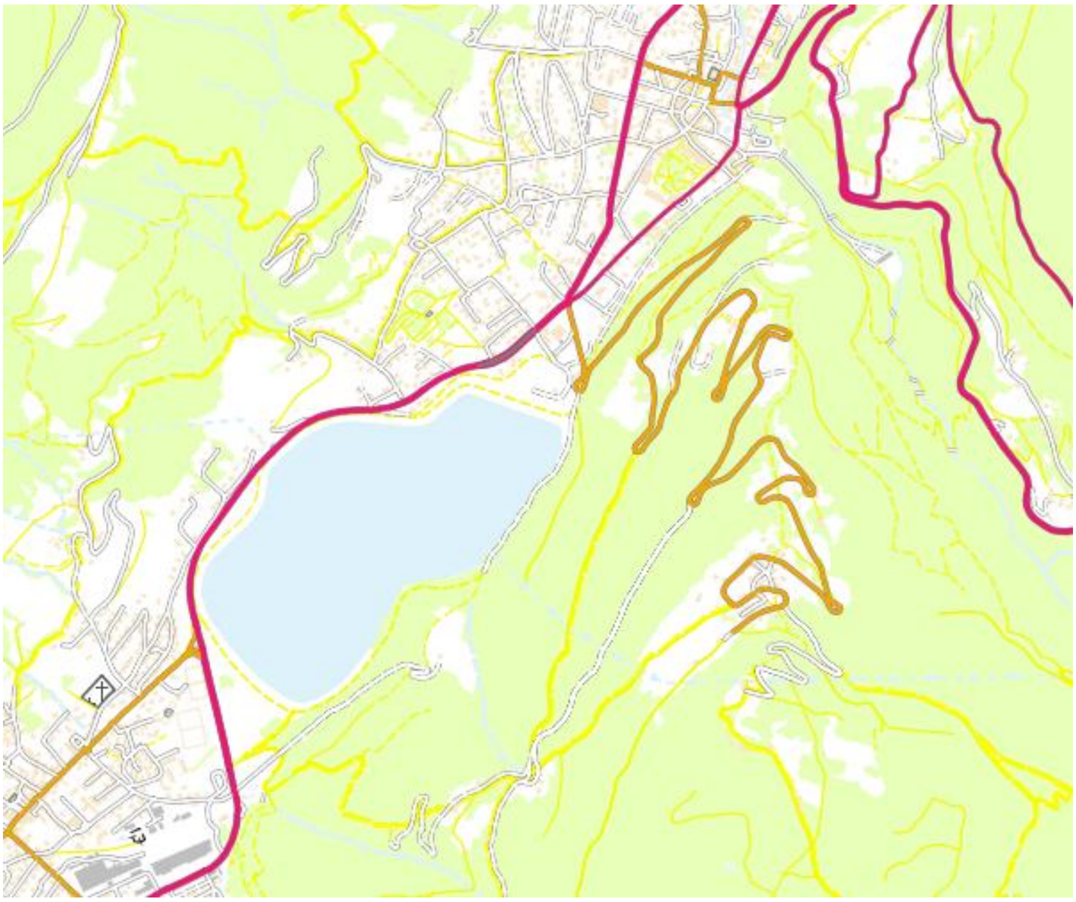
C. Domingues[1], T. Kharchi[2]

[1]IGN, laboratoire COGIT, SAINT-MANDE, France; [2]Université de Montpellier 2 & 3, MONTPELLIER CEDEX 5, France

A full-length version is available and can be opened here:

_extendedAbstract\367_proceeding.*

Making on demand maps is a problem which is shared by plenty of national mapping agencies and cartographic companies. A map can be seen as the result of the application of a legend to a geographic data set. Different strategies may be used to help a map maker to make his/her map. For example, extracting color palettes from paintings and making different legend proposals from these palettes (Christophe & Ruas, 2009). Another strategy is based on analogy: instead of acquiring cartographic knowledge, the map maker can select maps among different map examples. Secondly, the corresponding legends are applied to the map maker's data to obtain maps which are supposed to be like the original examples. This strategy requires a large example base. Thus, the point is to explore this map base in order to offer the map maker a reasonable number of relevant examples. Previous work (Domingues, 2008) defines map visual global properties, some of which are : *realistic, precise, original, balanced*. These may provide a basis to define map groups and help to guide the map maker towards relevant map groups thanks to their properties. In this work, we outline a survey which aims to: i) evaluate the visual global properties of topographic map samples and ii) build groups of maps which will be offered to mapmakers in the software interface. **1. The survey** It was based on an online questionnaire, available on a website for 15 days in July 2012, whose construction was as follows: - 48 topographic maps: 16 color palettes applied on 3 types of landscapes: *mountainous, rural, urban*; - one closed question repeated for every map; - 4 properties defined as follows: * *realistic*: does the symbolization refer to reality? * *precise*: does the map give the right information about the situation on the ground at first glance? * *original*: is the map different from the usual mapping uses? * *balanced*: are the different elements in the map represented evenly? - 6 response choices were given for each property: *don't agree at all, disagree, neither agree nor disagree, agree, strongly agree* and *no opinion*. - information about job, sex of the respondents and their comments. **2. Result analysis and discussion** The survey database contains more than 270 responses. It is sufficient to carry out a statistical analysis for each property. The qualitative choices have been translated into quantitative values to calculate average and standard deviation, for each map and each property. These value distribution graphs allow to classify map samples. Two kinds of classification can be listed: 1. construction, for each property, of two groups of maps: the *very* and the *non* maps (e.g. *very realistic* maps and *non realistic* maps); 2. construction of map groups sharing two or more properties, i.e. classification which considers several properties. Moreover, this survey provides a basis for a semiotic study. The map samples have been examined thanks to the salience theory (Landragin, 2006) in order to highlight the salient features relative to properties. This study aims at answering the question: "how can we map out our data in order to obtain a map?" **3. Conclusion** This work is the first step to analogy-assisted map making. The next step will consist in deducing global visual properties from elementary salient features. **References** Christophe S and Ruas A. (2009) A process to design creative legend on-demand, 24th International Cartographic Conference. Domingues C. (2008) Description de cartes géographiques. 8èmes journées francophones "Extraction et Gestion des Connaissances" - Workshop on "User modeling and Web interface customization", p. 59-68. Landragin F. (2006) Visual Perception, Language and Gesture: A Model for their Understanding in Multimodal Dialogue Systems. *Signal Processing* 86(12), Elsevier, Amsterdam, The Netherlands, p. 3578-3595.



Not at all realistic map:
A map example which has been classified into the less realistic map group.

Very realistic map:
A map example which has been classified into the most realistic map group.

8C.4 | **Developing a framework for describing and comparing indoor maps** (#84)

A. Nossum

Norwegian University of Science and Technology, Civil and Transport Engineering, Trondheim, Norway

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 218

Traditionally, research on cartography has primarily been focused on visualization of outdoor environments. Recently, however, indoor cartography has increasingly attracted attention both from the academic world and from commercial enterprises. Indoor cartography calls for markedly different visualization strategies. Frameworks for describing map communication and use exist for general maps. But so far, no such framework exists for indoor maps. This article presents and discusses several map types for indoor spaces found in the literature and commercial products. The different characteristics of each one are identified and described. On this basis, a framework for indoor maps is developed and presented. Arbitrary indoor maps can be described by their properties using the framework. This allows indoor maps to be compared and described using a common platform.

ORAL

Session S8-D

Learning to Map

Wednesday, 28 August, 2013

11:00 - 12:15

8D.1 | **Traditional map design vs. info graphics: motivating students to reveal their talents – Examples from a student assignment collection depicting 47 distinct topics** (#346)

G. Schaab

Karlsruhe University of Applied Sciences, Faculty of Information Management and Media, Germany

A full-length version is available and can be opened here:

_extendedAbstract\26_proceeding.*

Nowadays info graphics imparting knowledge seem to receive more attention than thematic maps. While information design is almost entirely the domain of graphic designers, there is the common believe that maps can be produced by anyone. But why should trained cartographers not also be able to come up with appealing info graphics? At Karlsruhe University of Applied Sciences, students following the study course leading to a Bachelor degree in Cartography and Geomatics follow in their 5th semester an advanced module on map compilation. In a first assignment of this seminar the students are asked to design an info graphics as well as a map. It all starts with students bringing along (traditional) maps as well as info graphics from newspapers, magazines or the Internet. This forms the basis for jointly discussing the differences between the two media means. Next, the students can choose among topics to be visualized. Each student will receive different thematic data being related to administrative units (Germany, Europe, or the world). Nowadays portals on statistical data facilitate this otherwise cumbersome task of finding and providing data on up-to-date topics. The students are now challenged to depict their one to three data fields on a DIN A4-format sheet each: as a traditional map suitable for a conservative-style newspaper printed in black and white and as a colour info graphics for e.g. a stylish magazine. Importantly, the info graphics has to make use of the spatial reference. Both depictions are to be presented and layouted in combination with a text which the students are asked to phrase and which has to accompany the graphical depiction. The assignment has proven to be of fun and benefit for both the students and the lecturer. First at all, the students are fascinated by the task and put a lot of efforts in their individual elaboration of the task. They are generally highly motivated, i.e. after having already a good knowledge on thematic cartography and the handling of DTP software, in this task they can readily start being creative. Up-to-date or unusual topics further enhance the motivation as does the individual instead of group working plus the first-time depiction within a student assignment. For the lecturer it is fascinating to look through the versatile results instead of marking similar student assignment outcomes. But most importantly, this assignment allows the lecturer to get a very good picture on the individual qualities and skills of each student: talents are revealed related to a) map design (following the cartographic rules in regard to map layout, graphic variables, map types), b) graphic design (handling of vector graphics software, possessing of a so-called ‘graphical eye’, use of colours vs. black & white, typography), c) text phrasing (putting a text/story together, structuring the text, phrasing neutral map titles vs. catchy ones), and d) geographic interpretation (explaining patterns). In addition, it becomes clear which student is e) interested and informed, f) works thoroughly, and/or g) is creative. Thus this first assignment is a perfect introduction into the broad topic of this rather practical seminar as well as an addition to the later major assignment of planning, designing and compiling a map product from the very scratch, which in comparison covers almost the entire term, is done in groups of two, and therefore often experiences motivation levels diminishing with time. For the paper and presentation it is planned to demonstrate the differences between cartography and information design as well as the various skills adding to such outcomes –not to be neglected in our IT-focussed training of students – by showing and discussing examples from the collection of 47 distinct topics having resulted from this student assignment.

8D.2 | **Open learning platform for the Open Geospatial Community** (#1045)

A. Pourabdollah, S. Anand, J. Morley, M. Jackson

University of Nottingham, Nottingham Geospatial Institute, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\438_proceeding.*

The ELOGeo Project is a UK Government-funded project led by the Nottingham Geospatial Institute at the University of Nottingham in partnership with the Mimas Centre of Excellence at the University of Manchester. Its objective is to enable the wider community (not just GIS experts) to make use of open source geospatial tools for solving real world problems. Currently, there is a big learning curve for new users to understand and use these technologies and if a general take-up of them is to be achieved it is necessary that an open, interactive, user friendly learning framework is developed. This project addresses the provision of infrastructure for education, transfer of knowledge and training of users and researchers on the effective use of open geospatial services, by providing a set of methodologies, tools and materials. The courses target the researchers, non-geospatial experts and general public who want to use open data, standards and tools. The framework can be accessed at http://elogeo.nottingham.ac.uk The primary users of ELOGeo are lecturers, students, researchers and also those from related sectors in government, NGOs, charities etc. The ELOGeo project has proven successful in establishing an infrastructure and a community for sharing and disseminating knowledge of emerging open source geospatial software, data and standards. The ELOGeo platform and learning materials are freely available to anyone with Internet accesss, and even the framework itself is developed in open source platforms. The ELOGeo repository was launched in June 2011 and within a short period had built a strong community of contributors and users for the project. As of November 1, 2012, ELOGeo has 84 registered users, with 67 material items (lecture notes, practicals, handouts, papers etc) submitted to the repository by the community. In this period there were over 55,000 accesses of the materials and over 10,000 performed searches which demonstrate the strong demand from the targeted community. The learning materials are classified and archived in the repository (http://elogeo.nottingham.ac.uk/xmlui). The users can search and find their materials through different searching and listing tools, including full-text search. They also can register/login to the system to manage their uploads. The administrators can run the workflow of accepting/rejecting/modifying the uploaded materials as well as administrating the user accounts. System users can create and access the wiki-styled materials at www.osmgb.org.uk/elogeowiki. Users will be able to take advantage of knowledge sharing in a wiki environment, including the ability to interlink, discuss and access to the previous editions as necessary. Moreover, administrators can approve/reject the changes made and manage the users' accounts. The wiki can act as a knowledgebase on its own, as well as providing a conceptual interlinked layer over the ELOGeo repository. ELOGeo was implemented as a community led project with support, for example, from the Open Source Geospatial Foundation and International Cartographic Association. Strong growth is being recorded in materials contributions and the user base. The paper will focus on issues such as semantic interlinking development for future research topic.

ELOGeo Interface:
ELOGeo repository

8D.3 | **How much instructions are needed for a good GIS map?** (#573)

M. Murad-Al-Shaikh
Esri, Education, Redlands, United States

A full-length version is available and can be opened here:

_extendedAbstract\387_proceeding.*

Geographic Information Systems (GIS) education is flourishing in Geographic Information Systems certification and academic programs. A Geographic Information Systems cartography course is becoming an essential component of such programs. Creating a Geographic Information cartography course to teach Geographic Information Systems analysts is a challenging task, especially if the objective of the candidates of such certification or degree programs is mainly mastering the Geographic Information Systems technology for solving real world problems. This paper deals with the discussion of how much of the cartographic design principles, and how deep one wants to go into, in teaching such analysts enough to make them productive, and be able to create good, acceptable, and communicating maps. This paper will go through the standard basic cartographic design principles and evaluate their effectiveness and practical use for such Geographic Information Systems analysts. The structure of the designed lectures of the Geographic Information Systems cartography course is analyzed in details to check what works and what does not work for the Geographic Information Systems analysts. This is mainly deducted from how the course was developed over fifteen years that the author had taught such courses in these kinds of programs. The structure of the designed exercises of the Geographic Information Systems cartography course is also analyzed in details to check their usefulness. A check list was created and developed over the years of what critique questions a Geographic Information Systems analyst should ask himself or herself when designing a map. This check list is also analyzed and discussed in details. The length and duration of these Geographic Information Systems cartography courses is also analyzed to determine how many meetings and how many hours per meeting will be necessary for maintaining an ample time of exposure with the students so they attain the proper proficiency in creating GIS maps. This paper will demonstrate the results of teaching this Geographic Information Systems cartography course over fifteen years in such programs, demonstrating that there is certainly a limit of what is needed to be taught as compared to similar programs that graduate people in pure cartography (not GIS-related environment). The paper will be demonstrated with a multitude of maps created repeatedly and progressively over the history of teaching this course supporting the findings of this paper.

8D.4 | **GIS-based land-use suitability mapping: cognitive processes and instructions that leads to expertise.** (#1142)

R. Balzarini[1,2], M. Ney[1], P. - A. Davoine[1]

[1]*Grenoble Laboratory of Informatics, Saint Martin d'Hères, France;* [2]*ESRI France, Education et Recherche, Ecully, France*

A full-length version is available and can be opened here:

_extendedAbstract\290_proceeding.*

We present an ongoing research project that aims to examine how perception, strategies and cognitive processes change from novice to expert in GIS-based land-use suitability mapping based on multi-criteria spatial analysis (MCSA) (Malczewski, 2004). MCSA requires to choose, to standardize and to weight criteria and to make iterative visual analysis on the cartographic productions. Abstract thinking skills, problem-solving strategies, storage and recall of a wide array of information, all exemplify what it means to be an expert (Petcovic et Libarkin, 2007). According to MacEachren's mental categories and knowledge schemata, expertise in map reading and comprehension is highly dependent on the efficient processing of visually presented information (Kent et Cheng, 2011). Research by Rieber (1995) and others indicate that a subject's background knowledge interacts with the visual stimuli to create mental representations. Lowe (1993) stated that two types of background knowledge—*domain-general* and *domain-specific* knowledge—play major roles in the construction of appropriate mental representations. Our study addresses one main question: What operations and concepts are used by experts and students when solving suitability maps problems? To shed light on this research question, we performed an experiment using Design-Based research paradigm (Richey et Al., 2003). The participants were 65 third-year undergraduate students in environmental earth sciences and three experts (geophysicist, cartographer, SIG project manager). We designed a Problem-Based Learning situation (Hmelo-Silver, 2004) in which participants had to locate suitable sites for a ski resort in the Southern Alps. The GIS is ArcGIS 10.0. We collected data from productions (maps, reports), verbal interactions among students during key moments of the problem-solving procedure (audio and video records), three open-ended questionnaires and expert's video records with a think-aloud protocol. Data analysis is based on productions and verbatim. The problem-solving procedure is broken down into tasks and sub-tasks, which are further subdivided into operations that can be described each by one or several methods of execution. Each operation calls for one or several concepts identified in the transcribed verbatim and further grouped into categories. Then, operations and concepts, used either by students or by experts, are compared and differences between these two populations are quantified using binary (present-absent) codes, pattern analysis and measures of distance. Three tasks were more specifically analyzed: T1 weighting and combining datasets, T2 selecting the best map among a set of suitability maps and T3 selecting the best site out of the alternatives. Preliminary results show significant differences in T1 and T2. For instance, experts' strategy of restricting study areas to sub-sets of map information –information chunking-, or experts' ability to correlate weight sum resulting areas with the relief, were never used by students . Some operations or methods of execution as well as concepts that expert use and that were absent in students' strategies suggest that different type of learning scaffolding could be provided:

- methodological scaffolding : create raster mask for partitioning
- thematic scaffolding : provide rules and notions in semiotic
- strategic scaffolding : suggest to control for conflicts, errors or anomalies
- technical scaffolding : learn how to manipulate visual effect tools in the GIS to enhance visual analysis

Understanding the transition of novice to expert is a necessary prerequisite to developing effective learning environments for students at all levels. Strategies that help students to move closer to expertise in problem-solving ability involve the explicit teaching of expert strategies, the use of real-world problems and of collaborative groups to encourage metacognition (Petcovic et Libarkin, 2007).

ORAL

Session S8-E

Natural Disasters

Wednesday, 28 August, 2013

11:00 - 12:15

8E.1 | **Cartographic Visualization of Vulnerability to Natural Disasters** (#658)

T. Opach, J. K. Rød

Norwegian University of Science and Technology, Department of Geography, Trondheim, Norway

A full-length version of this contribution has been published in: Cartographica, Vol. 48, Number 2 (Summer 2013, Title:"Selected Papers from the 26th International Cartographic Conference, Dresden, Aug., 25-30: The Challenges of Visualization"), Pages 113-125

The goal of our research is to improve the understanding of the vulnerability to climate change inducted natural hazards like storms and floods by providing a map-based visualization approach that integrates different visualization techniques in order to present multivariate data. Improving the visualization of the comprehensive vulnerability data has farreaching potential to inform efficiently on indices that influence the overall vulnerability, and as a consequence, to raise people’s awareness about factors that make places vulnerable to natural threats. To address this challenge, some system design issues must be overcome.

This paper illustrates the design of the example application ViewExposed, as a means to overcome such problems by employing cutting edge visualization techniques and user friendly tools that nevertheless can visualize complex data. Advantages described include: comprehensive visualization of complex vulnerability data, easy-to-use nature, and open-source approach. Those features have the potential to change the attitude to tools which are expected to facilitate understating the integrated vulnerability data.

8E.2 | **The Impact of Hurricanes on Crime Using a Data Mining and Visual Analytics Approach** (#1240)

M. Leitner[1], D. Guo[2]

[1]Louisiana State University, Geography and Anthropology, Baton Rouge, United States; [2]University of South Carolina, Geography, Columbia, United States

Surprisingly little research has analyzed the impact that exceptional events (natural disasters, sporting events, concerts, political rallies, etc.) have on the spatial and temporal distribution of crime (Andresen and Tong 2012, Leitner and Helbich 2011, Leitner et al. 2011). This research applies the space-time and multivariate visualization system (VIS-STAMP) approach (Guo et al. 2005, Guo et al. 2006) to investigate the relationship between one type of natural disaster, namely hurricanes, and crime in Louisiana from 2000–2010 and the city of Houston from 2005-2011. The crime data from Louisiana include the FBI Uniform Crime Reports (UCR) Part I offenses murder, rape, robbery, aggravated assault, simple assault, burglary, larceny theft, and motor vehicle theft, aggregated by month and by parish for the entire time-period. The crime data for Houston are aggregated by day and include the same set of crime types as Louisiana plus arson and manslaughter by negligence at the street address level. VIS-STAMP, an acronym for Visualization for Space Time and Multivariate Patterns, is a visual analytics approach to the analysis of complex datasets that contain geographic locations, time series, and multiple variables. It integrates self-organizing map (a dimension reduction and clustering method), color encoding, and multidimensional visualization to map the changing trends and relationships of multiple variables over space and time. Empirical studies on the impact of hurricanes on crime are inconclusive. For areas hardest hit by hurricanes, it is assumed that crime declines shortly after the disaster and slowly increases to pre-disaster levels over time. However, this assumption has not always been confirmed (Leitner and Helbich 2011, Leitner et al. 2011). For example, a study in Houston revealed a significant spike in burglaries contemporaneous with the largest ever mandatory evacuation in the cities' history, prompted by the approach of Hurricane Rita (Leitner and Helbich 2012). This temporal burglary cluster could be associated with a spatial cluster in the (north) eastern part of Houston. In contrast, for regions receiving evacuees from those hardest hit areas, the few empirical studies seem to support theories that suggest that crime rates remain stable or actually decline (Leitner et al. 2011). This research provides not only new evidence of the relationship between an important natural disaster and crime but also new insights into the development of Part I crime types across all Louisiana Parishes and the city of Houston for the first decade of this millennium. **References** Andresen, M.A. and W. Tong (2012) The Impact of the 2010 Winter Olympic Games on Crime in Vancouver. *Canadian Journal of Criminology and Criminal Justice*, 54(3): 333 - 361. Guo D., M. Gahegan, A.M. MacEachren, B. Zhou (2005) Multivariate analysis and geovisualization with an integrated geographic knowledge discovery approach. *Cartography and Geographic Information Science*, 32: 113-132 Guo D., J. Chen, A.M. MacEachren, K. Liao (2006) A visualization system for space-time and multivariate patterns (VIS-STAMP). *IEEE Transactions on Visualization and Computer Graphics*, 12: 1461-1474 Leitner, M. and M. Helbich (2011) The Impact of Hurricanes on Crime: A Spatio-Temporal Analysis in the City of Houston, TX. *Cartography and Geographic Information Science*, 38(2): 214-222. Leitner, M., Barnett, M., Kent, J., and T. Barnett (2011) The Impact of Hurricane Katrina on Reported Crimes in Louisiana: A Spatial and Temporal Analysis. *The Professional Geographer*, 63(2): 244-261.

8E.3 | **Exploratory Spatial-Temporal Visualization of Hurricane Impacts on Crime Events in Miami, Florida** (#1374)

S. Sim, W. Walker, R. Doyle, L. Keys-Mathews
University of North Alabama, Geography Department, Florence, United States

A full-length version is available and can be opened here:

_extendedAbstract\118_proceeding.*

ORAL

Session S8-F

Planetary Mapping

Wednesday, 28 August, 2013

11:00 - 12:15

8F.1 | **Cartographical aspects of Martian moons modelling** (#1099)

E. Grishakina[1], **E. Lazarev**[2,1], M. Lazareva[1]

[1]*Lomonosov Moscow State University, Geographical, chair on Cartography and geoinformatics, Russia;* [2]*Sternberg State Astronomical Institute, Lunar and Planetary Research, Moscow, Russia*

A full-length version is available and can be opened here:

_extendedAbstract\305_proceeding.*

Topographic or hypsometric maps and 3D-models of space objects with irregular shapes are one of the most significant components of Solar System thematic cartography. It gives possibilities to investigate different relief features, to develop space missions including landing on celestial bodies, and to find out space object origin and geology. Such maps are important in popularization of space science and can be used in educational work. Phobos orbits round about 9378 km from the center of Mars and Deimos – 23500 from the center of the planet. For its modeling we used the Phobos radii of 13,0×11,4×9,1 km and Deimos ones of 7,8×6,0×5,1 km recommended by the IAU (Archinal et al., 2011) and digital elevation models (DEM) with 0,5 degree resolution for Phobos (240 747 object points) (Wählisch, Willner et al., 2009) and 5 degree for Deimos (2700 object points) (Thomas, 1993). The heights on Phobos and Deimos are referenced to spheres of mean radii 11,1 and 5,77 km respectively. There are some problems in mapping the surfaces of Martian satellites Phobos and Deimos. We can distinguish three main factors influencing on mapping and modeling: - small sizes and irregular shape - typical relief features - difficulties in obtaining and processing of remote sensing data. Considering these aspects we created hypsometric maps and 3D-models of the Martian satellites. The Phobos and Deimos relief map (fig. 1) was compiled in orthographic projection and published in 2012 (Lazareva, 2012). As the Moon both Phobos and Deimos always face only one side to the planet since their rotation periods are the same as the period of their orbits rotation. The central longitudes of the hemispheres are 0 and 180 degrees being corresponded to the satellites' nearside and farside respectively. So the map grids were derived from the best-fitted biaxial ellipsoids 11,2×9,1 km for Phobos and 6,0×5,1 km for Deimos. The special color height scale with the equal interval of 500 m was designed with respect to the real colors of the satellites surface (Fig. 2). A scale of 1: 60, 000 was selected for the map, which results in an acceptable resolution of 11.8 pixel/mm (300 dpi) for A1 format hardcopy prints. All IAU approved Phobos and Deimos surface features names (17 craters, Lagado Planitia, Laputa Regio and Kepler Dorsum on Phobos and 2 craters on Deimos) (Gazetteer…) are set both in Latin and in Russian variations. The map was compiled using the ESRI ArcGIS Desktop software. 3D-models of Phobos (Fig. 2, left) and Deimos were created using the Autodesk 3Ds max software. The first step of modelling is extrusion the three-dimensional body from the sphere of a fixed radius according to elevation values from DEM. Next, global mosaics of Phobos (Thomas, Stooke, 2011) and Deimos (Stooke, 2001) and the topographic textures with contours were overlayed upon the 3D-figure. Suggested techniques of mapping and modelling could be applied for any celestial body with irregular shape for that we have digital elevation model with a determined precision.
References: Archinal, B. et al. Report of the IAU Working Group on cartographic coordinates and rotational elements: 2009. Celest. Mech. Dyn. Astron. 2011. Vol. 109. P.101-135. Gazetteer of Planetary Nomenclature // URL: http://planetarynames.wr.usgs.gov/ Lazareva, M. Kartografirovenie reliefa sputnikov Marsa. LAP Lambert Academic Publishing, Saarbrucken. 2012. 56 pp. Thomas, P., Stooke, P. et al. Phobos names with shaded relief image. 2011. URL: http://planetarynames.wr.usgs.gov/images/phobos-cylindrical-grid.pdf Stooke, P. Cylindrical map of Deimos. 2001. URL: http://www.solarviews.com/cap/mars/deimoscyl4.htm Thomas, P. Gravity, Tides, and Topography on Small Satellites and Asteroids: Application to Surface Features of the Martian Satellites. Icarus. 1993. Vol. 105, P.326-344. Wählisch, M., Willner, K. et al. A new topographic image atlas of Phobos. EPSL 294. 2009. P.549-550.

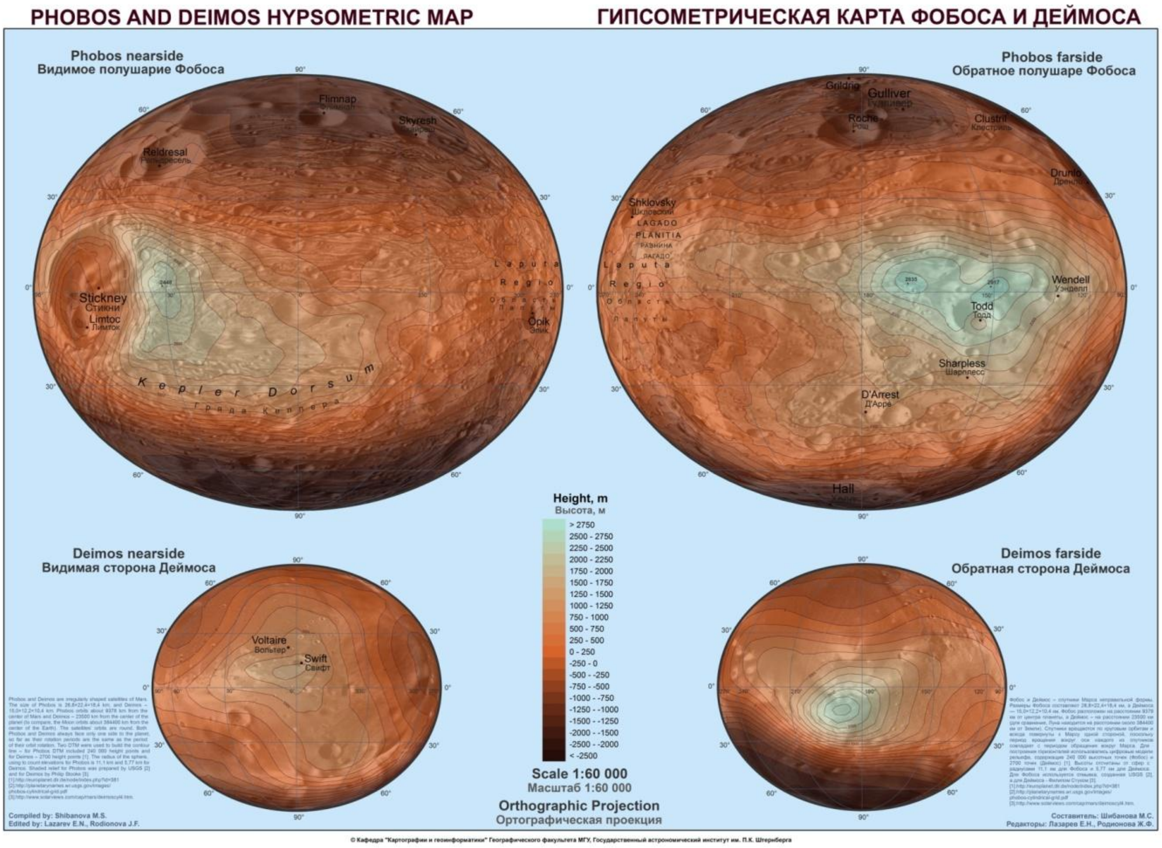


Fig.1:
Phobos and Deimos relief map.

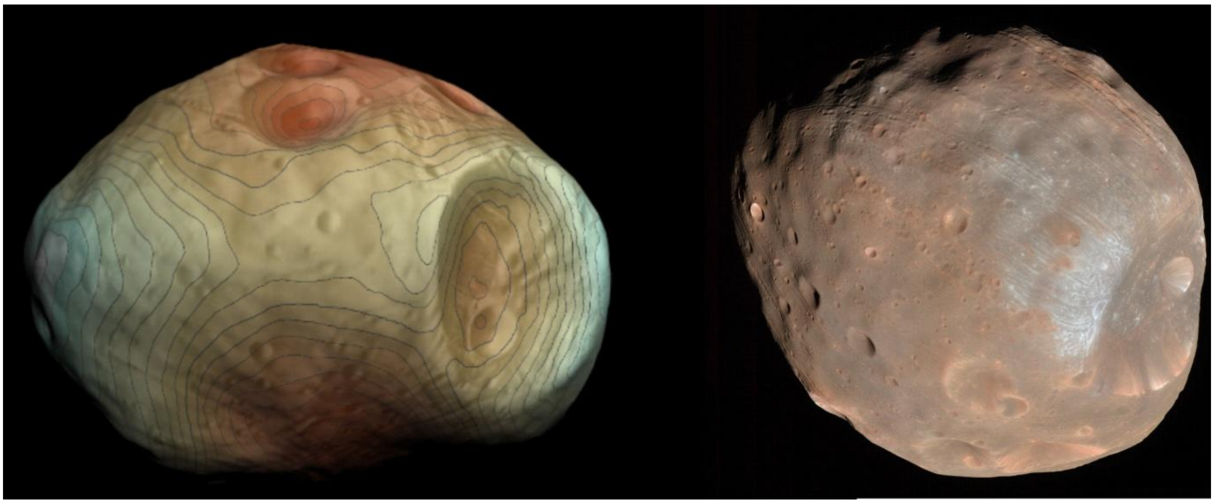


Fig.2:
Phobos 3D-model (leading side) (left) and an example of one HiRISE (Mars Reconnaissance Orbiter) observation (right).

8F.2 | **On the Concept and Integration of Geologic Time in Planetary Mapping**

(#104)

S. van Gasselt[1], A. Nass[2]

[1]Freie Universitaet Berlin, Planetary Sciences and Remote Sensing, Germany; [2]German Aerospace Center (DLR), Institute of Planetary Research, Berlin, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 271-280

Planetary image data and maps form one of the most accessible scientific products for establishing cross-communication between planetary research disciplines and the general public. In particular geologic maps comprise a wealth of thematic information and form an accessible and esthetic medium for both, laypersons as well as scientist. Geologic maps form a substantial part of the planetary map data record that is publicly available. If such maps have been designed carefully they condense 2.5+t dimensions (coll. 4D) into a two-dimensional map domain by connecting thematic attributes with geometry and time and by allowing (a) to completely reconstruct the subsurface extent as well as attitudes of mapped units by means of geometry, and (b) to establish a sequence of time units by relating legend items with geometric reconstructions. Despite the well-considered design of such maps, their higher non-geometric dimensionality and compression to two dimensions cause severe limitations in querying mixed non-spatial and spatial relationships, e.g. time, even in digital systems. This, however, is required for geological mapping in order to establish cross-relationships across regions on a local and even planetary scale. We here present a data framework which allows storing, managing and querying 2.5D+t information used in planetary geologic mapping. The focus is put on the general abstract ontological as well as the logical relationship concept which is designed to be employed in state-of-the art geographic information systems (GIS) commonly used for planetary geologic mapping.

8F.3 | **A Framework for Planetary Geologic Mapping** (#1226)

A. Nass[1,2], S. van Gasselt[3]

[1]German Aerospace Center (DLR), Inst. for Planetary Research, Dept. of Planetary Geology, Berlin, Germany; [2]University of Potsdam, Inst. of Geography, Geoinformation Science Research Group, Germany; [3]Freie Universitaet Berlin, Inst. of Geologic Sciences, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 261-270

Archives of published planetary maps hosted at the United States Geological Survey or other facilities consist of a large number of small to large-scale geologic maps of terrestrial planets, in particular the Moon and Mars. Along with recent and upcoming missions also to Mercury, the Outer Solar System moons, and asteroids systematic mapping of surfaces has received new impulses. As planetary geologic mapping today is performed by individual scientists not only in the US but also in Europe with dedicates mission programs and participations (ESA Mars Express, ESAJUICE, …) a general framework of mapping and in particular for organizing cartographic output is paramount. This work presented here provides a general overview of cartographic and data requirements in the context of collaborative mapping programs and establishes an innovative data framework that allows data integration, management and access in order to support communication of scientific results across disciplines and the public.

8F.4 | **Exploring Martian Climatologic Data Using Geovisualization: MARSIG a Spatio-Temporal Information System for Planetary Science** (#1258)

P. - A. Davoine[1], M. Villanova-Oliver[1], C. Plumejeaud[1], I. Baretto[1], J. Gensel[1], P. Beck[2], B. Schmitt[2]
[1]Laboratoire d'Informatique de Grenoble, Saint-Martin d'Hères, France; [2]Institut de Planetologie et d'Astrophysique de Grenoble, Saint-Martin d'Hères, France

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 247-260

The accumulation of observation data about the planet Mars during the last decade has contributed to the development of the Martian climatology field. This field focuses on the study of temporal evolution of physical proprieties of surface and atmosphere of the planet Mars. Taking into account the temporal dimension is a new topic in planetary sciences, which requires new methodologies and tools to explore data. Data about Mars come from Mars-Express or Mars Reconnaisance Orbiter spacecrafts. These data are multidimensional, including spatial, temporal, spectral and thematic components. They are also extremely heterogeneous and incomplete. To carry out their studies, the researchers need to identify and to extract some relevant dataset for a region of interest and a selected time period.
This paper presents MARSIG, a spatio-temporal information system dedicated to explore and visualize Martian climatologic data. First, the main characteristics of the Martian climatologic data are presented, and the needs of the researchers in planetary sciences in terms of exploration and visualization are discussed. Then, we present how the different dimensions of these specific data, and more especially temporal dimension, have been integrated into a geovisualisation interface to answer their needs.

ORAL

Session S8-G

NMCA - Neighbour Countries and Cross-Border Activities

Wednesday, 28 August, 2013

11:00 - 12:15

8G.1 | **Topographic databases on the border states** (#968)

J. Zieliński, J. Kamińska

Head office of Geodesy and Cartography, Department of Geodesy, Cartography and Geographical Information Systems, Warsaw, Poland

A full-length version is available and can be opened here:

_extendedAbstract\245_proceeding.*

Work on the harmonization and interoperability of databases have started in the last century, and have become genuine momentum in Europe, together with the work on the INSPIRE Directive and its implementation into the legal system in the countries of the European Union. Previously issues related to harmonization and interoperability was concerned, only in a limited range, on spatial databases within countries. The exchange of data between different systems within one country still makes a lot of problems. Much more complicated issue is the exchange of data between countries and their integration using different methods and different levels of integration. The cooperation of Polish and German geodetic and cartographic services is based on the agreements on *Cooperation and enabling mutual access to geodetic, cartographic and photogrammetric data and geographic databases* signed in 2008 and 2009 by the Surveyor General of Poland with the three neighboring german lands: Saxony, Brandenburg and Mecklenburg and Vorpommern. One of the results of signed agreements are work on a coherent model of topographic objects database in the border area, using topographic objects collected in the databases: BDOT10k in Poland and ATKIS in Germany. Works rely on performed the expertises in the field of harmonization of topographic objects database in the border area. Each country describing country's space by spatial database models with an accuracy of maps in the scale of 1:10 000, refers to their traditions and experiences on topographic cartography. The method of describing a similar area on the border of the state usually takes differing models of spatial data. The same objects in neighboring countries can be classified in different categories of objects with different attributes and different ways named and defined. Fundamental premise to undertake the work on harmonization, interoperability and integration of topographic databases on the polish – german border is the fact that at least in some parts the bases are similar. This means that the types and methods of description of the classified objects in the bases have common parts. The basis of the analyzes were data models defined in the relevant technical standards for individual databases, materials and data from ATKIS and BDOT10k. The basis of the analyzes were the data models defined in the relevant technical standards for each database, materials and data from ATKIS and BDOT10k. Objects from ATKIS and BDOT10k databases were divided into two main groups: - Objects that appear in one database, - Objects that appear in both databases. Objects from the second group (which are the subject of a possible integration) is significantly more than in the first group. The issue of harmonize the topographic databases on the border states is an essential issue for the implementation of particle production at different scales of topographic maps in countries, as well as for the construction of domain-specific geoinformation systems, proper spatial planning and development of border regions.

8G.2 | **Cross-border cartography for new French base map at 1:25 000 scale**

(#1026)

F. Lecordix, P. - E. Gautreau, Y. Sciardis

IGN, Service des développements, Saint-Mandé, France

A full-length version is available and can be opened here:

_extendedAbstract\376_proceeding.*

The French national mapping agency IGN developed a new production flow line of vector cartographic database at 1:25 000 scale, by tiles of 20 km x 20 km, deriving the initial data stored in geographic database BDUni and BDComplémentaire. The BDUni is the national referential at large scale, with a metric precision, available on the whole French territory and continuously updated. This database provide all topographic information: road, railway, hydrographic and electric networks, buildings, land cover, toponymy…The database BDComplémentaire is building-up on the whole territory at the rate of tiles mapping and stores the complementary information which is necessary to produce the wished topographic map, in particular touristic information (itineraries, point of interests,…) and other specific information not registered in the BDuni, for example contour lines. The derivation process proposed, described in detail in (Maugeais and al, 2011), consists of different highly automatic steps to derive the data, first, in a reference database, called BDRef, which allows in particular to introduce the data consistency of 2 initial vector databases. The second step provides a cartographic derivation to obtain France25, a cartographic database at 1:25 000 scale, with the wished symbolization (Figure 1). This derivation uses complex generalization process (Barrault and al 2001), and label placement which are highly automated to maintain low production cost. The production of this new cartography is finishing the increasing. The specific cases must be examined henceforth to be able to produce all tiles. A specific case concerns the cross-border tiles where the information requires for producing the whole tile, in particular the foreign part, is not available in the BDUni which limits his contain to the French territory. An example of the result obtained with the present process on the tile of Hendaye, in border with Spain, is provided in figure 2. We can observe the lack of information on the foreign part. For previous edition of maps at 1:25 000 scale, obtained in the past with traditional process and updated now in a raster mode, the used process consisted in the integration by traditional way or by raster file of cartography provided by the foreign NMA on their own country. For other smaller scales of maps, the solution used at IGN consists in a digitalization the foreign information from existing maps in the data model of French map. These solutions don't allow providing either a homogeneous representation on the both sides of frontier, either a low cost of production. IGN France decided to launch a study to propose a new solution exploiting the similar data produced by our European neighbor counterpart. This experimentation was done with data from IGN Belgium. The aim of work consists in using foreign vector data, by translation of Belgian data model and data projection of foreign part in French data model and projection, and then linking of Belgian data with French data in the frontier. Then, the nominal process of cartography can be used on the whole cross-border tile. This specific step to prepare Belgian data is managed with the 1Spatial software Radius Studio. The submitted paper will detail the proposed process, difficulties and results discovered on a tile, which can be extend to other data of foreign counterpart and to other production flow line. **References : Barrault M., Regnauld N, Duchêne C., Haire K., Baeijs C., Demazeau Y., Hardy P., Mackaness W., Ruas A., Weibel R. 2001.** Integrating Multi-agent, Object-oriented, And Algorithmic Techniques For Improved Automated Map Generalization. *Proc. of the 20th ICC, vol.3*, Beijing, Chine, 2001, pp. 2110-2116 **Maugeais, E., Lecordix, F., Halbecq, X., Braun, A. (2011)** : Dérivation cartographique multi-échelles de la BDTopo de l'IGN France : mise en œuvre du processus de production de la Nouvelle carte de base, *International Cartographic Conference*, 2011, Paris.

Figure 1:
The New Base Map at 1:25 000 scale derived from BDUni and BDComplémentaire

Figure 2:
Figure 2: Bad result obtained at this moment in the new flow-line for cross-border tile

8G.3 | **The new civil-military topographic maps of Austria** (#529)

R. Ditz[1], A. Stummvoll[1], H. Zierhut[2]

[1]*Ministry of Defence and Sports, Institute for Military Geography, Vienna, Austria;* [2]*Federal Office of Metrology and Surveying, Cartography, Vienna, Austria*

A full-length version is available and can be opened here:

_extendedAbstract\267_proceeding.*

The official topographic mapping in Austria is based on three main scales. By decision of 1959 these map series were the Austrian map 1 : 50 000 (ÖK50), 1 : 200 000 (ÖK200) and 1 : 500 000 (ÖK500) which covered the needs of all governmental users including the military as well as the private sector. Responsible for production and edition was in the past and is at present the Federal Agency of Metrology and Surveying. By joining the European Union and the Partnership for Peace (PfP) Programme in 1995 also the preconditions in Austrian security policy changed and had therefore an impact on national mapping. The Austrian government agreed to a NATO's proposal to change the official map series from national to international standards. That proposal, by the way presented to all PfP-members and also agreed by the countries, resulted nationally in the change from GAUSS-KRÜGER-projection to UTM-projection and the introduction of a map series 1 : 250 000 for the Austrian Armed Forces instead of the map series 1 : 200 000, which remained a civil map series until 2011. The production of the ÖK200 ended and the first civil-military map series 1 : 250 000 has been produced since than. The topographic maps at the scale of 1 : 50 000 of Austria had historically based a civil and a military edition with some slight differences in content and map layout. Due to financial restrictions, the costs of the production of these two editions had to be reduced. This led to a discussion, whether these two different editions are necessary or up to date, and if and how these differences could be abolished. The results of this discussion will be presented in this paper. The compromises that had to be made concerning the map data outside of Austria and all about the problems that occur in using map data delivered by the neighbouring countries will be depicted as well as the adjustments of the layout, which had to be designed completely new. The map 1 : 500 000 is the last map that will be published in a civil-military edition and a new layout. The results will also be presented in this paper.

8G.4 | **Swiss Maps from Paper to Geo Services** (#1029)

R. Künzler

Federal Office of Topography swisstopo, Cartography, Interactive Map Applications, Wabern, Switzerland

Switzerland has had its current boundaries since 1815, but maps of the Old Swiss Confederacy have been drawn since the 16th century. The first topographical survey on a federal level began in 1809, resulting in the Topographic Map of Switzerland or Dufour Map. From 1869 to 1901, this map was replaced by the Topographic Atlas of Switzerland or Siegfried Map. Since 1901, the Topographical Survey of Switzerland has been an independent division within the military, introducing the Swiss coordinate reference system in 1903. 1938, the replacement of the old Dufour and Siegfried Maps by new map sheets was started. Appearing in 1:50’000 scale first, and from 1952 also in 1:25’000 scale. In addition, further generalisations were made in order to be able to produce smaller scale maps. In each scale, the whole of Switzerland was covered. In 1979, with the publication of the last 1:25’000 scale map sheet, the work was completed. After that, the regular actualization process was initiated and the maps were updated every six years. The map sheets have been produced in several different versions: (standard) topographic maps, hiking maps featuring the footpath network of Switzerland and maps for special purposes like for example aeronautics and geology. In the later 80ies, the availability of large format scanners allowed to capture printed map sheets in order to get digital map material. The standard dimensions of these digital map sheets together with the geo-referencing made the usage of pixel map data on computer systems possible. These pixel maps were used to create the first SWISS MAP 100 product featuring the whole of Switzerland in 1:100’000 scale. The product was sold on a CD-ROM, which carried an easy-to-use Windows software and the digital map data. Over three product generations, the media-based Swiss Map products evolved and reached the Macintosh computers in 2003. Finally, the product series covered all the National maps of Switzerland up to the 1:25’000 scale. Based on the Act on Federal Geoinformation from 2007, the implementation of a Federal Spatial Data Infrastructure (FSDI) was decided and realized. This infrastructure allows to bring all the federal data providers together and offer their geographical information on one single web and mobile access point. The launch of the portal geo.admin.ch in 2009 and the availability of its geo services allowed Swiss Map to get rid of the media which carried the map data. Swiss Map online, issued in 2011, combines the two concepts of traditional native hybrid software (Win and Mac) and reading spatial data over the internet directly from the FSDI via the geo services of the portal. The Swiss Map software of the fourth generation offers additional functionality and value: flexible GUI, extended drawing functions, GPS interface, calculation of altimetry profiles, import/export features and more. The growing distribution of smartphones and tablets lead to an increasing demand of a Swiss Map for mobile devices. These palm-sized computers offer power, connectivity and various sensors. They are a very attractive hardware basis for mobile map applications. Swiss Map Mobile started 2008 with a simple Java ME application for a first mobile phone in cooperation with SonyEricsson and the prime mobile provider in Switzerland. In 2009, the palette of supported devices and platforms could be broadened with both Windows Mobile and iPhone versions. Swiss Map Mobile for Android followed 2011. Swiss Map Mobile is one of the most successful interactive map products ever issued by swisstopo. It is a reliable companion: it offers the combination of a powerful device featuring various sensors with a rich application for track recording, moving map display, calculation of panoramic views and even Augmented Reality (AR). All these products would never have been possible without the top quality topographic map material of Switzerland.

ORAL

Session S8-H

International Map Year

Wednesday, 28 August, 2013

11:00 - 12:15

Session S8-I

Business Meeting of the Commission on Map Production and Geo-Business

Wednesday, 28 August, 2013

11:00 - 12:15

POSTER

Session P2

Poster Session

Wednesday, 28 August, 2013

12:15 - 12:45

P2.1 | **River Classification and River Network Structuration in River Auto-selection** (#855)

L. Jiang[1,2], Q. Qi[1,2], F. Zhou[1,2], A. Zhang[1,2]

[1]Chinese Academy of Sciences, Institute of Geographic Sciences and Natural Resource Research, Beijing, China; [2]State Key Laboratory of Resources and Environmental Information System, Beijing, China

A full-length version is available and can be opened here:

_extendedAbstract\855_abstract.*

P2.2 | **Automated Cartographic Generalisation: Can we learned from the Classical Maps?** (#255)

V. Talhofer[1], L. Sokolova[2]

[1]University of Defence, Military Geography and Meteorology, Brno, Czech Republic; [2]Military Geographic and Hydrometeorologic Institute, Dobruska, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\215_proceeding.*

Cartographic generalisation is a complex process in which the holistic approach is necessary to apply. Cartographic tools that are usually part of production systems are very effective means for map production. However, the setting of appropriate parameters for particular object or geographic area, from which is the map processed, is a weak point of such tools. The guidelines for map content creation are usually specified in a production organisation including details of feature generalisation. Such the guidelines for topographic maps 25K, 50K and 100K are used in Military Geographic and Hydrometeorological Institute in the Czech Republic. Some parameters of generalisation are set in numeric form (mainly for selection), but some parameters are given only verbally and final result depends on the experience and ability of an editor. The Geographic Service as a guarantor for military topographic maps has issued six editions of topographic maps in the last sixty years. The first four editions were mainly edited manually and only the last two editions were produced using GIS software. Classical cartographers were usually not only highly skilled map editors, but also topographers, and therefore they were able to create map content like holistic problem. On the other hand they had an individual attitude to cartographic generalisation and some differences in details can be found in old maps. It is a question; whether despite of above mentioned individual differences it is possible to apply the experience of former cartographers in modern technologies? Because ArcGIS is in present utilised like a fundamental system for the map creation, different types of generalisation´s tools and their parameters were consider in our research. In our research the examples of topographic maps scales 25K, 50K, and 100K coming from previous editions were digitized and generalisation tools of ArcGIS 10.1 were applied. The goal of the task was to find out which parameters of given tools are essential to enable us to receive the results corresponding as much as possible to original map. Two different types of landscape were chosen as an example – an urban area and rural one. Results were compared with maps generated using present automated technologies. Typification of landscape according to its structure (communication, build-up areas, forests, hydrology etc.) can be done and generalization rules and parameters typical for given type of landscape can be applied in map editing process in the future.

P2.3 | **Some aspects of the generalization of small-scale digital elevation models** (#724)

Z. Ungvári, R. Szabó

Eötvös Loránd University, Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\317_proceeding.*

Digital elevation models (DEM) are widely used in cartographic practice, but it is important to know their limits. The technical parameters are known from the documentation, but their cartographic applications are sometimes incorrect. The goal of the current project is to examine the usefulness of contour lines of the vertical and horizontal generalization in various map scales generated from DEM. The examinations were started with 1 : 25 000 000 and smaller scale maps. We chose a sample area, the Arctic Ocean[1] , for which the elevation model was freely available. This area is over 60° north, therefore the SRTM and ASTER GDEM are unusable; in addition, most of the areas are marine regions. The best choice was the ETOPO1 dataset of the bedrock of the ocean basin with 1 arc second spatial resolution. This database is free for download from NOAA's ERDAP [2] server. This model contains the elevations for the maritime bedrock under the ocean surface. Using the Global Mapper Generate Contour Lines function, we got the automatic generated bathymetric isolines, which can be corrected afterwards manually. The horizontal and vertical generalizations are closely related, but they should be separated in particular cases. Using the information from the DEM's about the heights and depths of the terrain, it is possible to create the demonstrative hypsometric curve of each elevation frequency for a sample area. In the past, these diagrams were made manually, which was hard work and some data were neglected. We must consider this histogram to get a realistic image of the surface. According to earlier studies [3] that gave recommendations for the number of contour lines and their values, the minimal number is sixteen at this scale. The map of the Arctic Ocean was based on these values. The authors modified the map after taking into consideration the floor morfometry and the histogram, and created another map to show the differences. Another comparison was made with the GEBCO bathymetric maps. The horizontal generalization depends on the knowledge of the tectonic forms. The horizontal generalization on topographic and large scale maps are now developed and regulated, but it goes more subjective on medium and small scale maps. In addition, these databases are based on the digitization of national topographic maps (in several cases on automatic digitization of contour lines) and not on the freely downloadable contour lines automatically generated from DEM's. The elevations data from the national digital topographic maps are very expensive in most countries, including Hungary. Therefore, it is necessary to know the efficiency of using generated contour lines from different DEM's, and to decide which can be combined with other representation techniques like hill shading (also generated from DEM's) and hypsometric tints. In this paper, the authors examine how to reduce the subjectivity of generalization in map making and give ideas using DEM's in generalization. The authors plan the examination of the automatic generated contour lines for as large map scales as possible. Not only the undersea features are studied , but also some sample areas to learn about the usability of digital terrain models like SRTM, GTOPO30, ASTER GDEM created for continents.

---

[1] **Renáta Szabó**: *Az Északi-sarki óceán tengerfenék-domborzati többnyelvű földrajzinév-tára. MSc degree thesis, Budapest, 2012.* [2] *http://coastwatch.pfeg.noaa.gov/erddap/index.html* [3] **Mátyás Márton**: A Világtenger. *Eötvös Loránd Univ., Dept. Cartography and Geoinformatics, Budapest, 2012. pp. 124-169.*

P2.4 | **Calculating the number of settlements on the basis of the relationship of population density and density of settlements.** (#773)

A. Dvornikov[1,2], O. Shirokova[3], V. Nikeeva[3]

[1]Moscow State University of Geodesy and Cartography, Science and Education Center of Geoinformation Mapping, department of cartography, Russia; [2]Urban Environment Research and Design Institute, Urban planning and audit department, Moscow, Russia; [3]Moscow State University of Geodesy and Cartography, department of cartography, Russia

A full-length version is available and can be opened here:

_extendedAbstract\202_proceeding.*

At the Department of Cartography of the Moscow State University of Geodesy cartography of Dr. Ivanov A.G. was developed the automate system for the creation and transformation of small-scale cartographic basis. The system should provide automated creation of digital cartographic basis for any area of the world in the best map projection scale 1:2 500 000 and smaller. As part of this work was carried out studies on the establishment of the variation of the number of settlements and to develop the body of mathematics for the selection of settlements based on their density in the Russian Federation. Settlements' selection results reached high similarity with existing cartographic products (maps and atlases, which were highly appreciated by experts). During the course of research, it became clear that transition to foreign territories requires different mathematics' body basis, since information on settlements' density all over the world, in different scales, is difficult to aggregate and maintain up to date. The task was to make a transition, in terms of technology, from density of settlements to the population density. The population density data is easily available, in the actual status, on any area of the world. After analyzing a large number of maps of Europe, published both in Russia and abroad, the dependence of settlements' number variation (shown on the map on the territory of Europe) on the map's scale and population density was revealed. On the basis of this relationship the mathematics' body was developed, which can calculate the number of settlements on the territory of a given set of scale. During the course of work, a thorough study on peculiarities of settlements' placement and distribution of European population was conducted. Further research will concentrate on the study of the relationship between settlements' density and road density, which will allow us to make geographical demarcation of the territory on the basis of its development, since these two parameters are the key, when we are talking about the development of the territory.

P2.5 | **Research and Application of Two-peak Changing Law of Electronic Map Load** (#408)

N. Jiang, Q. Sun, Y. Cao, H. Zhang, Y. Gu

Information Engineering University, map and gis, Zhengzhou, China

Map load, also known as the capacity of the map, is generally understood as the amount of symbols and annotation within the map border. Obviously, map load limits the map content. So far, people prefer to S-Style Curve as the law of paper map load changing with scale variation. Many scholars developed researches on key scale of multi-scale display and automated map generalization, which are based on the changing law of s-style curve map load. In fact, under the circumstances of electronic maps, due to the change of the electronic map cognitive environment and usage method, there are many differences between electronic map load changing law and paper map load changing law. However, electronic map load is the key factor that influence the clarity, smoothness and gradation of multi-scale display of electronic map, but researches on the electronic map load changing law is still relatively few. Therefore, we steep from the practice , explored changing law of electronic map load with the scale variation, called "Two-peak Changing Law of Electronic Map Load". 1 Adaptive analysis of S-style map load changing law under electronic map condition 1.1 The formation and characteristic of S-style curve map load changing law S-style curve changing law of map load is formed by calculating the load of different scales and interpolation, all of which are under the conditions of paper map and series scale (1:10 000, 1:25 000, 1:50 000, 1:100 000, 1:200 000, 1:500 000, 1:1 000 000), as shown in Figure 1 below. 1.2 Analyze the trait of changing law of map load that under the condition of electronic map There is a great difference of changing law between the paper map and electronic map. Variation of electronic map load is mainly influenced by the following aspects: (1) The way that the electronic map used changing from passive to active. (2) Content of electronic map turn from changeless to diversification. (3) Electronic map scales range from local scale to full scale. 2 Proposes of the two-peak changing law of electronic map load In order to find the variation law of map load, we have done a lot of compute of muti-scale electronic map load and mathematical statistics analyzing. And then come up with the "Two-peak Changing Law of Electronic Map Load". 2.1 Calculation and data acquisition of electronic map load This essay calculate the load of electronic map area automatically, basing feature extraction of color elements on RGB, that is using chromatic aberration of target color and background color as weights to involve in the calculation of area load. 2.2 Processing of electronic map load data and variation curve fitting Taking the difference of different sites and different regions into account, I made pretreatment of dozens of sets of data and got the load of full-scale range of electronic map, shown in Table 1.

Tab.1

scale	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1	6.4	6.7	7.0	7.4	7.7	8.0	8.3
map load	0.25	0.33	0.35	0.36	0.34	0.29	0.22	0.17	0.11	0.13	0.15	0.19	0.22	0.17	0.15	0.08	0.07

Using the data in table 1 as a basis, we use Matlab to calculate the curve as Figure 2: which has two troughs and two peaks, and it can be called two-peak curve. 2.3 Analysis of Two-peak Changing Law of Electronic Map Load Through analysis we draw some useful conclusions. For example, influencing factor of the dual-peak curve; Curve of electronic map load in area of different feature density. 3 Application of the two-peak changing law of electronic map load We create a multi-scale display models, following the "Two-peak Changing Law of Electronic Map Load", construct a more scientific multi-scale map display model. Using the multi-scale display model in full-scale navigation electronic map and national boundary electronic map displaying, and have get a better map display effect.

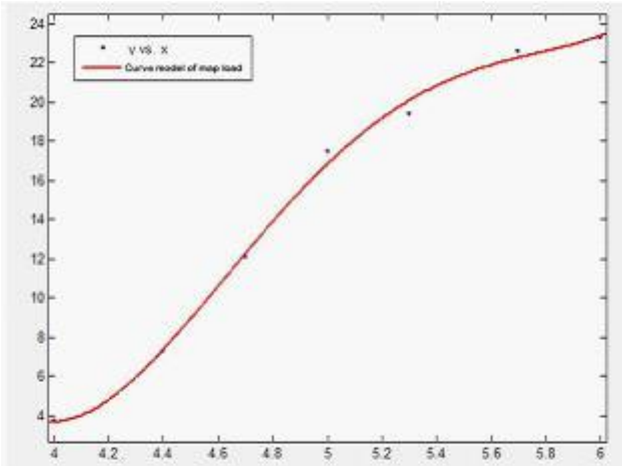


Fig.1:
S-Style Curve Model

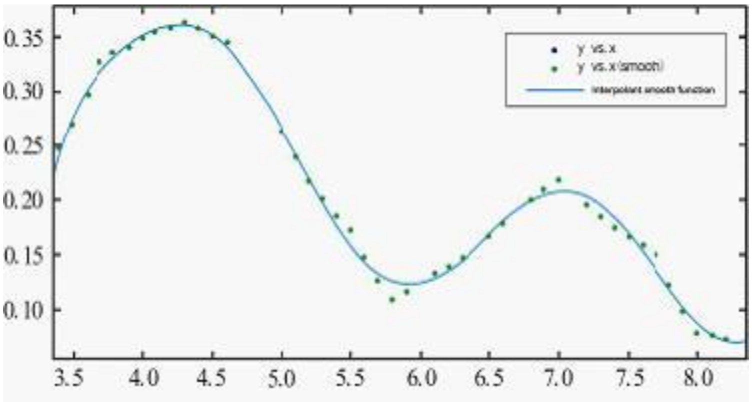


Fig.2:
Two-peak Changing Law of Electronic Map Load

P2.6 | **Cartographic generalization and specificities of geographical space in Algeria** (#139)

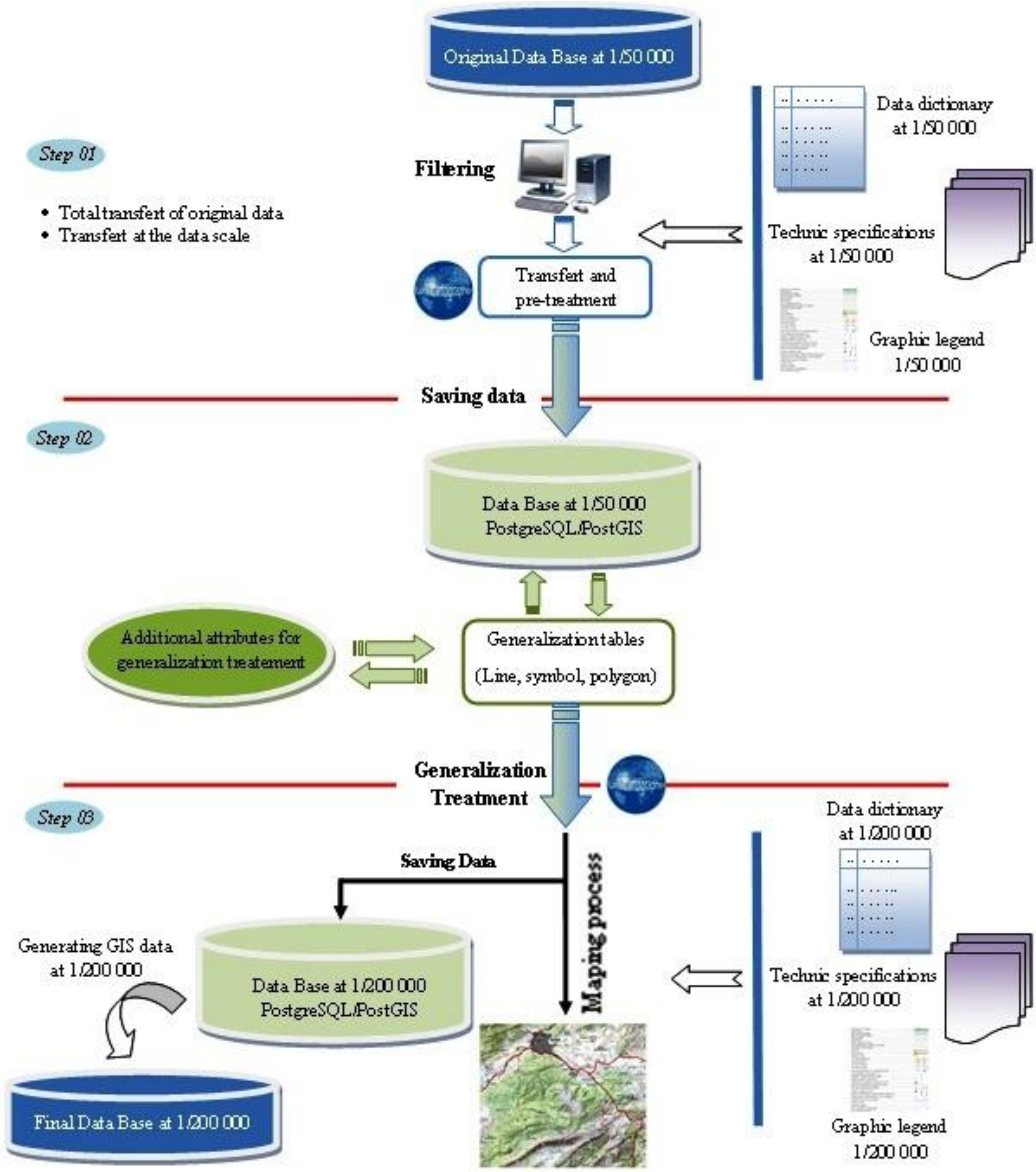
K. D. Abdelghani

National Institute Of Cartography and remote Sensing, Ministry of Defense, Hussein Dey, Algeria

A full-length version is available and can be opened here:

_extendedAbstract\63_proceeding.*

Moreover its large area, Algeria is characterized by the diversity of its relief. In north, the land is broken with the presence of several series of mountains having an effect on the road and hydrographic networks, very present in the zone. The large Sahara is characterized by flat grounds with the presence of dunes but also of an important hydrographic network. In the sub-Saharan zones, the relief is alternate between broken and quasi dish with more or less important roads and hydrographic network. The cover of the territory, entire, in topographic maps on various scales is considered to be very expensive and slow and this, compared to the surface of the country and the means granted for this mission. The objective, in the short and medium term, being to complete the cover at 1/50 000, to repair the old cover at 1/50 000 and to repair the cover at 1/200 000. To minimize the time and thus the production costs of maps, especially in order to repair or produce a new small scale maps, the National Institute of Cartography and Remote sensing (INCT) has devoted for a few years efforts in the automation of the process of generalization. This will to automate this task is due to the importance of generalization in the cartographic field and the slowness of the operation of manual generalization of the data (between 6 months and a year for a manual process, between 3 to 5 months for a manual generalization assisted by a software tool). The objective was the production of a new cover at 1/200 000 starting from a geographical database at 1/50 000. The difficulty is multiple: handle a very broad zone (16 cuts 15' x15' at 1/50 000 for each cut at 1/200 000 to produce) with an aim of contextual generalization, but to as make sure that information is continuous (connection between cuts) in the whole of the maps at 1/200 000 to generate. In addition, the technical difficulty of the automation of generalization is essential: which procedures does one apply?, in which order?, on which object? In this context, we propose an empirical and production oriented approach. The data Input being the information stored in the geographical database at 1/50 000, the Output will be a database at 1/200 000. The process suggested is articulated on a whole of programs of treatment of generalization, whose order of execution is fixed before, after a certain number of tests. The objects which we need generalize were identified before the execution of the programs of treatment. To the tables assignees of those objects were added additional attributes necessary than possible and this, in the objective to inform the system of generalization, best possible, so that it can choose among the possibilities, one of the treatments to apply to the objects to generalize. After series of tests, the parameters of generalization were fixed, and the priority in term of execution of the programs of generalization, were defined. The results, of this contextual generalization, are considered to be acceptable compared to the traced objectives. Nevertheless, improving programs and parameters setting will be necessary in the future in order to improve the final product. A second project is underway, that to achieve a total refection mapping at 1:50 000 through the generalization of the data resulting from large-scale restitution DMC images ‘very high resolution’. The process is defined and the tests will soon be started.



Generalization Process:
The figure details the steps to follow the production of map sheet at 1:200 000 from Data Base at 1:50 000

P2.7 | **The automation of technological processes for creating small-scale digital cartographic bases for general geographic and thematic mapping** (#771)

S. Krylov, A. Dvornikov, G. Zagrebin, V. Petrov, I. Plotnikov

Moscow State University of Geodesy and Cartography, Science and Education Center of Geoinformation Mapping, department of cartography, Russia

A full-length version is available and can be opened here:

_extendedAbstract\314_proceeding.*

The increasing demand for diverse and qualitative cartographic production can be satisfied by the automation of the technological processes of creating and using maps. First of all, we talk about both general geographic and topographic maps, which besides their common use, can be used as a cartographic base in thematic and atlas mapping. Small-scale general geographic maps don't have strict regulations. This fact prevents from using them as basic materials and creating new digital maps. Besides the increasing level of a generalization and the reduction of the map's scale reduces the accuracy of position of mapping objects, and it also prevents their use for the creation of digital maps. The system for office geoinformational mapping, solution to the problem of the automation of cartographical processes on the base of compiling, transforming and using cartographical data base was developed in the Moscow State University of Geodesy and Cartography under the scientific supervision of Prof. Dr. of Technical Science, Ivanov A. G. Direct formation of any database, including mapping, is a time-consuming and unprofitable process. Therefore, it is expedient to create mapping databases in the process of cartographic products creation. Cartographic basics, which are currently widely used in the thematic and atlas mapping, can be used as such products. The digital mapping basics include the borders, the elements of hydrography, settlements, and transport ways. The transformation of database content is carried out with the aim of mapping in a given mathematical and cartographic basis. For obtaining the required mathematical basis of a projected map the following processes have been automated: the validation of mapping scale, the choice of optimal cartographic projection; building the layout and the graticule. The transformation of the database content to any given scale of the derivative of a digital mapping base is carried out by means of the computer-aided technique of map objects' selection. For realization of the quantitative aspect of the selection process, a mathematical device for calculation of density index of cartographic objects was created. It allows you to determine the total number of settlements and set the overall length of the roads and rivers in the mapping of the territories of Russian Federation sub-federal units. Besides the ranking of mapping objects according to the degree of importance basing on identification codes of the objects takes place. We have developed a special program of mapping objects ranking for this; it also helps to decide a quantitative part of the selection. The qualitative part of mapping objects selection carries out in an interactive way. This development will provide not only the development of basic and derivative digital mapping frameworks for different areas of the Russian Federation in a given scale, but also will allow to use them for the development of thematic and special maps. It gives the opportunity to give up the search for a suitable traditional map of a required scale for using as a basic mapping material. The developed methodology and technology of converting the database contents were tested in a number of variously-scaled maps of the Russian Federation sub-federal units. The comparison of the created and the traditional maps showed good agreement on quantity and composition of objects.

P2.8 | **BASEMAP EVOLUTION IN MULTI-SCALE CARTOGRAPHY** (#938)

S. Zaychenko, M. Voronina, T. Khaibrakhmanov, K. Zykova, A. Isakov
SCANEX RDC, Moscow, Russia

New features of web technologies determine the rapid development of web mapping and web mapping design. Many users use web maps not only in the traditional sense - ground navigation, but also as a background for their own services showing on the basemap different user-generated content, statistical information, media content. Today, the developers of such services have the option of using resources not only of many web portals with online maps, but also the option to select different basemaps such web portals have. In the present study, the authors traced the evolution of the existing online map services from the point of view of the main approaches to the basemap creation, the tendency to increase the number of its variants and modifications. Initially most of the public web maps were created as the road maps. And for the users they are primarily associated with navigation using them. Now with increasing uses of web maps, so does the number of map backgrounds to which the user can switch on a web mapping service. Public map services are more conservative therewith and limited to a standard set of switchable backgrounds: map, satellite, hybrid, terrain. The contribution of cartographers-designers working on each of them can be traced in a consistent or chaotic modification of background style, addition or transfer of thematic layers (e.g., hill shading) from one map to another, the change in the content of scales. Web-GIS platforms, in turn, tending to a wider range of choice of the thematic basemaps. The obvious question is - does it make sense to classify basemaps and limit their number on the web service, or allow any thematic map function as a basemap? The simplest classification - is the division into basemaps that have the same content but different in style (monochrome versions of the maps, night mode, etc.) and maps with different original source and thus that differ in content. Details and thematic composition of map scale levels depend on the principles of generalization, which guided the cartographer-designer when creating it and are one of the components of his work (in addition to the map style and sign system). Developed by the authors methodical approaches to the principles of generalization for multi-scale carthography enable to optimize technology of basemap creation and allow designing different thematic backgrounds. The authors applied their knowledge in practice. At the moment for the Web-GIS Geomixer.ru, developed in ScanEx RDC, several basemaps have been produced: world map, terrain map, hybrid, and maps of different styling (www.kosmosnimki.ru). The main purpose of the diversity and plurality of background maps - is to ensure high-quality basis for the creation of web-services, based on the technical possibilities of the Geomixer platform. Versatile data sources are used for basemap compilation: opensource - OSM, Natural Earth; licensed - Collins Bartholomew, RuMap. It should be noted that one of the first companies that have decided to use and publish in their service several options for the map background, was the ESRI company, providing their users with a set of specific basemaps on the ArcGIS Online service and predict their popularity. The authors see a clear trend of increase in the number of basemaps. Tne mixing of genres of using maps (storymaps, web-GIS, geoportals) creates a new direction of user requests to the different subtleties in basemaps. At the same time mass services rather tend to a finite number of options, providing map self-manipulation tools to the users. Perhaps in the future we can expect the creation of a set of automatic generalization algorithms that form by the user's request a certain type of basemap, as evidenced by the tends of transition to vector web maps, dynamic rendering and the formation of thematic maps "on the fly".

P2.9 | **Automation of generalization operators of the building class for MRDB**

(#1227)

K. Kozioł[1], T. Chrobak[1], A. Krawczyk[2], M. Lupa[3]

[1]AGH-UST University of Science and Technology, Geomatics, Kraków, Poland; [2]AGH-UST University of Science and Technology, Surface mining protection and Geoinformatics, Kraków, Poland; [3]AGH-UST University of Science and Technology, Geomatics, Kraków, Poland

The legal regulations as regards functioning of the spatial data resources in Poland entail interoperability, harmonization and automation of the processes. The assumed automation concerns, among others, the digital generalization of DLM, which should allow the multirepresentation of the data. The article presents the using of generalization operators to creating automatically the objects in the multirepresentation /multiresolution topographic database from large-scale database (1: 500-1: 5000). Presented algorithms of generalization operators using as threshold parameter the standard drawing recognition, which is independent of the user. Studies have shown that we need to perform classification and organize data about the objects in the database by including their invariants, segmentation and the collection of spatial relationships. The generalisation process should be also classify by classification of each functionality and results of generalization operators. It is possible to satisfy the requirement of high automation level if the conditions of data orderliness, classification and hierarchy are fulfilled and the unambiguity of the process is ensured. The author’s research focuses on the automation of the generalisation process. It consists in defining the algorithms for generalisation operators, regard being had to the standard drawing recognition. The following operators have been examined: simplification, elimination, rectangularisation, shifting, joining and typification. The authors have proposed a three-tier concept in its it system, in which the business layer will consist in the main of the tools implemented on the basis of the presented this article generalization operators. The final product of the system will be simplified objects of the MRDB, according to the specifications. After all will enable the smooth power base and full integration between level of details in MRDB for building class. In order to assess the outcome of research the authors process of road infrastructure layer and generalization of surrender. Obtained results confirm that using of the standard drawing recognition with condition of automation in generalisation process of objects eliminate the parameter of threshold defined by user. The results of the process are unambiguous repeatable and could be verify by the standard drawing recognition.

P2.10 | **Multi-scale Representation: Modelling and Updating** (#812)

O. N. Çobankaya[1], N. Uluğtekin[1,2]

[1]*himself, genaral command of mapping, ankara, Turkey;* [2]*herself, istanbul technical university, Turkey*

A full-length version is available and can be opened here:

_extendedAbstract\49_proceeding.*

Although there is only one world, representing of this reality can change according to the purpose and scale. So, different products can be formed to represent the same world reality for different purposes. National Mapping Agencies are responsible to produce map series at different scales. This situation reveals an updating problem of the digital map series with a relevant method. Updating the digital map series is a process requiring time and cost because of the volume of data at national level. In order to perform this process more efficiently, dataset with lower resolution can be updated and generalized automatically after master dataset with high resolution is updated manually. In this study, it is aimed to establish the relationship between spatial objects belonging to the same world reality in a multiple representation database and to apply the revisions in master digital landscape model to the other digital landscape models with low resolution automatically.

P2.11 | **The integrated cartographic generalization of water system and geomorphology using 3D Douglas-Peucker algorithm** (#875)

F. Lifan[1], **H. Lina**[1], H. Jing[2]

[1]*School of Resource and Environmental Science, Wuhan University, Wuhan City, China;* [2]*Faculty of Resources and Environment Science, Hubei University, Wuhan City, China*

A full-length version is available and can be opened here:

_extendedAbstract\203_proceeding.*

In the field of digital cartographic generalization, the spatial conflicts between river symbols and contour lines frequently occur, especially when the generalization process for water system and geomorphology are separately performed. Several optimization techniques have been proposed to detect and correct the existing spatial logic conflicts between generalized hydrological symbols and hypsometrical curves in topographic maps or databases at home and abroad. However, it is not an easy task if the processes are performed still 2-dimensionally and the generalization of water system and contour lines are still separate. This paper puts forward a new method for automated cartographic generalization, namely, the integrated generalization for water system and geomorphology to deal with the frequently encountered problem of conflicts in spatial logic. The basic idea which gave birth to this proposal is from the fact that the geographical and geometrical relationships between the water system and the geomorphology are completely harmonious on the surface of the earth. While 3D coordinates of a river describe its shape, they reflect also part of the important structure lines of the surrounding relief. Like the contour lines, they can also be regarded as a means to describe the earth's surface with 3D geometrical information. Theoretically speaking, these two kinds of geomorphological information can be used simultaneously during cartographic generalization in order to achieve the natural and harmonious relationship between these two kinds of features. At the heart of our research, there are two novel generalization techniques: On the one hand, we expand the classic Douglas-Peucker algorithm which is one of the most popular methods for simplification of 2D linear features into three-dimensional with a TIN densification process to select recursively the potential feature points. These points are subsequently used to derive the contour lines representing the simplified terrain. On the other hand, we merge the terrain points from DEM and the streamlines in the data pre-process so as to realize the integrated characteristic point abstraction for the water system and geomorphology. An efficient pseudo point-plane weight is designed to make the river points more "tough" (not so easily to be deleted) during the generalization. Preliminary experiments have shown that with the integrated generalization of water system and contour lines using a TIN densification and 3D Douglas-Peucker algorithm, the relationship between the hydrological symbols and the hypsometrical curves in the source data can well be maintained or even be improved in the results.

P2.12 | **Formalizing rules for automatic symbol translation in representation of city structure and road network on multiscale maps** (#1230)

A. Podolsky[1], T. Samsonov[1,2]

[1]Lomonosov MSU, Faculty of Geography, Department of Cartography and Geoinformatics, Moscow, Russia; [2]Yaroslavl State UNiversity, Delaunay Laboratory of Discrete and Computational Geometry, Russia

A full-length version is available and can be opened here:

_extendedAbstract\328_proceeding.*

1. Introduction Multiscale mapping assumes that detailing and symbology of the image change interactive depending on scale (Brewer Buttenfield 2007). Changes in detail are controlled by generalization algorithms and are rather well automated (Li 2007). At the same time the logic of scale-adaptive transformation of graphic representation is formalized adequately and it hinders automation of the process. A consequence of it is that the traditional technology of multiscale maps design assumes personal design of each scale level. Our research is devoted to formalization of transformation rules of visualization methods, graphic means and variables in case of representation of settlements and a road network structure on multiscale maps. These rules are urged to automate process of translation of map symbology from large scales to small. **2. Technique** We simulate symbol conversion of each phenomenon as serial modification of the initial visualization method with certain parameters. It is supposed that the objects displayed on a map are stored in a database with multiple representations linked via hierarchical links. In case of the settlements it is optimal to operate 4 hierarchical levels: houses, quarters, blocks of quarters and settlements. In turn, the road network can include lines of several hierarchical classes. Design of objects and its conversion can be formalized as follows: 1. If the symbol employs two colors (inking and filling), in the HSV color space the vector connecting these two colors is built, and further change of colors occurs along this vector. 2. If in case of reduction of scale step-by-step disappearance of an inking is supposed, it is possible to pull fill colors and inkings towards each other along a vector in a proportion of k:1, k> 1, (that fill color which is more recognizable prevailed). 3. In case of "convergence" of colors of the central line and an inking the values of saturation and brightness should move in proportion to the value defined as 3/4 away from fill color to color of an inking. The last shift makes colors identical. Using these principles, design of settlements can be performed using the following algorithm (Figure 1). The quantity of road classes varies with scale and territory. However, in case of quantity of classes more than three, k of the largest classes shall be recognizable in all scales and have the minimum changes of external appearance. We accept k=2. All roads except the most small-sized class are made out by inked lines, and k largest classes have more bright and saturated colors (it is made out manually). Remaining classes are made out as follows: light-that a symbol increases, and the thickness decreases with class reduction. Further all roads follow sequence of actions (Figure 2): 1. “The convergence point” divides the linear gradient connecting initial inking and filling colors in proportion 1:3. 2. Both segments are segmented, which quantity on 1 less quantities of scale levels the given roads class life cycle, and each subsequent part of a segment in m>1 times more previous (numbering begins from large scales). 3. After the filling and inking colors are equal, the line is symbolized using the minimum visible thickness. Then it becomes translucent, and the next stage is exception of given road class. Such algorithm is universal, though not all classes of roads pass all steps. So, the largest classes are restricted to steps 1-2, and the most small-sized – 2-5. Transformation rules developed by us can be applied to automatically translate settlements and transportation network symbology from large scales to small. References: Brewer CA, Buttenfield BP (2007) Framing Guidelines for Multi-Scale Map Design Using Databases at Multiple Resolutions // Cartography and Geographic Information Science, No34(1), pp. 3-15 Li Z. (2007) Algorithmic Foundation of multi-scale spatial representation. CRC Press, 310 p

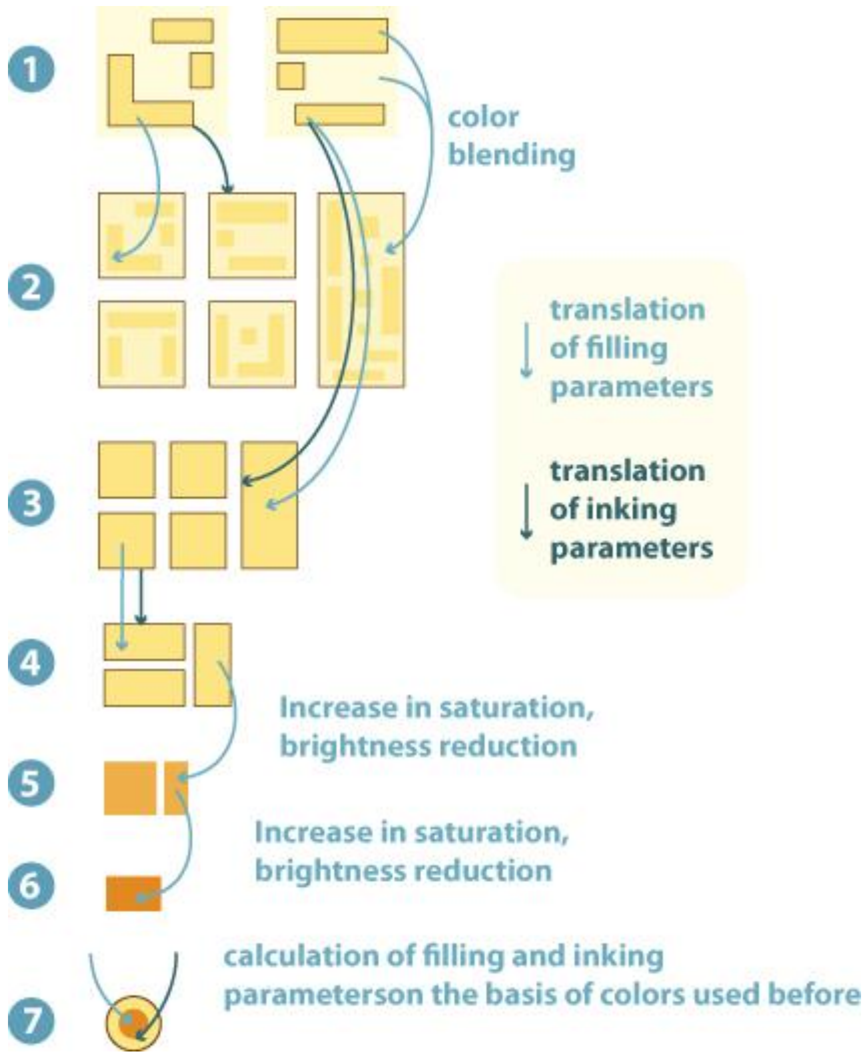


Figure 1:
The rules of settlement structure symbol transformations

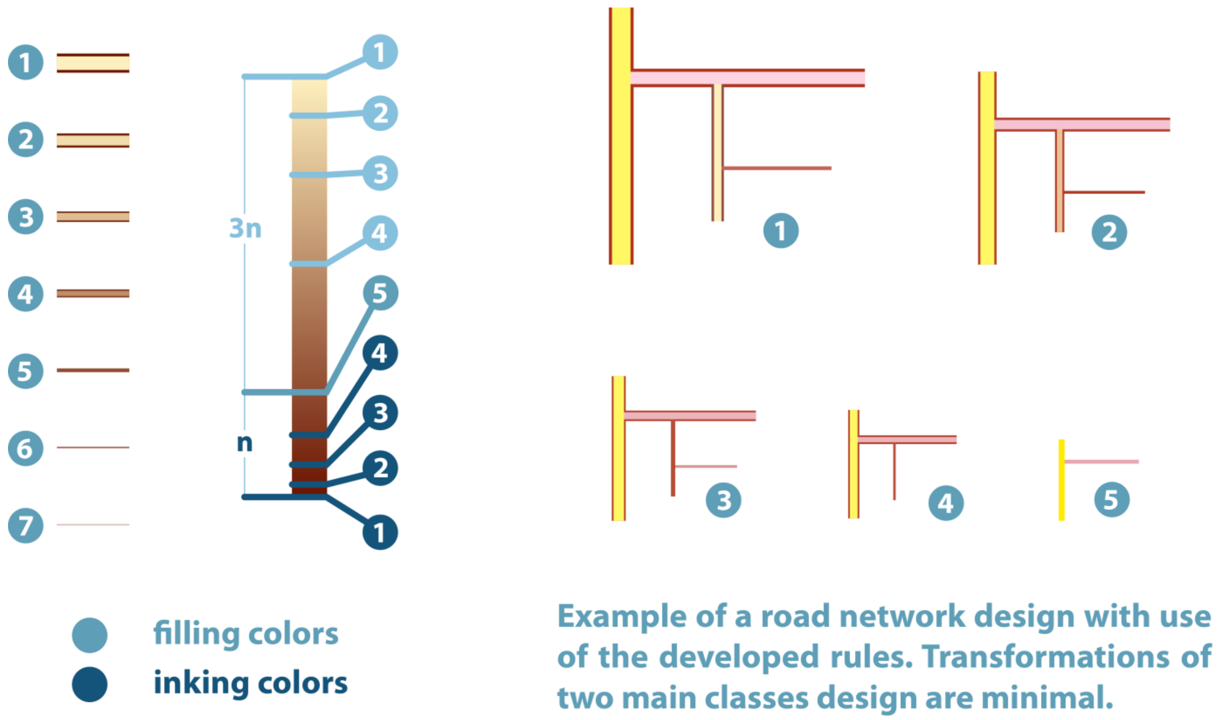


Figure 2:
The rules of road network symbol transformations.

P2.13 | **Automatic selection of symbols for pie charts and cartograms in multiscale thematic mapping** (#1242)

N. Yurova, T. Samsonov

Lomonosov MSU, Faculty of Geography, Department of Cartography and Geoinformatics, Moscow, Russia

A full-length version is available and can be opened here:

_extendedAbstract\329_proceeding.*

Background Automation of generalization and symbolization of data on multiscale maps is one of the key issues of modern cartography. Automated generalisation has been touched in many fundamental studies (Buttenfield & McMaster 2001, Li 2007). However resymbolization and graphics replacement in addition to generalization takes place during the scaling (Brewer, Buttenfield, 2007). Automation of this process is not developed enough. Usually it is necessary to symbolize every scale level individually, which is time-consuming task. In this experiment we focused on symbolic transformations that are applied to pie charts and cartograms (choropleth maps) when scale is changing. Developed formal rules can be used for automatic symbol selection and translation through scale levels. **Methodology** A set of formal rules for symbol transformation of pie charts and cartograms has been developed. These rules assume that several levels of detail (LoD) in database are available for every type of object and objects are linked through levels. This allows to keep track of how object geometry and attributes are changed during the transition to the next scale, and to select symbol transformation rule accordingly. Pie charts are intensively used on socio-economic maps. Consider we have point objects that are symbolized using pie charts. If the map is zoomed out this type of symbol can be applied to areal territorial unit (i.e from city point to areal district). On the next zooming territorial unit is switched to next hierarchical level. Let's consider this process as a set of separate formal transformation of graphical visualization: 1. The localization of the object changes from point to the polygon. 2. Aggregation of information is made by summation of values inside one territorial unit. 3. If the complexity of pie chart is not increased significantly after combining data from multiple points to one polygon, then initial diagram classification and colors can be used. Otherwise next hierarchical level of classification is applied to pie charts. The classification is stored in additional table. The colors are blended for categories that are joined in one class. 4. Chart size varies both with the scale of resulting image, and the range of values. The range increases if territorial units are aggregated (in case of use of absolute indicators). Growth of values on is analyzed and appropriate function (linear, quadratic, cubic, logarithmic) is applied to derive diagram radius from the value (Figure 1). Cartograms (choropleth maps) are usually used for display of relative parameters per territorial units. At scale reduction this method of visualization is applied to smaller mapping units. Process of scale-adaptive transformation of cartogram color and numerical scales can be controlled by following rules:

1. Values should be calculated for every LoD of data (different territorial units).
2. The analysis of histograms of an attribute for different LoDs of data allows creation of uniform color scale that covers distribution ranges for all levels of detail. Colors and critical values are selected automatically.
3. At reduction of scale there is a changeover to larger territorial units. Thus from a uniform color scale the interval corresponding to range of values at this level is selected (Figure 2).

The developed rules can be used in systems of drawing multiscale maps as follows: if the symbology for the most detailed mapping level is set, it can be translated to less detailed levels automatically.
References: *Brewer CA, Buttenfield BP (2007)* Framing Guidelines for Multi-Scale Map Design Using Databases at Multiple Resolutions // Cartography and Geographic Information Science, 2007, No34(1), pp. 3-15 Buttenfield BP and McMaster RB (1991), Eds., *Map Generalization: Making Rules for Knowl- edge Representation*, Longman Scientific and Technical, London, 1991. *Li Z. (2007)* Algorithmic Foundation of multi-scale spatial representation. CRC Press, 310 p.

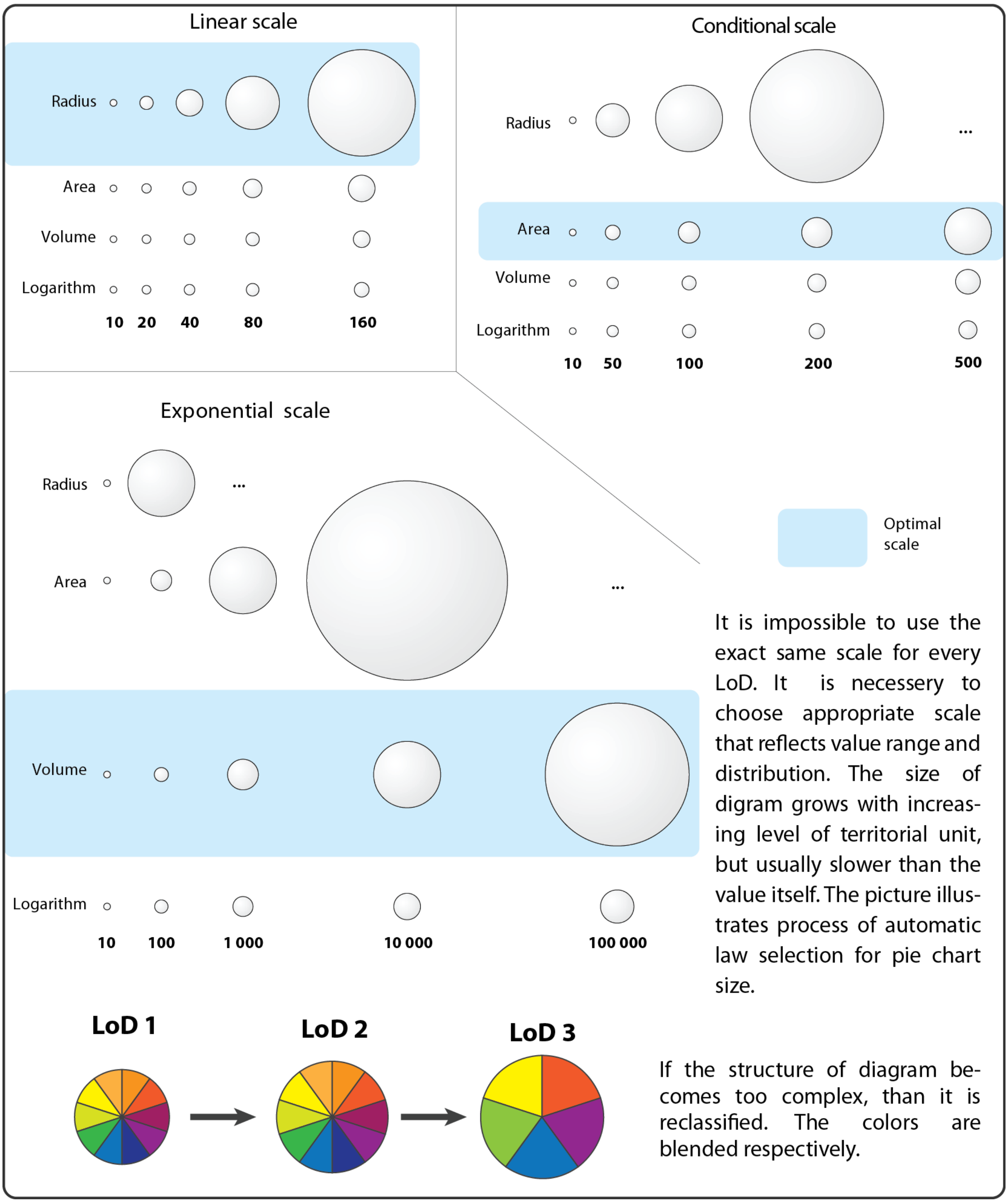


Figure 1:
Selection of size scale and reclassification of structure in pie chart visualization

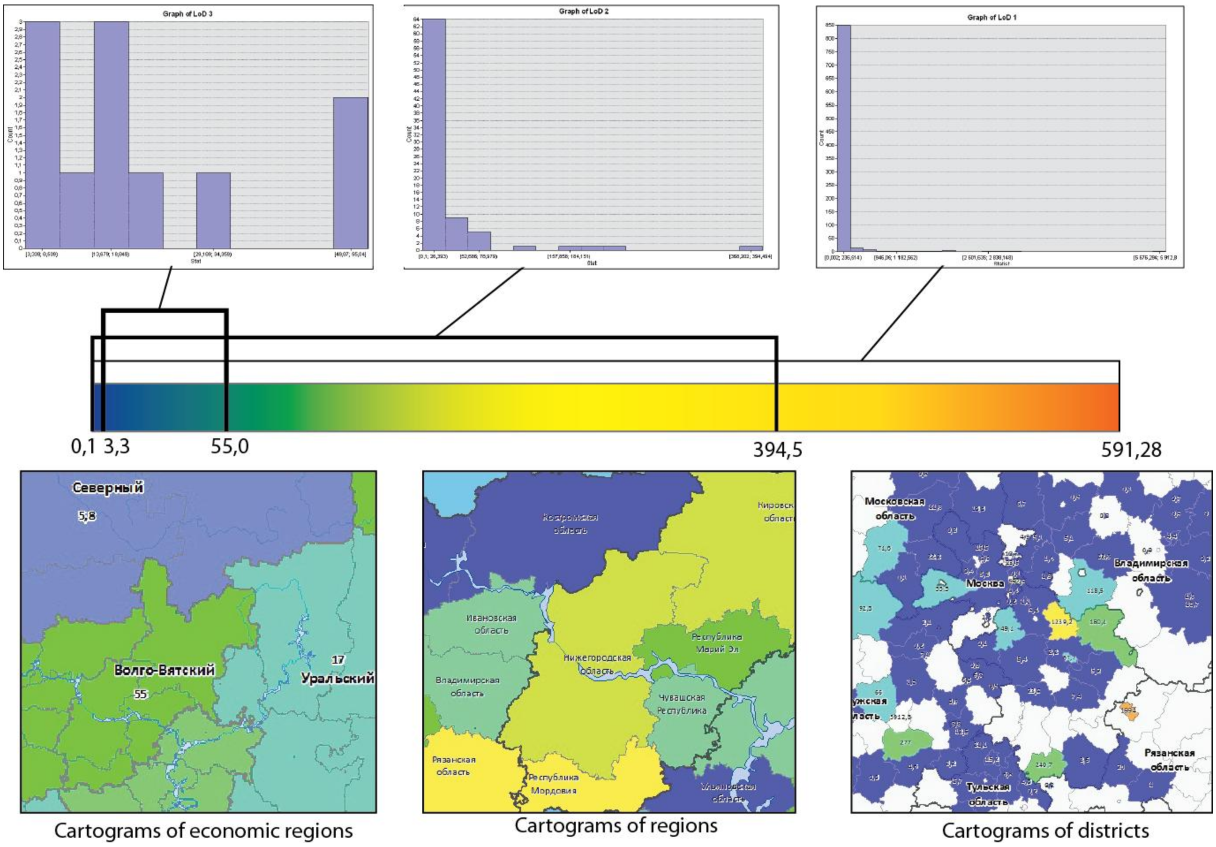


Figure 2:
Selection o color scale for cartogram multiscale visualization

P2.14 | **Way finding and needs of map users from Indigenous to ICT Knowledge applications: a comparative analysis of rural and urban societies of Serowe in Botswana and London in the United Kingdom (UK)** (#1371)

J. G. Maphanyane, J. G. Maphanyane
University of Botswana, Department of Environmental Science, Gaborone, Botswana

A full-length version is available and can be opened here:

_extendedAbstract\1371_abstract.*

P2.15 | **Perception of urban sustainability and environmental risk: the use of color schemes** (#682)

T. S. D. Silva, A. L. Iescheck, L. Olaerts, R. N. Ayup-Zouain
UFRGS, Institute of Geoscience, Geodesy, Porto Alegre, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\344_proceeding.*

Developing effective and reliable methods for representing and communicating geoinformation to decision-makers is a relevant challenge in GIS-based modeling and map making. Among all the choices one should make regarding map design to succeed in communicating information through maps, those related to symbology are crucial. Color schemes, in particular, can lead to completely divergent interpretations depending how they are applied. The management and planning of the Campus do Vale (Federal University of Rio Grande do Sul) in Southern Brazil, as virtually any other institution, relies on many cartographic information. Flood risk and urban suitability models are examples of indexes that must be considered in this process, as the local environmental agency requires. They consist in a relative measure, ranging from 0 to 255, so the understanding of the parameter per se is not an easy task for everyone. Besides, the possibilities to represent information of this nature are diverse, and a bad choice would likely ruin the ability of the user to understand important information for University expansion plans. In this study, we tested 4 different color schemes to represent each of the parameters related to urban suitability and flood risk. Undergraduated students with background in Cartography and GIS were asked to complete a questionnaire so that information about how easy it is to associate a color scheme to a parameter and to distinguish different levels of risk/suitability could be collected from the answers. To represent urban suitability, a blended palette ranging from red (low suitability) through yellow and green to blue (high suitability) was pointed as the best, given the prompt association between color and parameter. However, the classified version of this map (consisting in 5 classes: red for very low, orange for low, yellow for moderate, green for high, and blue for very high suitability) showed the best results in allowing to identify places in specific levels of suitability. The flood risk, on the other hand, was better associated to a blue palette, ranging from light blue (low risk) to dark blue (high risk). Again, once classified, the map readily allowed to identify places in specific levels of suitability. We conclude that even if urban suitability and flood risk are both ranked data, presented with the same range, the nature of the parameter influences its association with a color scheme. However, in both cases, a classified map separating the continuous range of data in 5 classes, from very low to very high, helped the user to identify different levels of suitability/risk, confirming that simpler representations may be a better choice than fancy, complex ones. In this study the audience was familiar with the map-making process. We believe that simpler representations would benefit even more users with no skills in geoprocessing techniques and very basic knowledge of Cartography. Thus the follow step is to test the same representations in the understanding of urban suitability and flood risk by managers of the university to obtain further information of the color scheme effect on the cartographic communication in dealing with a different audience.

P2.16 | **Customized Multilingual Topographic Maps of the Canadian Arctic**

(#1431)

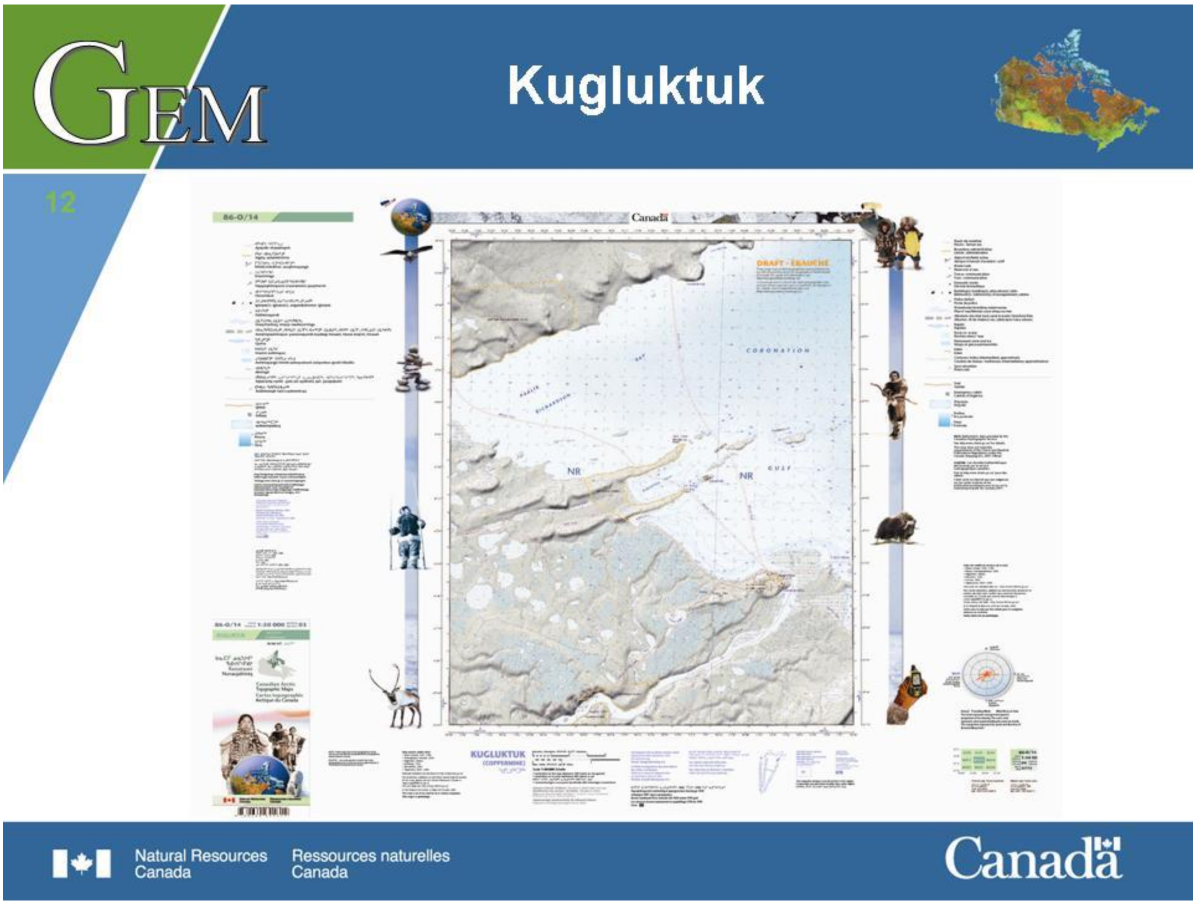
E. Siekierska[1], P. Williams[2], D. Carry[3], É. Loubier[1]

[1]Mapping Information Branch, Natural Resources, Ottawa, Canada; [2]Mapping Information Branch, Natural Resources, Ottawa, Canada; [3]MDT Communications, Ottawa, Canada

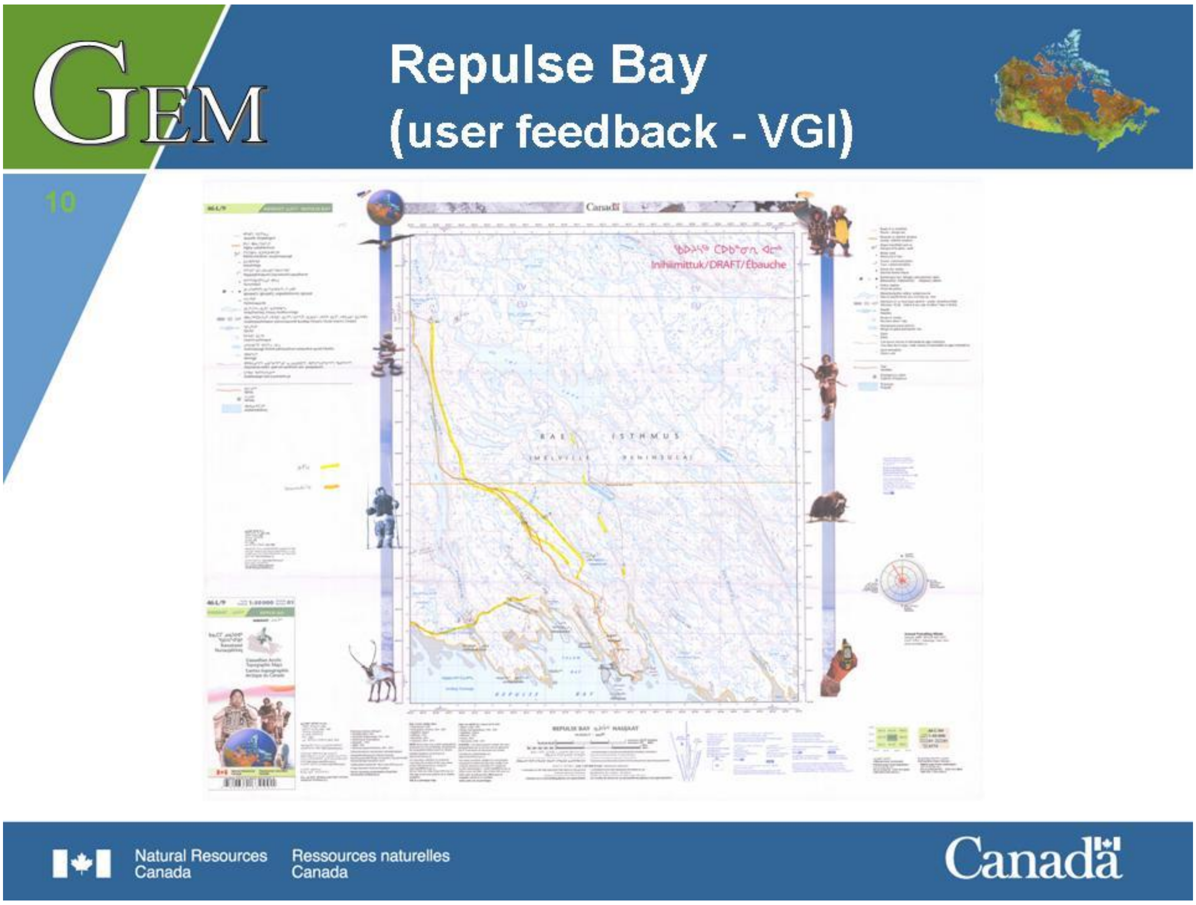
A full-length version is available and can be opened here:

_extendedAbstract\390_proceeding.*

Climate change and technological advancements have greatly impacted the Arctic regions providing economic opportunities and causing rapid environmental and social change. To respond to the increasing demands for geospatial information, the Centre for Topographic Information of Mapping Information Branch, Natural Resources Canada, has completed the mapping of the arctic region at the 1:50 000 scale. Based on the newly available base maps a research project has been initiated to develop customized, multilingual topographic maps, which responds to the needs of inhabitance of this unique region. The development of the customized maps is being carried out in collaboration with the Geological Survey of Canada and the Canadian Hydrographic Service. The customized maps will include features necessary for navigation and field work, such as: bathymetric contours, hill shading, and abandoned airports. The additional arctic topographic features have been requested by the arctic communities, such as: winter snowmobile trails, emergency cabins, open water surrounded by ice (polynia), prevailing wind directions, and others. The community is willing to provide this type of information on a voluntary basis, i.e. Volunteered Geospatial Information (VGI). The approach taken for development of the customized maps is based on an in-depth consultation and collaboration with the northern communities. Consultations were conducted in the three culturally distinct regions of the Arctic, the Eastern and Western region of Nunavut: Qikiqtaaluk and Kitikmeot, as well as in the arctic region of the Northwest Territories - Inuvialuit. The customized multilingual maps are illustrated with cultural and wild life elements using design style that resonated well with the Aboriginal maps users in the North. The Elders and heritage organization as well as educational institutions are interested in using these maps to transfer the traditional knowledge to younger generation and for preservation of Inuit cultures and life style. The key contribution of the customized maps is the portrayal of the Aboriginal place names in their language and script, however, accompanied by a transliteration into predominantly used in Canada roman characters. Inuit of the Eastern Nunavut, speak Inuktitut, written in Syllabics, whereas the languages spoken in Western Nunavut (Inuinnaqtun) and NWT (Inuvialuktun) are written using Roman alphabet. The use of Syllabics presents numerous challenges to cartographers. Additional challenges are: the use of long descriptive place names, naming of partial features, the existence of combined land-water features, and the inclusion of generics in the names itself. This paper will elaborate on the approach chosen for the development of the multilingual, customized arctic topographic maps. Present the status of development and feedback received from the potential users of these maps. The customized, multilingual maps are communicative and have been viewed as a culturally sensitive vehicle that facilitates communication and preserves traditional knowledge, a practical tool which enhances safety of activities in the arctic regions and as a long awaited vehicle for the depiction of the Arctic as seen through the eyes of its original inhabitants – the Inuit.



Integration of Bathymetry:
Customized Arctic Topographic maps with Aboriginal names, bathymetric information and hill shading



User provided Information:
Traditional Knowledge Provided by Inuit Elders - Repulse Bay map

P2.17 | **Multiple representations thematic and spatial reading-level and higher-level question: An experience in basic education in Brazil** (#1282)

B. Zucherato[1], M. I. Freitas[2]

[1]UNESP - State University of São Paulo - campus Rio Claro - SP Brazil, PPGG - Post Graduate Program in Geography, Brazil; [2]UNESP - State University of São Paulo - campus Rio Claro - SP Brazil, DEPLAN - territorial planning department and geoprocessing, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\165_proceeding.*

The representation area in thematic cartography has as one of its methods the graphic sociology, which rests on the system of signs and meanings guided by the reading of the space at different levels of analysis, as the level of the question and the reading level. These levels can be applied to different methods of spatial representations. The reading space in the question level allows the reader of the representation establish the reading of the geographic space presented in two orders: the level of detail question and the level of global question. The first allows answers to questions such as "what place? what's there?", while the second allows answer for the question “in what place is this data value?”. The reading space on the upper level requires the reader a spatial analysis, in what should be done a correlation between different thematic values presented by representation in different localities. With the purpose of observing these different levels of spatial reading using different representations, this work presents the results of a practice held in a public school located in the county of Santa Gertrudes (State of São Paulo), with forty-nine students of the 3rd year of high school, aged 17 years. The practice held sought to establish how students interact with the reading of a geographic space represented by multiple representations graphics and cartographics – column charts, anamorphosis maps, coropleth maps – and also establish what levels of question reading and of upper reading were performed by these students in their interaction with the representations used. The content used in practice has consisted of developing multiple spatial representations (column charts, anamorphosis maps, coropleth maps) of the same geographic theme proposed by the teacher: the indigenous population of Latin America. First these representations were presented to students and, then were asked questions related to the topic presented. This exercise required the students to do a reading of question level and upper level. In the activity the students should indicate which representation was used to answer each question. The results of this practice showed that 65% of students used only one representation to answer the exercises, while the remaining 35% used multiple representations. Among the students who used the multiple representations, the practice has disclosed that 65% of them answered correctly the exercise that required the level of global question, while 82% of students answered correctly the exercises that required a reading level of detail question and an upper reading of the presented informations. These results show that most students who participated in the practice performed did not use multiple representations, and among students who used multiple representations, the reading level of the global question was the one in which students had more reading difficulty. We can conclude that it is extremely important the encouragement of the use of multiple representations since the Elementary School, in order that students can to develop better this level of reading, what may provide a better reading of geographical space. Considering that each type of representation values a certain level of reading space disadvantaging another one, the teacher should indicate to students what types of representations are more suitable in every context.

P2.18 | **Designing maps from texts** (#1151)

G. Brun, C. Dominguès
IGN, laboratoire COGIT, SAINT-MANDE, France

A full-length version is available and can be opened here:

_extendedAbstract\397_proceeding.*

Semiology teaches us that maps as texts express ideas. In this thesis work which is still in progress, we focus on maps which come with texts. In this particular case, texts and maps are supposed to express the same ideas. The point is to help users to make map which conveys the same message than the text it accompanies. A map may be seen as the result of the application of a key map to a geographic dataset. Although information about relevant dataset can be found in the text, this work only talks about the key map. **1. Extracting and structuring the text message** A message results from an intellectual construction which can be seen as structuring main topics and concepts pertaining to these topics. In order to extract the text message, tools from natural language processing and knowledge management are usually utilized. These techniques are based on corpora. Thus, a corpus of French texts from various sources (newspapers, magazines, atlases, etc.) and accompanied by maps has been collected. The corpus is specialized; its theme is the geopolitics of natural resources, assuming that the approach can be applied to others themes. The first step of the text analysis consists in identifying the main topics. To complete this task, lexical statistics are used. For example, Lebart & Salem (1994) make it possible to identify the most frequent and the significantly frequent lemmas of a text, i.e. the relevant concepts of the specialized corpus, by Chi-square measures with a reference corpus. In this case, the reference corpus is non-specialized and journalistic. In the specialized corpus, the lemma *pétrole* (*oil* in English), *gaz* (*gas)* or *mine* (*mine*) has been identified. The second step consists in extracting and structuring the concepts pertaining to the identified topics. This set of concepts comes from two types of resources: a field ontology containing concepts like *champ de pétrole* (*oil field)*, or *forage pétrolier* (*oil well*) and based on already existing ontologies (Horrocks 2008), and terminological resources which make it possible to identify the “semantic relations” (Bertin 1967) between thematic concepts. These text segments are retrieved thanks to a stream of morpho-syntactic patterns applied to the text. The result of the second step is a key map structure based on Jacques Bertin’s semantic relations. **2. Assigning a graphic representation to the identified topics** The assignment of a graphic sign to each line of the key map is done by applying a set of rules, that has been defined beforehand, to the key map structure. This set can be divided into two groups. The first is related to Jacques Bertin's graphic semiology that deals predominantly with both semantic relations and visual variables. The first ones are called *selectivity*, *associativity*, *order* and *quantity* and have allowed to organize the key map structure through the structuring process mentioned above. Thus symbolization suggestions can be made on the basis of the visual variables, for example, using value variation to express order relation. The second group of rules could be called the user’s preferences and is based on the cartographer’s daily practices guided by their experience. These rules are laid down after interview with some cartographers who explained how they design maps on the basis of a text. The specialized corpus has been analyzed in order to identify recurrent graphic signs. The latter are realistic symbols and symbolic colors, as well as usual representations, for example, representations usually assigned to design changes of geographical objects over time.

P2.19 | **Tactile Mapping and tourism for disabled people: study in two touristic cities in Brazil** (#722)

M. R. Catelli, C. C. Reinaldo Gimenes de Sena
UNESP/Ourinhos, Geography, Brazil

When it comes to the process of inclusion, people with disabilities are related to the school environment or in the labor market. So, barriers still exist and are serious when we consider the leisure and tourism of these people. The perception of the space is given primarily by sight (85%), because it is the most comprehensive and synthetic sense. Therefore, it was felt the need to study how the visually impaired person understands the space of a tourist town and, more specifically, how the Tactile Mapping can contribute to a more efficient communication of touristic information, so the individual can understands better the touristic space and thus feel more motivated to travel and meet new places. The study takes place in the touristic cities of Barra Bonita and Igaraçu do Tietê – Sao Paulo, which receive about 15 thousand tourists per month. It also seeks to analyze accessibility in cities, know the demand and needs of tourists with disabilities, which is characterized by many scholars as an `ideal tourist`, because they spend more and stay longer in one place than an ordinary tourist. Tactile materials will be developed about the location of the cities and their attractions (Campo Salles Bridge and Lock Bonifacio Soares). The materials will be analyzed by people with visual impairment of the both cities, that will perform a tour coordinated by the researcher, and potential tourists. After the research, the materials will be available in the Municipal Historical Museum Luiz Saffi. The materials also have the potential to help other tourists with special needs, such as children or people with intellectual disabilities. The Tactile Mapping is an area that gives us the basis to think about effective communication, so the visually impaired people can enjoy a better quality of touristic spaces. We can define it as "the science and art of transposing visual information in such a way that the result is a document that can be used by people with visual impairments" (CARMO, 2009, p. 46-47). The thematic materials geared for tourism should be attractive, as it can contribute to the expectation of tourists on a particular place. They may also contain useful information (location of hotels, hospitals) and curiousities, as a brief history of the cities. According to the Global Code of Ethics for Tourism (1999), tourism is a means of individual and collective development, a form of self-education, mutual tolerance and learning to respect differences, promote the rights of men, especially the most vulnerable groups: children, seniors, people with disabilities, ethnic minorities and indigenous people. Through collaboration between government, university and private institutions, tourists with disabilities can enjoy more independence, autonomy and dignity of the touristic areas of the city, in a true social inclusion. The FIFA World Cup™ and the Olympics that will be held in Brazil in 2014 and 2016, respectively, will increase the flow of tourists in Brazil, which is not yet prepared to receive tourists with disabilities. The research, as well as the materials that will be constructed, may contribute to decrease the gap between leisure and tourism and people with visual impairments. **Reference:**
CARMO, W. R.. Cartografia tátil escolar: experiências com a construção de materiais didáticos e com a Formação continuada de professores. 2009. Dissertação (Mestrado em geografia) – USP - Faculdade de Filosofia, Letras e Ciências Humanas. São Paulo. SP.

Campo Salles Bridge:
Campo Salles Bridge is a tourist spot in Barra Bonita

Lock Bonifacio Soares:
Lock Bonifacio Soares is a tourist spot in Igaraçu do Tietê

P2.20 | **Tactile Thematic Quantitative Maps** (#1269)

C. Gimenez, C. C. Reinaldo Gimenes de Sena
Universidade Estadual Paulista - UNESP, Geography, Ourinhos, Brazil

This work is about an undergraduate project that has being realized on UNESP (Universidade Estadual Paulista), Ourinhos, São Paulo, Brazil. The general objective aims to evaluate the use of different graphical variables adapted to the tactile form in tactile thematic quantitative maps through the production and tests of different materials. The objective is being constructed in parallel of a discussion about the paper of Tactile Cartography inside the Inclusive Geography. The Graphical Semiology is one of the most important foundations to the Thematic Cartography and it also can be important to the Tactile Thematic Cartography. Graphical Semiology is the theoretical methodological basis of this project, which studies in what manner these procedures can be transformed in a Tactile Semiology. If the graphical language is a code, may we tell the same about tactile language? Is it possible to standardize the tactile relations of difference/similarity, order, proportional so as occurs in graphical form? The research identified that there are many few studies around this subject, because of that, in this work it was used an existing propose of graphical/tactile adaptation, suggested by Vasconcellos (1993). The propose of Vasconcellos was deeply studied in search of the best way to communicate cartographic information in quantitative maps through of the tact. After these reflexions, it were constructed a proportional symbol map (in 3D), a dot distribution map (in 3D) and a choropleth map (the graphical variable was adapted to the height tactile variable). All these maps were elaborated using the free software of carthomatic named Philcarto and with a database about brazilian population. The next step was to test the functionality of these adapted variables with people with or without visual deficiency. The tests occurred on AJADAVI (Associação Jacarezinhense de Atendimento ao Deficiente Auditivo e Atendimento ao Deficiente Visual), a partner of UNESP institution. The proportional geometrical figures method, which uses the size graphical variable, communicated more efficiently the quantitative cartographic information to the people with visual deficiency. The students completely blind also understood the height map. People who have low vision didn’t understand height map because they doesn’t have sufficient tactile ability to handle the maps. Referrals: VASCONCELLOS, RA. **Tactile Cartography and Visually Impaired: a review of the steps production and use of the map.** 1993. Doctoral Thesis. Department of Geography. FFLCH-USP. São Paulo. 1993.

P2.21 | **Solutions of cartographic presentation used in „Atlas of the World for the blind and visually impaired”** (#663)

K. Przyszewska

Head office of Geodesy and Cartography, Department of Geodesy, Cartography and Geographical Information Systems, Warsaw, Poland

In accordance to the Act of 17th May 1989 – the Geodetic and Cartographic Law, (Journals of Law, 2010.193.1287), the Surveyor General of Poland is responsible for development, maintenance and provision of special and thematic cartographic elaborations (Art. 7a, Sec. 14e). Furthermore, in accordance with the Enactment of 3rd October 2011 – on the Cartographic Thematic and Special Elaborations (Journals of Law, 2011.222.1328), the Surveyor General of Poland performs and provides thematic elaborations in the form of digital maps, including hydrographical maps, sozological maps, geomorphologic maps, agricultural-soil maps, land cover maps, land use maps, maps of technical infrastructure, maps of the average transaction prices of land, maps of the territorial divisions of the country, atlases of Republic of Poland and special maps – typhlographical maps intended for the blind and visually impaired. In August 2012 Head Office of Geodesy and Cartography published in 500 copies the „Atlas of the World for the blind and visually impaired”. Paper concerning progress in atlas preparation has been presented in 2011 during The International Cartographic Conference in Paris. It is the third atlas – following the Atlas of Poland and Atlas of Europe – published by the Head Office of Geodesy and Cartography for the blind and visually impaired people. Preparation to publishing takes nearly five years. There was eight main stages of preparation: I) preparation of the atlas concept, (topic selection, technique selection, format, etc.); II) cartographic preparation of maps with sample print color and Braille layer, generalization; III) work of the Consultation Team on preparation of the *Atlas of the World for the blind and visually impaired* - opinions in the field of readable for the blind as well as finding new solutions and methods of graphic presentation. Main rule of this works was to: “do the same for blind and visually impaired”; IV) review of second cartographer, amendments; V) preparing cartographic and typhlographic description for each map of atlas (including review and amendments) and process of description text to mp3 files (including transcription of geographical names to synthetic voice); VI) prepress of Atlas set: maps, CD content, packaging; VII) prototype – amendments and acceptation; VIII) print in 500 copies. That publication was made using relief technique, with the application of color background. Unlike the methods used before, it enables superimposing Braille fonts onto traditional descriptions read by visually impaired. That technology allows to save space, which extremely important on maps of the world, where many features need to be presented and described in limited space. Blind and visually impaired users need to have different information put into the map, as well as information extended in comparison with regular users. For example the first basic information for users have to be orientation on the map – where is the top and bottom of the sheet. Addition information has been use, for example so called „runners” are used for thematic maps especially to indicate the direction of temperature decrease. There is also “sign key” implemented in atlas for "object type" such as lakes, mountains etc. The “sign key’ is one for all maps as well as common legend. Distinguishing between objects on thematic maps is possible because of using different patterns. Patterns were used in very thoughtful way. Each topic have specific way of presentation to achieve the best quality of readable for blind users. In October 2012 Head Office of Geodesy and Cartography spread Atlas between special resorts for blind and visually impaired and Polish Association of the Blind. Atlas is designed for reading in place and to borrow from a libraries.

P2.22 | **Artificial Neural Networks in Geosciences – Possibilities for Predictive Mapping** (#1523)

A. Knobloch, S. Noack, S. Etzold, A. Barth
Beak Consultants GmbH, Freiberg, Germany

No abstract or full paper available.

P2.23 | **Three-dimensional observations for spatial analysis of landscape dynamics** (#774)

M. Fernandes, T. L. C. Santos, P. H. F. Coura, P. Menezes, A. J. S. Graça

Federal University of Rio de Janeiro, Laboratory of Cartography - Geography Departament, 25651076, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\186_proceeding.*

Landscape dynamics is a geoecological characteristic that defines changes in a landscape spatial structure and function during an established time scale. In this kind of analysis, geoprocessing is an essential tool, because it combines several technologies that help in this work. However, some questions arise and they need to be addressed through scientific investigation. One of these questions is that geoprocessing does not consider the dimensionality of the data and the information to be used, which is projected, not measured from modeled surface observations, thus it cannot interpret the structure, function and dynamics of geoecological elements of a landscape correctly. This difference is greater in landscapes of irregular relief. Even having a range of options to work with the dimensionality of the elements of a landscape, like the use of digital elevation models (DEM), geoprocessing has a limitation established by the non-consideration of the irregularity of the area to be examined. In this sense, even when working with 3D data, the area is not taken into account as being continuous, endowed with relief, so measurements of area and distance of the elements that make up the landscape may be under-estimated, particularly in areas with a rough relief. Considering that, this paper intends to assess the difference between observations on modeled and planimetric surfaces on the interpretation of landscape dynamics. The study was conducted in the massif of Tijuca, Rio de Janeiro (Brazil) using land use and soil cover maps of different times. The results show an increase of dynamic areas values when observations were carried out on modeled surface, as well as the deforestation rate (17.57% or 0.13 km^2/year). This survey showed higher values in comparison with observations on planimetric surface, characterizing more modeledistic interpretations of how the structural elements and analyses made from these are structured in the landscape.

P2.24 | **Point pattern analysis of star dunes in Ar Rub" al Khali desert, Saudi Arabia: The application of spatial statistics to the understanding of dune field self-organization** (#527)

S. Alsharrah
University of South Australia, Barbara Hardy Institute, Adelaide, Australia

A full-length version is available and can be opened here:

_extendedAbstract\57_proceeding.*

P2.25 | **Research on Spatial Trend Surface Simulation of Cities in China Based on Spatial Interpolation Model** (#1049)

C. Dong, J. Liu, Y. Zhang

Chinese Academy of Surveying and Mapping, Geogrnment GIS Research Center, Beijing, China

As centers of population, politics, economy, cultural activities in a country, cities have always playing important roles in the regional and national development. There are 287 cities at prefecture-level and above in China. The percentage of their land areas to the whole country is only 6.5, but the percentage of population and GDP is 29 and 62. Then analysis on these cities is important. In order to value the development degree of these cities, urban comprehensive competitiveness evaluation indexes have been put forward in this paper. There are 60 attribute indicators from economy, society and environment selected. And methods of Multiple Indicator Analysis and Mean Variance are adopted to calculate these indexes from the corresponding three levels. In order to plot out the urban spatial units, spatial trend surface has been simulated. And the accomplishments rely on spatial interpolation model and spatial clustering algorithm. Here, several spatial interpolation methods, such as Ordinary Kriging, Inverse Distance Weighting, Spatial Spline, Nearest Neighbor, CoKriging, have been used. And analysis results show that Cokriging Model acquires the highest accuracy. Spatial clustering has been accomplished by using K-Means algorithm and taking the surface centers as the cluster centers. Considering the exceptive topographical characteristic in China, the geographical factors such as altitude, terrain, water system and traffic system and so on affect the regional development. In order to detect the influence degree from these factors, additionally for the reasons of correlation among geographical factors and faced the condition on multi-variable of independent and dependent, Partial least squares regression model (PLS) has been applied. As a result, as the strongest correlational factors, elevation and landform types have been selected. All of the counties (2089) have been taken as spatial interpolate points, and traffic distance instead of Euclidean distance among them has been put into the models in this paper for more reasonable results. And three shortest traffic distances are obtained by network analysis methods of GIS. The three distances are the highway distance from the current provincial capital to national capital, from the current prefecture-level city to provincial capital, and from country-level settlement to prefecture-level city. All of them construct the distance weight matrix to optimize spatial interpolation model by Entropy Model. Then Spatial Interpolate Model of Cities in China has been modeled and its accuracy has been valued through cross validation. Spatial trend surface of urban comprehensive competitiveness has been simulated and the feature of trend surface gradient has been analyzed. On the basis of spatial surface, by taking the surface centers for the clustering centers, spatial cluster has been done. Then urban spatial units have been plotted from the clustering results. Finally, some important results have been obtained. First of all, the accuracy of Spatial Interpolate Model of Cities in China is higher than other models, the average of predicted error is close to 0, and the Mean Standardized error approaches to the Root-Mean-Square Standardized too. Obviously, the regional anisotropy of urban comprehensive competitiveness has been estimated. Secondly, urban comprehensive competitiveness reduced generally from east to west in space, and the difference is very significant. Thirdly, notable characteristic of multi-center concentrated in the whole has been revealed expressly. And just it is the basement of plotting urban spatial units. Three highest main gathering centers and some certain sub-centers have been identified. And this corresponds to three main urban spatial units and secondary urban spatial units.

P2.26 | **Spatial Interpolation of Airborne Laser Scanning Data with Variable Data Density** (#1276)

J. Hofierka, M. Gallay, J. Kaňuk

Pavol Jozef Šafárik University in Košice, Institute of Geography, Slovakia

A full-length version is available and can be opened here:

_extendedAbstract\173_proceeding.*

The main use of the airborne laser scanning (ALS) data is in producing highly detailed digital models of surfaces sampled by the laser beam which can be reflected (returned) from several surface levels and recorded. Spatial density of the bare ground returns varies with the land cover properties as they determine the capacity of the laser to reach the ground through the canopy. The varying density may pose a problem for some interpolation methods frequently used to compute a grid-based digital terrain model (DTM). Numerous artifacts such as abrupt spikes or squared terraces may occur in the contact zones of high and low data density. [1] suggested some solutions albeit not focusing on the specifics of the ALS data. In contrast to traditional data sources, the ALS data comprise a huge number of points entering the interpolation with very high computer processing power demands. There are studies proposing reduction of the input data while the output surface is satisfactory [2]. However, if applied globally, points over smaller landforms can be lost. The aim of the presented research is to tackle the issue of varying data density by a selective reduction of the input data and proper parameterisation of the interpolation method to preserve important geomorphic features in a karst terrain (e.g. dolines).   The ALS data used in this research represent a 2 by 2 km portion of the Slovak Karst, East Slovakia. The area is mostly wooded with occasional meadows and scrubs comprising a plateau dissected by a deep canyon. The altitude ranges between 540 to 704 m a.s.l. The data were acquired in the leaf-on conditions in 2009 and supplied as a filtered point cloud. The supplier claims the vertical root mean square error (RMSE) of 23 cm. The sample area contains 217 984 points classified as bare ground of spacing varying between 1–80 m (Fig. 1). The DTM was computed using regularized spline with tension method implemented in GRASS GIS 6.4.2 as the *v.surf.rst* module with robust means for tuning the function [3]. The number of input points was controlled by the *dmin* parameter. The other key parameters were set to *tension*=20, *smoothing*=0.1 and *npmin*=400 to keep the resulting surface as close to the input points as possible and to minimise the interpolation artifacts from the segmentation procedure used in the module. The spatial resolution of the resulting grid-based DTM was set to 2 m. The DTM was based on the varying reduction of the input data points using the *dmin* parameter controlling the minimal distance between the points. Numerous tests showed that the loss of information due to reduction of input points is negligible while still preserving the necessary accuracy of the resulting surface needed to map specific karst landforms (Fig. 2). The main benefit of the suggested approach is in reduction of the interpolation artifacts arising from the uneven distribution of the input points and much higher speed of computation. The accuracy of the resulting surface is controlled using the control points taken from the original dataset. If the absolute error between the interpolated surface and these points is above a given threshold (e.g., the RMSE value of the ALS data) the points with such an error can be added to the dataset and be used in the repeated interpolation. Usually, such errors occur in areas with abrupt changes in the resulting surface.   This paper originated with the support of the following grants: OPVaV-2008/2.1/01-SORO 26220120007, VVGS 63/12-13, VVGS-PF-2012-62 UPJŠ, VEGA 1/1251/12, VEGA 1/0272/12.
References [1] Hofierka, J., Cebecauer T. 2007. Spatial Interpolation of Elevation Data With Variable Density: A New Methodology to Derive Quality DEMs. Geoscience and Remote Sensing 2. Letters, IEEE, 4/1, 117–121. [2] Liu, X. 2008. Airborne LiDAR for DEM generation: some critical issues. Progress in Physical Geography, 32/1, 31-49. [3] Neteler, M., Mitasova, H. 2008. Open Source GIS: A GRASS GIS Approach. Springer Verlag, New York.

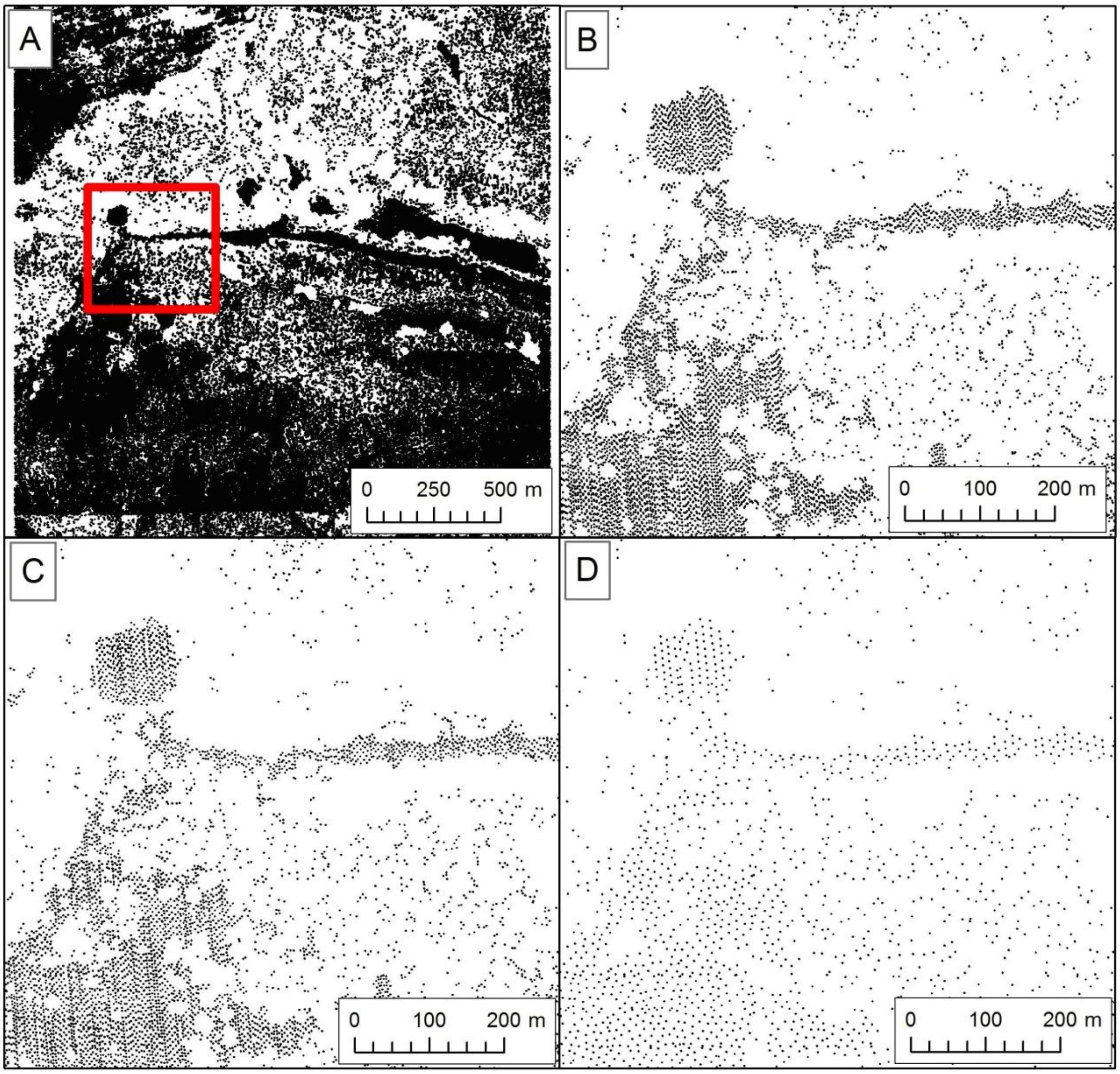


Fig. 1. Input ALS points:
A – entire study area. B – detail of the area in the red square on A. C – reduced dataset with a minimal spacing of input data set to 2 m, D – reduced dataset with a minimal spacing of input data set to 6 m.

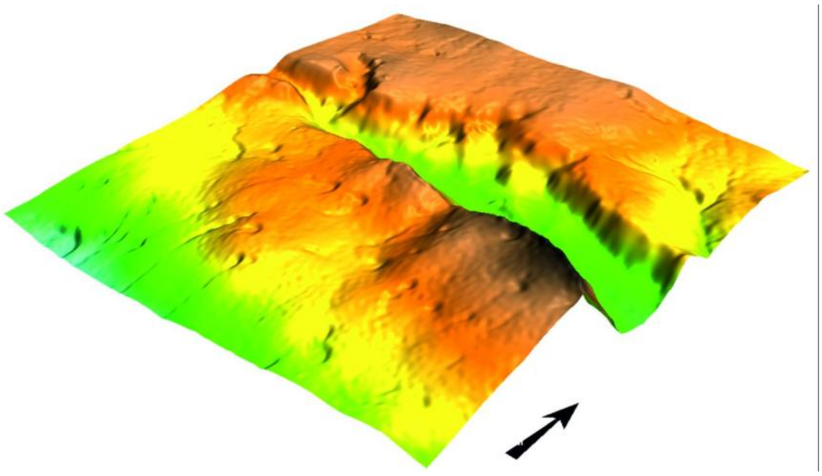


Fig. 2. Resulting DTM.:
Specific karst geomorphic features remain preserved in the interpolated surface.

P2.27 | **Research on vertical distribution of cities in China based on spatial statistical models** (#1078)

J. Liu, C. Dong, J. Chen, Y. Zhang

Chinese Academy of Surveying and Mapping, Geogrnment GIS Research Center, Beijing, China

The terrain and location are the most important factors in deciding the distribution of residents. Corresponding to it, the spatial distribution pattern can be carried out from two aspects, horizontal distribution and vertical distribution. And vertical distribution pattern is more concentrated in the field of ecology, physical geography, demography and so on. Little researches on the vertical distribution pattern of cities have been found. As centers of population, politics, economy, cultural activities in a country, cities have always playing important roles in the regional and national development. In China there are 287 cities at prefecture-level and above. The percentage of their land areas to the whole country is only 6.5, but the percentage of population and GDP is 29 and 62. Accordingly we can say that the economic development level of these cities can characterize the whole country to a certain extent. In China a ladder-shaped distribution in elevation from west to east is very obviously. The range of vertical height in China is almost 9000 meters, and the range of elevation from Lhasa city to Yancheng city is 3639 meters. On the other hand, the density of cities in flat area along the Southeastern coast and central plains is much greater than it in the Western plateau and mountain region. It is demonstrates that the research on vertical distribution pattern of cities in China is significant implications. First of all, an index system including twenty-one economic indexes has been established considering comprehensiveness and completeness. By standardization of range and standard deviation process, economic comprehensive competitiveness indexes of 286 cities in recent 10 years (2001-2010) have been calculated. In addition, the elevation of each city has been acquired by tool of overlay analysis in GIS. As a basis on it, global and local spatial autocorrelation model has been used to analysis the spatial clustering pattern of these cities. Here economic comprehensive competitiveness index has been used as the main variable, transport distance among cities as distance weighting. Hot-spot and cold-spot cities have been discovered in the recent ten years. Then according to the distribution of the average elevation of hot and cold spots cities, logarithmic transform operation has been used to correcting the skewed distribution of elevation. Taking hot-spot and cold-spot cities as sample points, the range of elevation which is suitable or not suitable for economic development has been estimated. Finally, some important results can be drawn. Firstly, cities in low elevation always have higher level of urban economic development than cities in high elevation. Secondly, there are three hot-spot regions and one cold-spot region have been acquired from the results. The hot-spot cities generally are located in coastal areas with lower elevation; cold-spot cities are distributed in the middle and Southwest region with relatively high elevation. Thirdly, from 2001 to 2010, the number of hot-spot cities is a significant increasing implicating that the economic strength of Chinese cities improves obviously. On the other hand, cities in cold-spot region are decreasing gradually and most of the cities divorced from the cold-spot region are in low elevation during the ten years. It indicates that cities in low-elevation areas have better condition to economic development but high-elevation worse condition. In other words, the spatial distribution pattern that high cluster in low-elevation and low cluster in high-elevation is existence. The range of hot-spot cities is almost between 30-90m in elevation in the decade.

P2.28 | **Dynamics and Entropy of Land Use Changes of Metropolitan Areas in Poland (abstract)** (#123)

P. Werner[1], P. Korcelli[2], E. Kozubek[2]

[1]*University of Warsaw, Faculty of Geography and Regional Studies, Poland;* [2]*Stanisław Leszczycki Institute of Geography and Spatial Organization Polish Academy of Sciences, Warsaw, Poland*

Dynamics and Entropy of Land Use Changes of Metropolitan Areas in Poland (abstract) Land use is defined as the spatial distribution of forms of land cover patches utilized or unutilized by human within the framework of spatial and mutual relationships. The term refers to a given terrain's functional character and is identified with a socio-economic description of the surface (Ciołkosz & Bielecka, 2005). The observed dependency of land use and neighbouring land cover patches is discussed in many geography and spatial economy publications i.e. the economic utilization of an observed lot (or patch) has significantly less implications for its future utilisation than the existing land use in its neighborhood. Factors stimulating further land use changes include the existing neighbouring land use or the predominant land use type in a given region (Hagoort, 2006). The advancement of GIS has facilitated simulations and geovisualizations of results of spatial analysis of land use. The majority of analyses confronted two categories of factors influencing the observed land use changes and, at their core, involved an evaluation of spatial changes which resulted from the impact of neighbouring and consecutive forms of land use in a given area. The types of land use classes differed depending on the aim, the scale and the area of an individual geographical study. The changes in land use can be treated as a complex and (to an extent) random process. The research aims included the formulation of a theoretical structure of the neighborhood coefficients (Werner, 2009), analysing their operationalization and verifying their practical application. Cellular automata are mathematical models for complex natural systems containing large numbers of simple identical components with local interactions. The concept of neighborhood coefficients is based on the combination of map algebra with two-dimensional cellular automata. The NBC is calculated on the basis of a mathematical formula (Eq.1) which contains the numbers describing land use classes and the consecutive numbers of the cells in Moore neighborhood (3x3). The NBC is reversible. It is therefore possible to reconstruct (recalculate) the original input land use classes in Moore neighborhood (their nominal numbers) on the basis of the value of the central cell's NBC (Eq.2). These above formal constructions serve as the starting point to evaluate the spatio-temporal processes of the changes of spatial differentiation of land use changes in Metropolitan Areas in Poland using the entropy formula. The proposed approach lets to present statistical estimation and makes possible of uniform comparative studies of land use changes of metropolises in Poland and simultaneously cartographical visualizations of locations and details of dynamics of land use changes. The verified hypothesis concerns the first assumption of the growing entropy of particular metropolises as the whole units and their internal spatial differentiation. The second assumption states that there are uniform stable core urbanized areas (zero entropy) which in fact are not changing with time.

$$NBC_c = \sum_{i=0}^{8} k_i n^i$$

$$\text{where } k \in \{0,1, \ldots, n\} \quad (Eq.1)$$

Eq.1.:
Neighborhood Coefficient

$$k_i = (\text{quotient}\ (NBC_c / (n^i)))\ \text{mod}\ n$$

$$\text{where } k \in \{0,1, \ldots, n\} \quad (Eq.2)$$

Eq.2.:
Reverse Neighborhood Coefficient

P2.29 | **Dynamics and Entropy of Land Use Changes of Metropolitan Areas in Poland** (#536)

P. Werner[1], P. Korcelli[1], E. Kozubek[2]

[1]University of Warsaw, Faculty of Geography and Regional Studies, Poland; [2]Stanisław Leszczycki Institute of Geography and Spatial Organization Polish Academy of Sciences, Warsaw, Poland

A full-length version is available and can be opened here:

_extendedAbstract\164_proceeding.*

Land use is defined as the spatial distribution of forms of land cover patches utilized or unutilized by human within the framework of spatial and mutual relationships. The term refers to a given terrain's functional character and is identified with a socio-economic description of the surface (Ciołkosz & Bielecka, 2005). The observed dependency of land use and neighbouring land cover patches is discussed in many geography and spatial economy publications i.e. the economic utilization of an observed lot (or patch) has significantly less implications for its future utilisation than the existing land use in its neighborhood. Factors stimulating further land use changes include the existing neighbouring land use or the predominant land use type in a given region (Hagoort, 2006). The advancement of GIS has facilitated simulations and geovisualizations of results of spatial analysis of land use. The majority of analyses confronted two categories of factors influencing the observed land use changes and, at their core, involved an evaluation of spatial changes which resulted from the impact of neighbouring and consecutive forms of land use in a given area. The types of land use classes differed depending on the aim, the scale and the area of an individual geographical study. The changes in land use can be treated as a complex and (to an extent) random process. The research aims included the formulation of a theoretical structure of the neighborhood coefficients (Werner, 2009), analysing their operationalization and verifying their practical application. Cellular automata are mathematical models for complex natural systems containing large numbers of simple identical components with local interactions. The concept of neighborhood coefficients is based on the combination of map algebra with two-dimensional cellular automata. The NBC is calculated on the basis of a mathematical formula (Eq.1) which contains the numbers describing land use classes and the consecutive numbers of the cells in Moore neighborhood (3x3).

The NBC is reversible. It is therefore possible to reconstruct (recalculate) the original input land use classes in Moore neighborhood (their nominal numbers) on the basis of the value of the central cell's

NBC (Eq.2).

These above formal constructions serve as the starting point to evaluate the spatio-temporal processes of the changes of spatial differentiation of land use changes in Metropolitan Areas in Poland using the entropy formula. The proposed approach lets to present statistical estimation and makes possible of uniform comparative studies of land use changes of metropolises in Poland and simultaneously cartographical visualizations of locations and details of dynamics of land use changes. The verified hypothesis concerns the first assumption of the growing entropy of particular metropolises as the whole units and their internal spatial differentiation. The second assumption states that there are uniform stable core urbanized areas (zero entropy) which in fact are not changing with time.

$$NBC_c = \sum_{i=0}^{8} k_i n^i$$
$$where\ k \in \{0,1,\ \dots,n\}\ (Eq.1)$$

Eq.1:
Neigborhood coefficient

$$k_i = (quotient\ (NBC_c /(n^i)))\ mod\ n$$
$$where\ k\ \in\ \{0,1,\ \dots,\ n\}\ \ (Eq.2)$$

Eq.2:
Reverse Neighborhood Coefficient

P2.30 | **Use of cartographic modelling for the assessment of rural areas development** (#522)

J. Gasiorowski, Z. Polawski

Institute of Geodesy and Cartography, GIS Department, Warsaw, Poland

Rural areas represent more than 93% of the territory of Poland and play a significant role in contributing to economic, social and environmental development. The present picture of Polish agriculture and rural areas is constantly changing. The evolutionary character of their development is natural, induced by the need to adapt to the changing situation and socio-economic environment. Past experiences related to the development of agriculture and rural areas in Poland have shown that a lot of problems are generated due to a lack of balance between economic, social and environmental factors. Cartographic modelling is a methodology that plays a very important role in the analysis of conditions associated with elements of the natural environment and social and economic factors significant to rural areas. Cartographic modelling methods allow for the performance of either simple or complex spatial analyses with a particular emphasis on distribution or availability analyses and the calculation of single or synthetic indexes. This approach helps to develop a model for rural area and agricultural development that will contribute to the improvement of rural area management and to economic development in balance and harmony with social expectations and environmental requirements. The basis for the analyses conducted was provided by data obtained from the National Geodetic and Cartographic Resource, Central Statistical Office and municipal administration, as well as various indicators that describe environmental determinants for rural development. The indicators proposed are of a structural and functional character and describe the socio-demographic, environmental, spatio-structural and infrastructural aspects of rural areas. Rural areas located in the south-west of Poland have served as a testing area. As a result of land consolidation carried out there in recent years, they are characterised by an organised structure of farms and, in addition, diversified terrain relief and the presence of protected sites. The spatial level of detail of the study corresponded to the accuracy of maps of a scale of 1:5 000. Cartographic modelling has included, inter alia, exploratory data analysis (EDA) consisting of an inductive search for non-trivial and hidden dependencies in data and the use of visualisation techniques for the quick reviewing of large amounts of spatial data, the analysis of geographic objects spatial distribution focussing on the measuring of density, clustering and the dispersion of point, linear and surface objects, availability analysis allowing for the determining of potential development possibilities for rural areas and multi-factor analysis, which includes searching for statistical and spatial relationships between environmental conditions, and the management of rural areas. The result of the study was the development of a model for the environmental conditions of rural area management. In addition, an evaluation of the current development of rural areas was carried out and actions were identified to improve the management of these areas. The results were illustrated on thematic maps, graphs and tabular sheets.

P2.31 | **Automatic classification as a tool for regionalization according to example of Polish part of the Sudety Mountains** (#792)

M. Wieczorek, M. Kosmalska

University of Wroclaw, Department of Cartography, Poland

Regionalization used to be made by using topographic maps, thematic maps, field research and expert knowledge. In this paper authors compare automatic morphometric classification of terrain relief against regionalization made by experts. The following questions need to be answered: 1) is morphometric classification one of the important factors in regionalization process; 2) could automated morphometric classification be helpful in reviewing existing regionalization. This study was provided in Polish part of the Sudety Mountains. The classification was performed on morphometric variables of the relief by using the k-median method, which is one of the non-supervised classification algorithms. A digital terrain model with a 250 m grid resolution is used for the analysis. On the base of this model the following variables were generated: slope, aspect, profile curvature and plan curvature. The aim of this study is to compare the classification results to the map of physiographic division of regions on macro- and meso-level, in order to make a comparison of two different regionalization approaches. The regionalization was drawn on map in 1:500 000 scale. The landform maps were compared to the boundaries of physiographic regionalization. As a result of the comparison, it was found that most of the border line coincides with the relevant landforms of the area. The k-median algorithm in the Sudety Mountains led to the designation of the correct classes that identify the most important features of the relief at different levels of generalization. The generalization stage was dependent on the number of classes that were used in the analysis. For some meso-regions it was not possible to identify a specific boundary. This is because expert's regionalization use other features, mainly geology, which were not considered here.

P2.32 | **FOREST LANDSCAPE DYNAMICS AT MUNICIPALITY SCALE: A SOCIAL-ENVIRONMENTAL EXPLANATION STUDY CASE: MICHOACAN. MEXICO** (#215)

C. Arredondo

UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO, UNIDAD ACADEMICA DE ESTUDIOS REGIONALES DE LA COORDINACION DE HUMANIDADES, JIQUILPAN, Mexico

This study boards forest landscape dynamics in three Michoacán´s municipalities during three periods of time 76-86; 86-96 and 96-00. In order to do that, it required Landsat MSS (1976 and 1986) and ETM (2000) satellite images and 1995 digital orthophotos (scale 1:75,000). To obtain a better Landsat MSS and Landsat TM land cover differentiation, it utilized color composes (red, green and blue): 2, 3, 4 and 3, 2, 1 (natural color) and; 4, 5, 7 (color false), respectively. The land covers were established considering its origin –natural/cultural- and vegetation physiognomic development. Covers were interpreted through a "visual" method that uses direct, associative and deductive techniques to differentiate landscape "features" (Enciso 1990, Mas and Ramírez 1996, Arnold 1997, Slaymaker 2003, Chuvieco 2002). Images were corrected geometrically and georeferenced to topographic maps scale 1:50,000, through the "Tie-Points" method (Maus 1996, ITC 2001). Control points were taken from the land-cover map (1:50,000) (INEGI 1983), and the RMSE index, or SIGMA ≤ 2 was used to check the precision (Mas and Ramírez 1996, ITC 2001). The size of the minimum cartographical area was 4 ha (Campbell 1996). Two types of processes were identified with four variants: ***a)*** positive processes: *conservation* and *regeneration* and; ***b)*** negative processes: *disturbance* and i*ntensification*. The results indicate that even deforestation and land use intensification (rainfed and irrigation agriculture and human settlement, for instance) still being at municipality scale as the principal negative processes, at the same time pine-oak conservation process remains in Michoacán highlands, specifically in the "Meseta Purépecha" (Purépecha Plateau) municipalities due to the cultural customs of the native social actors.

P2.33 | **Monitoring of Coastal Erosion - Study from Beaches of Rio Doce and Casa Caiada – Olinda/PE –Brazil** (#207)

M. Carneiro[1], L. Sá[2], S. Sato[3]

[1]IBGE - Brazilian Institute of Geography and Statistics Brazil, Base Territorial, Recife, Brazil; [2]Federal University of Pernambuco – UFPE Brazil, Decart– Department of Cartography Engineering, Recife, Brazil; [3]Federal University of Pernambuco – Department of Cartography Engineering – UFPE Brazil, Department of Cartography Engineering –, Recife, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\38_proceeding.*

P2.34 | **Geodata integration for the researches in Russian sector of Arctic region** (#744)

A. Medvedev

Institute of geography of Russian Academy of Sciences, Department of cartography, Moscow, Russia

Meeting the challenges of environmental and geographical research in the Arctic is unthincable without the scientific and information support, without analytical basis for Basic Scientific research for the solution of practical problems and, ultimately, without complex processing of information including spatial data on the state of the environment and its possible adverse changes. The prerequisites for the research on this topic are: - The need to solve complex and resource-intensive tasks in the joint work of geographically dispersed groups of users interacting with the subject-sectoral and international information systems; - Geographically distributed, highly heterogeneous informational resources created by different research programs, including international. Meeting the challenges of resources' volume assessment, forecasting the future state of the environment, environmental management and environmental protection in the Arctic with the help o a distributed geodata system is closely associated with a script to use and user groups for which they are intended. Any attempt to integrate data and information between different systems in the end is based on the discovery and the use of system's metadata. Getting information about the metadata - is only half the problem. The second, much more important half is the identification of relationships between the metadata of one system with the metadata of the other system. For each domain there is no single panacea solving all problems related to the construction of the information architecture and necessary models. The key of this research work is to provide simulation, which allows you to "do" the object of study by means of Cartography and Geomatics, to highlight and explore the major controllable and uncontrollable factors affecting the process or natural phenomenon. How would "play" the different strategies of management, to trace on the computer screen the possible consequences of decisions. It is no longer a subsidiary methodological device, but the fundamental methodology of the study of complex objects. Feature of this study is to apply the methods: - The space-time geoinformational analysis and modeling of regional terrestrial systems (including computer modeling and geographic forecasting); - Physical modeling of the software's component in the informational-analytical environment. The novelty of the scientific and technological solutions in the interdisciplinary research project is that at this stage of designing an integrated system is used: - Concurrent processes on a broad range of problems and scientific and technological problems (with constant monitoring and analysis of the results achieved, assessing available resources and configurations implementing architectures systems); - The agreed terms by subject area of research in Earth sciences to the reference models of standards and protocols forming spatial data storage means geo-distributed data processing and computing.

P2.35 | **Modeling the Ecological Capability Land for Agricultural Land use Using Fuzzy Inference System in Geographic Information System Environment (A Case study: Marvdasht County)** (#97)

S. K. Alavi Panah[1], H. Nasiri[1], A. Hosseini[2], A. Azizi[3]

[1]University of Tehran, GIS & RS, Iran; [2]University of Tehran, Urban Planning, Iran; [3]University of Tehran, Environment Planning, Iran

Optimum utilization of land and natural resources and organizing land use based on natural ecological potential has an important role in environmental management and preventing environmental degradation in order to achieve sustainable development. Evaluation of ecological land capability, as the core of environmental studies, by preventing possible crisis, provides an appropriate context for environmental planning. Since precise determination of land capability for all kind of land uses is almost impractical, fuzzy logic modeling can be used as a platform for modeling uncertainty in these conditions. Hence, in this research for better implementation of agricultural ecological potential, fuzzy inference systems and GIS techniques were used. The results from the Marvdasht region show that the FIS can model the ecological potential evaluation of land closer to reality. Fuzzy inference systems use linguistic terms to present the relationships between observing inputs and outputs in a system. So according to this logic, the reliability of this method is higher than other methods. The sensitivity analysis of parameters in the employed method shows the efficiency of FIS in ecological land capability studies. The main reasons for this can be using pixel base approach and considering the issue of uncertainty in input data (fuzzification of input data).

P2.36 | **Application of the GIS technology to groundwater vulnerability assessment in the context of sustainable development. Case study: Iasi City, Romania** (#764)

A. M. Oiste

University "Al. I. Cuza", Department of Geography, Iasi, Romania

A full-length version is available and can be opened here:

_extendedAbstract\111_proceeding.*

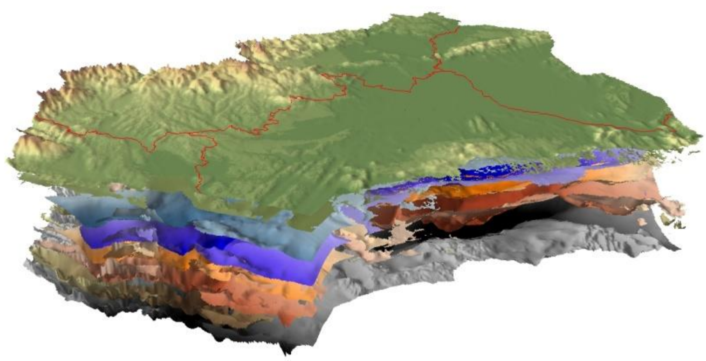
Territorial expansion of the urban area involves qualitative and quantitative pressures on the available natural resources, in order to sustain the urban growth. Groundwater represents an important resource in a sustainable urban environment development, being used as drinking water or in different activities (agriculture, industry, household) and is affected by numerous pollution sources: point, non-point and potential sources. The purpose of the paper is to determine the vulnerable groundwater zones in the Iasi City build-up area, one of the largest cities of Romania, using GIS techniques. The DRASTIC model was chosen, being an international method for groundwater vulnerability assessment establishing correlation with the nitrate content; the methodology was implemented by Aller et al, 1987. The model was applied in different regions of the world, including urban areas, except in Iasi City. The DRASTIC classic methodology is based on seven thematic layers (D - the Depth to water table, R - Recharge, A – the Aquifer media, S - the Soil media, T - the Topography, I - the Impact of the vadose zone, C - the hydraulic Conductivity) and was used to map groundwater vulnerability. Each layer received a standardized rank and the final score was computed applying the formula below: DRASTIC equation = DrDw + RrRw + ArAw + SrSw + TrTw + IrIw + CrCw Where: *r = rating w = weight* (Depth to Water Table – 4, Net Recharge – 2, Aquifer media – 5, Soil media – 2, Topography – 1, Impact of vadose Zone media – 5, hydraulic Conductivity of the Aquifer media - not used). To obtain data input as thematic layers, various materials were used, such as maps (digitized for: Geology - Romanian Geological Map, 1966 edition; Soil - Romanian Soil Map, 1971 edition; Topography - map sheet, 1964 edition; Land Use - satellite images, 2005 edition) and data table (for water table depth, average annual rainfall, geological profile, nitrates content). Nitrate level in the groundwater was determined after collecting 22 water samples from wells within the city, analyzed using the spectrophotometric method with sodium salicylate. This parameter was included in the study due to the relevance for the suitability for drinking. DRASTIC vulnerability map, verified by nitrate level in groundwater data revealed similarities between land-use map and vulnerable areas, highlighting anthropogenic influence. The vulnerability varies between 82 – 178; over 63% of the groundwater from Iasi City urban area is under very high vulnerability values and 21.9% under extremely high vulnerability values (according to Ne'mat, 2006), while nitrates level varies between 7.13 - 292.68 mg/L. Areas vulnerable to groundwater pollution were assessed and analyzed using GIS techniques, the most efficient tools for this type of study, that synthesize the natural conditions (DRASTIC thematic layers) and the anthropogenic influence (land – use map, nitrate level) on the groundwater resources quality, obtaining a spatial arrangement of the vulnerable areas easy to use by the local authorities for improving the groundwater quality. Groundwater quality protection and conservation procedures can be more efficiently managed due to the conclusions of this study (that analyzes and processes spatial data, in addition to chemical analysis) pointing the vulnerable groundwater areas and thus impacting the urban development process.

P2.37 | **Transenergy – surface geological map and 3D model horizons** (#647)

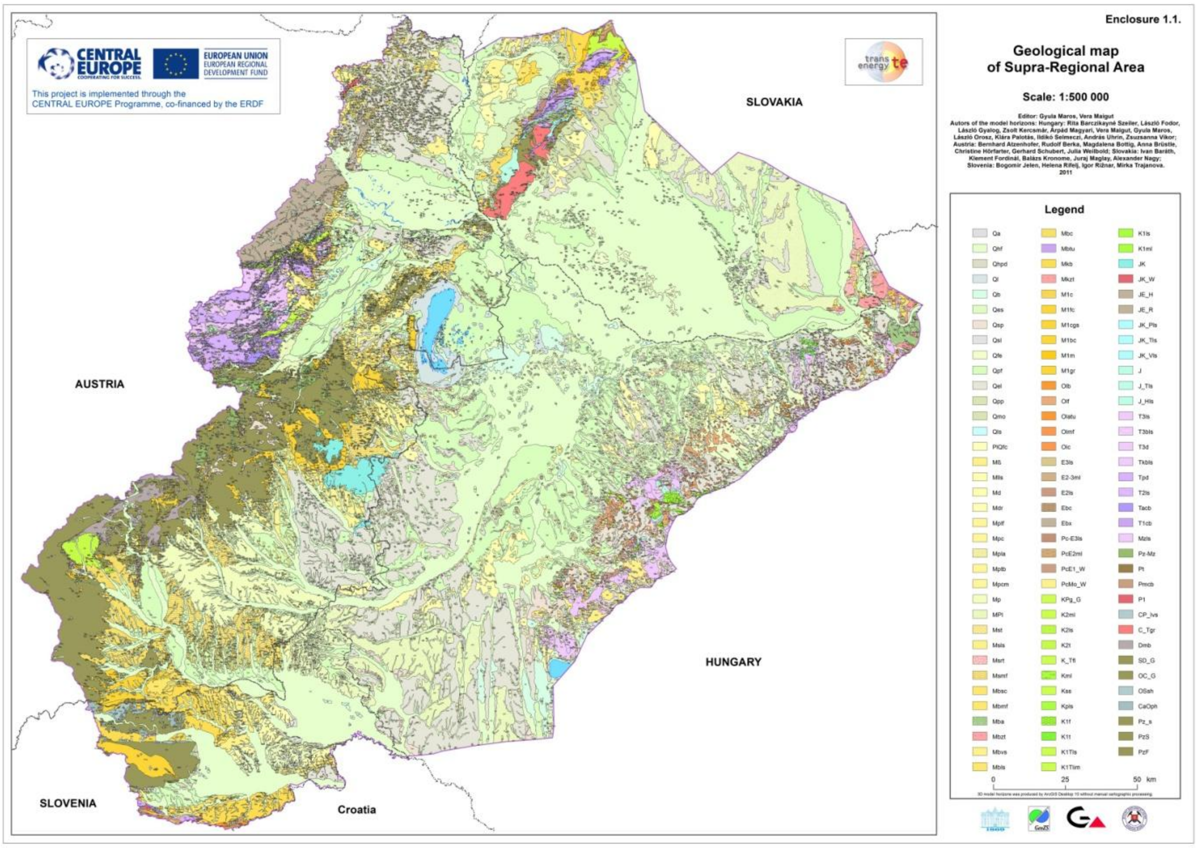
Z. Vikor, **V. Maigut**, G. Turczi

Geological and Geophysical Institute of Hungary, Geoinformatics, Budapest, Hungary

TRANSENERGY (Transboundary Geothermal Energy Resources) is an international project with the participation of Slovenia, Austria, Hungary and Slovakia. The ultimate goal of the project is to foster the sustainable utilization of geothermal energy in the western part of the Pannonian basin and to support the international efforts to increase the proportion of geothermal energy in the energy mix. The subject area is particularly suitable for this aim considering the fact that it has a characteristic of positive geothermal anomaly with a geothermal gradient of about 45 °C/km. The project is implemented through the CENTRAL EUROPE Program co-financed by the European Regional Development Fund. The level of geothermal energy highly depends on the flowing of thermal groundwater which is in a close relationship with the geological structures which of course do not stop at state borders. Therefore the project applied a transboundary approach during the creation of the main outputs. One of the most challenging problems during the creation of maps was to apply an agreed and uniform legend for multiple inputs, comprising borehole data, seismic data, contour maps, and existing geological maps. This was especially demanding in the case of harmonizing the geological units amongst different countries. In order to be able to model the distribution of geothermal energy, continuous surfaces must be known, therefore surfaces of different age has to be made. As a result, 8 geological maps and 3D models were completed for the area. Based on these maps and surfaces the 3D hydrogeological, water geochemical and thermal models are made supra-regional scale (1:500,000) and in more detail (1: 200,000 to 1: 100,000) of the pilot areas. The geological maps were spatially enabled with GIS solutions in ArcGIS 10.0. In order to retrieve desired information from the relatively raw data, the project used a rather unique workflow. As a first step, the surface geological map was made with the harmonized legend based on the spatially adjusted and edgematched maps of different countries. The following step consisted of the construction of the geological maps of each geological age. The continuous surfaces between geological levels of different ages called horizons, respectively top and base. Throughout the editing of these levels and maps both harmonized borehole data and surface occurrences were taken into account, improving the denotation of the top of geological horizons. However to get the desired output, the base levels, revaluation was required, and this resulted in the following surfaces and models: base horizon of tertiary, lower miocene, badenian, sarmatian, lower pannonian, upper pannonian and quaternary. The editing and alignment the surfaces were made with the ArcGIS Desktop's 3D Analyst and Spatial Analyst extensions. The resulting geological model enabled the construction of geological profiles by appointed surface lines. These models comprise depth of horizons, geological units and borehole data, represented with the harmonized legend. The results of the project are available at the website of the project: http://transenergy-eu.geologie.ac.at/



Geological horizons:
Geological horizons of Transenergy project



Surface geological map:

Surface geological map of Transenergy project

P2.38 | **Wadden Sea Regional Planning Portal – A trilateral interactive online map** (#608)

A. Hiller

EUCC-D, Rostock-Warnemünde, Germany

Increasing pressure on resources and competition for areas meets the World Heritage Wadden Sea, pipelines and wind power plants on cruise ships and recreation areas. The project Wadden Sea Regional Planning Portal is an interactive online platform for a sensible area and environment worthy of protection with its high interest in economy and tourism. Different languages, different cartographic standards and heterogeneity of data and maps shall be united in one GIS portal. The Küsten Union Deutschland e. V. (EUCC-D) and the Wadden Sea Forum e. V. (WSF) poses the task to build up a trilateral GIS portal. Since January 2012 the Wadden Sea Regional Planning Portal (www.eucc-d.de/waddengis) shortly WaddenGIS provides a tool for the Wadden Sea Region from The Netherlands over Germany to Denmark. It includes in addition to the Wadden Sea also the coastal areas up to 50 km into the land and the Exclusive Economic Zone of these three countries. The online GIS portal has a focus on existing and planned activities in marine and land areas and on demands on environment protection. A topographic background in form of Web Mapping Services (WMS) provides the territorial orientation. The WaddenGIS is created for everyone, who has an interest on the Wadden Sea Region. If layperson or expert, regional actors or tourists the web portal will accommodate the needs of this heterogenic user group with no to high experiences in using interactive GIS maps. Simple tools and a clear web portal shall be assisting the users. In October 2012 the WaddenGIS contains all in all 14 thematic groups with 76 layers like the group spatial planning with e. g. the layers tourism development and primary energy storage or the group mining with the layers sediment extraction and dumping grounds. The data results from research and inquires at various authorities in the Netherlands, Germany and Denmark. The variety of data covers maps in four different languages Dutch, German, Danish and English which are either ungeoreferenced maps from online map portals or e. g. regional development plans but also existing shape-files of these three countries. They have to be adjusted to an equal level of detail and a common language (English). There are gaps in the information density available because every country focuses on different themes. For example the layer energy reserves only exists in the Netherlands, but the aim is to cover the whole area with all themes. After selecting, georeferencing and editing the data with ArcGIS the symbolization of the map elements is done considering German cartographic standards. Approximately 180 map elements need a legible symbol which is not superimposed by other symbols – a very difficult task. The layer pipelines already comprise 26 different map elements. For the integration of the finished shape-files in the web portal, they have to be exported to a mapfile. This is accomplished by using mxd2map, an open-source programme. The Steinbeis-Transferzentrum Rostock receives the issued data from the EUCC-D and realises the technical implementation of the WebGIS. The aim of the actual extension of the WaddenGIS is to present further groups and layers like fisheries and ship movement for a selected time period. Also some technical updates shall be done. One of this is a transparency regulator which offers the possibility to put a layer to the background or highlight another one. The second update is the installation of a button for user operated uploads of WMS data. So anyone can complete the online map individually for himself. In the future it’s possible to extent the WaddenGIS more and more. New bordering regions could be added, existing thematic groups and layers completed or the English labelling could be amended by Dutch, German and Danish.

P2.39 | **Assessment of Anthropogenic Transformation of an Area Based on Soil Mapping and Current Statistical Information** (#1035)

O. Chernova[1], I. Ryzhova[2]

[1]A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia; [2]M.V. Lomonosov Moscow State University, Russia

Discussing problems concerning animals and plants diversity preservation attention is usually drown to protection of large, potentially useful or aesthetically attractive species. However recently discussion of rapid climate trends have attracted attention to the necessity of maintenance of biosphere homeostasis caused by preservation of sufficient areas of virgin ecosystems typical for certain regions. Spatial heterogeneity of soil cover is one of the most important factors determining ecosystems diversity. Geomorphological and geological factors, such as topography, water table and composition of groundwater, chemical and physical properties of parent material, as well as universal biosphere mechanisms of living nature distribution (zonal and local) influence greatly soils diversity. These factors influence composition and functioning of biocenosis through soils. Soil is the main habitat for various species of plants, animals and microorganisms in terrestrial ecosystems. Soil cover and plant assosiations form a such unique dependent system and mutually conditioned, so that the names of some soils are closely associated with certain plant formation. Nevertheless, clear coincidence of soils' and vegetation areals is evidently manifested for mature (climax) plant associations only. Distribution of basic soils areals compared to basic plant associations was analyzed on the base of scale 1:15000000 Soil map of Russia (2011) and of scale 1:4000000 Vegetation map of USSR (1990). In sparsely populated Asian Russia, within Yakutia, close coincidence of areals of permafrost-gleyed soils with larch forests of northern taiga, and calcy-cambic cryosols with larch forests of middle taiga were found. Cartographic analysis did not show similar clear correlation for the European part of Russia. Only in the north-west of Russia, in slightly anthropogenically disturbed region (Kola Peninsula and Karelia), sandy podzols and pine forests areals closely coincide. This fact is supposed to be caused by strong anthropogenic transformation of European part of Russia nature complexes over the last centuries. Assuming the soil cover to be more inert then the plant cover we plotted a schematic map of the imaginary restored native vegetation of the model region on the base of scale 1:2500000 Soil Map of Russia. Chernozem zone of Russia was selected as a model region, it is characterized by high productivity of natural vegetation, predominance of chernozems, which are the most fertile soils in the country and in the world and deep agricultural transformation of the territory. The following indicators of biological cycle of elements were selected for our estimations calculations: productivity of plant cover, fixation of organic carbon in soils, supply of organic carbon in soils and some indicators of nitrogen balance in biomes. These indicators for native ecosystems such as broad-leaved forests, woods, meadow steppes, bottomland meadows, were obtained in the processes long-term investigations of reserve ecosystems. Similar indicators averaged according to crop rotations were used for agricultural areals and recalculated in accordance to the latest data on the structure of agricultural lands. Series of schematic maps characterizing imaginary restored and present-day plant cover of administrative regions of Russian European chernozem zone were plotted on the base of these indicators. We believe the above proposed approach to allow assessing the extent of anthropogenic transformation of the area and proportion of natural landscapes required for sustained development of the region.

P2.40 | **Estimating-prognostic mapping of soil transformation, pollution and functioning at gas-bearing territories** (#920)

N. Mozharova[1], S. Kulachkova[2]

[1]*senior lecturer, Lomonosov MSU, Soil science faculty, Moscow, Russia;* [2]*researcher, Lomonosov MSU, Soil science faculty, Moscow, Russia*

Estimating and spatial prognostic mapping of soils by using of GIS technologies are considered. The empirical criteria received during monitoring and experimental research are used. *The general algorithm of estimating mapping of resource transformation and alienation, soils pollution pollutants, soils functioning at natural gas penetrating from subsurface includes the following blocks.* 1. Analysis and systematization of the natural and technogenic environmental hazards maps. Creating a series of maps to identify environmental hazards. Development and application of ecosystem and environmental criteria for estimation. 2. Analysis and systematization maps sources of anthropogenic impact, functional composition of mining allotment (compressor and gas-distributing stations, pipelines, well network at different levels), the boundaries of different function, natural objects and settlements. 3. Systematization of soil data, soil transformation, pollution and functioning. Analysis of the base soil map for the studied territory. Creation of the natural and technogenic disturbed soils list. 4. Start building a database. Creation of the factual material map. 5. Conducting field catenary and area (key) studies using earth remote sensing materials. 6. Development of chosen estimating criteria on the basis of a point method by simple or/and difficult scales. 7. Creation of a preliminary structure types soil cover contour map with image contouring basis of technogenic sources, environmental hazards factor, areas of influences. 8. Creation of estimating soils condition (change) maps of the territory. 9. Creation of soils stability estimating map. *The algorithm for a creating of spatial prediction mechanical violations, pollution and soil functioning maps includes the following components.* 1. Systematization of available soil data before impact of technogenic factors. 2. Systematization of environmental hazards data. Creation of maps identifying environmental hazards. 3. Development of landscape indication and a probabilistic model of soil-landscape relationships (SLR), diagnosing the degree of transformation, soil contamination and functioning. 4. Systematization of factors-indicators based on the estimating map. Grouping of vegetation, topography, parent material, types of photo images. 5. Compilation of contour (factor) bases plots a possible violation, pollution and functioning. 6. Development of a database (DB) in terms of the mechanical disturbances, soil contamination and functioning. 7. Isolation of anthropogenically disturbed soils types with various degrees of mechanical disturbances and chemical contamination. Landscape indication justifies the soil content of the factor base contours. 8. Extrapolation of the regularities installed at the key sites throughout the territory of underground gasholder based on the model of soil-landscape relationships. Compilation of author's original prediction maps of mechanical violations, pollution and soil functioning. 9. Evaluation of the accuracy of predictive maps, which relies on the assessment of probabilities of landscape-indicator relationships. 10. Interpretation of the predictive maps content, if necessary and the creation of complex prediction maps. The interpretation addresses to solve the ecological, ameliorative, remediation and other practical problems. Processing and analysis of data at all stages of the study includes their objectification and systematization, statistical and mapping techniques are combined with meaningful interpretation of results. Mapping algorithm described above is implemented in three phases: a preparatory office period, the field and the final office period. Particular algorithms for the mapping of transformation, soil pollution and functioning have some differences.

P2.41 | **Croatian State Geodetic Administration's official data usage in Croatian Mountain Rescue Service** (#621)

I. Vilus, I. Landek, M. MarjanoviĆ

State Geodetic Administration, Sector for state survey, ZAGREB, Croatia

Croatian Mountain Rescue Service (HGSS) has been facing, for some time now, dramatic increase in number of accidents and field interventions in different regions of Republic of Croatia. Together with the increase in numbers of tourists, enthusiasts, mountaineers and alpine climbers there was a rise in a number of incidents and accidents that were in most cases caused by a loss of spatial orientation. In order to maintain the capacity to rescue those in need. Such like situation has required from HGSS to put a lot of effort and significant resources in maintenance and improvement of their spatial orientation capabilities. As Croatian State Geodetic Administration (SGA) is a leading organization in Croatia in the field of cartography and as it continuously produces the official topographic maps, the *Agreement on long-term cooperation in the field of official and thematic cartography* was accepted in 2008, between the two parties, to facilitate the increased requirements for provision of Search and Rescue (SAR) service in Republic of Croatia. Based on the before-mentioned agreement, SGA delivers to HGSS the official topographic maps in scale 1: 5000, 1: 25000, digital model of relief (DTM), and digital orthophoto maps in 1: 5000 scale. HGSS uses those products as a basis for their own thematic maps of individual areas, where they also ad additional data (i.e. mountain paths, foot trails, caves, …) that may be of interest to prospective visitors. HGSS thematic maps,produced on basis of SGA official maps, depict an accurate and high-quality representation of terrain features. Following the production of their thematic maps, HGSS notifies the SGA of any changes they have spotted during their field reconnaissance. As it is customary for HGSS to operate in the remote areas of mountainous and difficult to access terrain, such like input represents the significant and very valuable source of information that provides important contribution to the quality of official SGA map products.

P2.42 | **“Flood Risk in Arid System Lluta River - Chile” — Hydrogeomorphological Chart** (#261)

R. Richardson, M. Muñoz

Universidad de Playa Ancha, Ciencias Geograficas, Valparaiso, Chile

In this work we have prepared the hydrogeomorphological chart for river basin Lluta and valley of the same name, which is located in the Fifteenth Region of Chile (Arica and Parinacota), between parallels 18º and 18º 30' south latitude and meridians 70º 20' and 69º 22' West Longitude, precisely in the provinces of Arica and Parinacota whose main river of the same name, empties into the Pacific Ocean in the coastal area called Valley Chacalluta between the city of Arica and the border with Peru. The surface of it is about 3447 km^2 and is located in a desert area. It is characterized by low rainfall and therefore all of its soils are devoid of vegetation except for the low end of the valley where land use is agricultural. Lluta River Basin in the natural system has permanent runoff to the sea throughout the year 1.44 m^3seg average flow. The river has carved a valley Lluta fairly narrow and deep which is limited by steep and slopes of high altitude. The impact has increased the flow, homogeneity is not presented with the full extent of the basin, showing striking spatial differences in the level of risk that would be created. Totally different from what was described the flood of 2001, the road infrastructure was badly damaged by the effects of scour and landslides, leading it in the reconstruction of road and railway bridges, implying a strong investment in river protection works of higher upstream of the bridges, ie, river protection works carried out in specific areas. The resident population and infrastructure are threatened by these events, not predictable, although it is estimated that it is possible to raise a reduction, the degree of risk mitigation. Mitigation requires knowing the precise location of the areas where work is needed for protection and control, an integrated study of the watershed we must provide an adequate knowledge of the characteristics, hierarchy and dimensions that comprise the course , it is possible to obtain by applying techniques based on an efficient use of hydro-mapping with which addresses this issue and also involve the dynamics of runoff, the processes that govern the water regime of themselves and their relation to the type of soil.

P2.43 | **Liquefaction damage by the 2011 Off the Pacific Coast of Tohoku Earthquake in Japan and land condition of damaged area detected by time serial geospatial information** (#902)

M. Koarai[1], T. Nakano[1], T. Okatani[1], K. Otoi[1], H. Une[2]

[1]Geospatial Information Authority of Japan, Geographic Information Analysis Research Division, Tsukuba, Japan; [2]Geospatial Information Authority of Japan, Kanto Regional Survey Department, Chiyoda, Tokyo, Japan

A full-length version is available and can be opened here:

_extendedAbstract\237_proceeding.*

“The 2011 Off the Pacific Coast of Tohoku Earthquake” caused heavy liquefaction damage to buildings, public facilities and lifelines in large parts of the Kanto District, especially on the Tokyo Bay side and at the lower plains along the Tone River. Conditions under which liquefaction occurs are as follows: strong earthquake motion, high ground water level and loosely deposited sand. Places with the high possibility of liquefaction are reclaimed land, former river channels, and lowlands between sand dunes and sandbars. To know the potential for liquefaction, it is important to determine the history of the land. The Geospatial Information Authority of Japan (GSI) has archived time-series geospatial information, such as olden topographical maps and olden aerial photos, and it provides these archived data to the general public. It is possible to understand the history of the land and liquefaction-prone locations from time-series geospatial information. We surveyed the damage at the liquefaction sites and researched geographical conditions of areas remarkably damaged by liquefaction using time-series geospatial information. We mainly used time-series geospatial information, such as olden French-style maps (Japanese: *jinsoku-sokuzu*), olden topographical maps, previous aerial photos, land condition maps and landform classification maps for river improvement. Although liquefaction occurred at many places in Itako City, Ibaraki Prefecture, which is at the lower reaches of the Tone River, liquefaction damage was especially serious in the Hinode area. Although the main roads were restored to some extent by June 2011, leaning utility poles were left. The school buildings showed apparent uplift about 25 cm at Hinode Junior High school. The damage tended to be more severe in the southern area. Street gutters were deformed by lateral spreading; cave-in and other damage to the lid of a gutter are seen. The *jinsoku-sokuzu* map published by the Japanese army about 130 years ago shows that the Hinode area is land that was reclaimed by the drainage of a small bay which liquefaction easily occurs. There is a low-lying former river channel in a band across the Kinu area of Shimotsuma City. This landform is shown on the “Mitsukaido” Land Condition Map published by the GSI. This former river channel sank, and land subsidence and relative groundwater level rise are presumed. Service on neighboring roads was suspended as a result of intense cracking and undulation of the road. Liquefaction damage, such as cracking, differential settlement and the tilting of buildings occurred even in the new residential area in the former river channel. The houses were destroyed by severe subsidence of reclaimed land and the collapse of foundation. The main stream of the Kinu River was shown as meandering in the *jinsoku-sokuzu* map of about 130 years ago. A new river channel was under construction in the olden topographic map (1:50,000 scale) published about 75 years ago. In the U.S. army aerial photo, it can be recognized that the former river channel has changed to paddy field. Urayasu City is one of the areas that were most severely affected by liquefaction caused by the strong motion of the Tohoku Earthquake. We carried out a leveling survey in Urayasu City and compared the results with the differences in LIDAR survey data measured pre- and post-earthquake, and upward displacement values of piled buildings to determine surface subsidence by liquefaction.

P2.44 | **Support of Disaster management by SDI and Cartography** (#702)

B. Toronyi, G. Iván

Institute of Geodesy, Cartography and Remote Sensing (FÖMI), Budapest, Hungary

On 4th October 2010 there was a red-mud sludge catastrophe in Ajka, Hungary. A sludge reservoir of an alumina factory damaged and approximately 1 million cubic meters of red-mud flooded the environment. The toxic red-mud is an alkaline, which means not only the flood, but the alkaline also ravaged the built, the natural and the human environment. During the disaster 123 people injured and 10 people died because they were directly hit by the flood and/or they had serious injuries on their skin. The Government immediately needed data and analyses for decision-making on disaster management. FÖMI was asked to complete and analyze data on the catastrophe territory. The paper will provide different data productions, actions and analyses carried out by FÖMI and presented cartographic materials as well for disaster management support.

P2.45 | **Mapping flood vulnerability. Case study: Tecuci Town (Romania)** (#339)

A. Nedelea, L. Zaharia, L. Comanescu
University of Bucharest, Geomorphology-Pedology, Romania

A full-length version is available and can be opened here:

_extendedAbstract\55_proceeding.*

The aim of this paper is to assess and map the vulnerability to flooding of an area (Tecuci Town) where such phenomena have been present since 2007. The intention behind our effort is to prepare a detailed map (scale 1:5000) of the areas that in September 8, 2007, suffered serious floodings that resulted in human loss and significant material damage. Tecuci Town lies in the northeastern part of the Romanian Plain, at the junction of Bârlad and Tecucel rivers. Its natural setting shows a number of speacific features that make it vulnerable to floods. These are related to the hydrological, meteorological and demographic factors, as well as to the land use. In order to produce the flood vulnerability map the following variables will be taken into account:

- Terrain features, assessed with GIS techniques (altimetry, altitudinal steps, channel dynamics, channel characteristics, hydrotechnical works)
- Hydrological characteristics of the Bârlad and Tecucel rivers, based on the data provided by the National Institute of Hydrology and Water Management (mean daily discharges, mean daily levels, rating curves, recorded floods)
- Meteorological conditions, relying on the data collected from the National Meteorological Administration (mean daily precipitation, mean daily temperatures, evapotranspiration)

All numerical data (meteorological and hydrological) were analyzed and interpreted thoroughly, so that to avoid the occurrence of potential errors. The results were processed by using statistical techniques as well, which allowed the computation of a number of indices that emphasize the general evolution trend. Under the circumstances, we were able to use for our GIS analyses the most accurate datasets. In order to develop the flood vulnerability map we used the following software and digital outcomes:

- The digital terrain model provided by the National Agency for Cadstre and Land Registration (N.A.C.L.R.), having an altimetric accuracy of 0.5 m along the main rivers and 0.5 – 2.5 m for the rest of the area;
- The watershed outline in ESRI format;
- The land use map of scale 1:50000 in ESRI ArcInfoshapefile format;
- The geological map of scale 1:200000 in ESRI ArcInfoshapefile format;
- Orthophotoplans of 0.5 m resolution of the entire watershed in ECW format;

The available information was processed by using the specific GIS instruments, such as: *Fill* – for filling the depressions resulted through interpolation, *Flow Direction* – to assign each grid cell a code meant to indicate the flow direction for the respective cell, and *Flow accumulation* – to define the stream network starting from a minimal threshold referring to the number of cells that contribute to the flow. All the work was accomplished by using the ARCGIS software. The resulting vulnerability map suggests that Tecuci Town, thorough its geographical position and geomorphological features, lies in an area where floodings are a common phenomenon. Consequently, one can identify the following types of areas: areas never affected by floods, with low flooding vulnerability; areas affected by exceptional floods, with medium vulnerability, and areas affected by floods every year, where vulnerability is high. Every type of vulnerability was mapped differently, by using specific indices. This contribution is part of the VULMIN project (from the PCCA category), managed by Associate Professor dr. Alexandru Nedelea.

P2.46 | **Mapping of natural hazards in Cameroon** (#716)

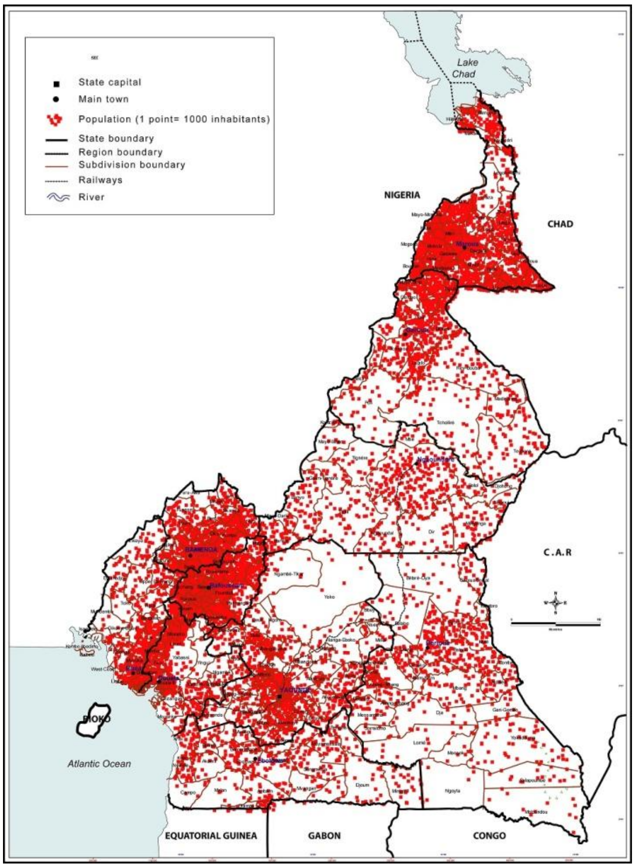
M. Tchindjang

University of Yaoundé I, Department of Geography, Cameroon

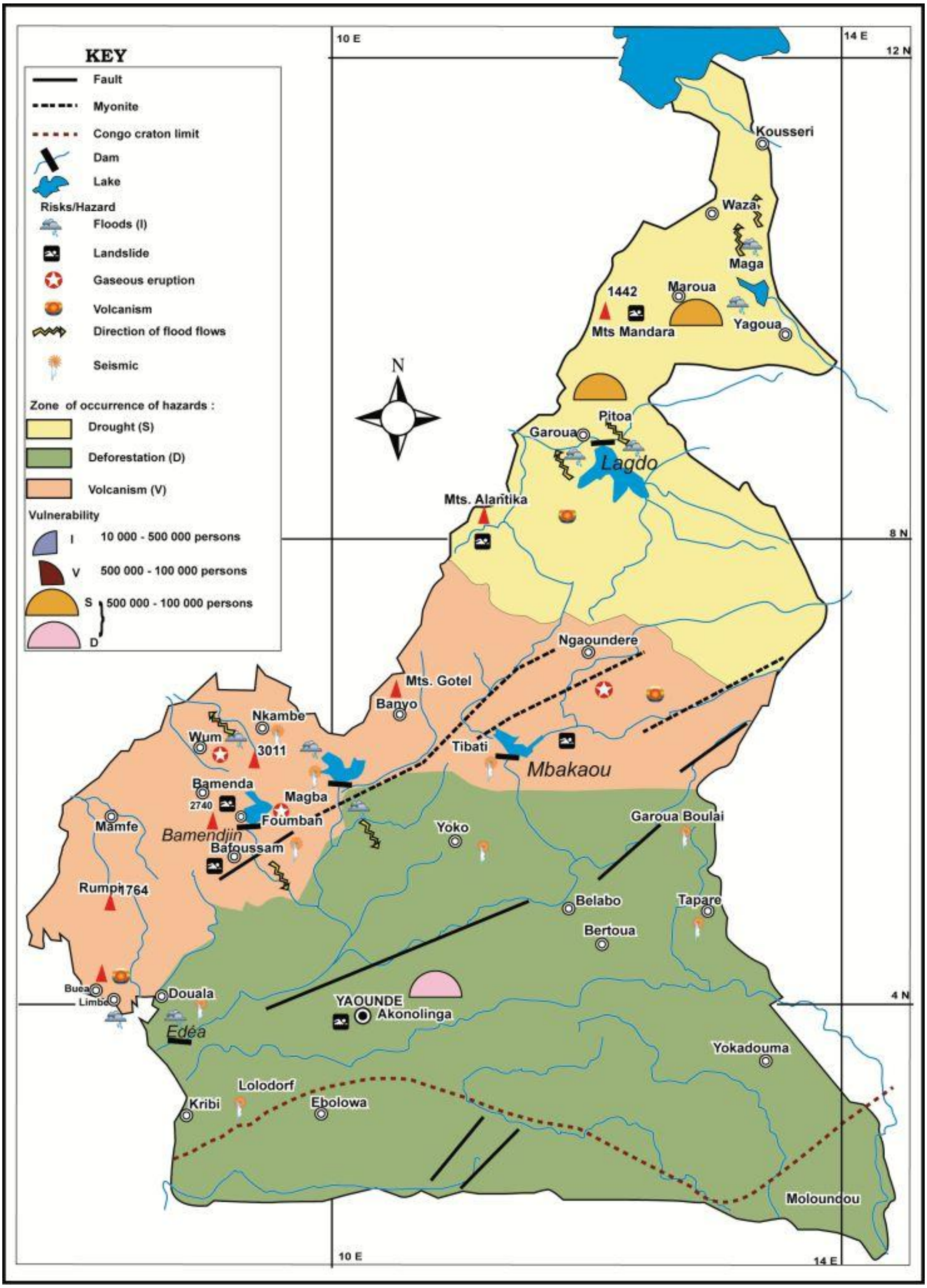
A full-length version is available and can be opened here:

_extendedAbstract\403_proceeding.*

With its wide extension in latitude (2-13 ° N, over 1500km) and longitude (9-16 ° E, over 800km), Cameroon by its triangular shape, occupies a unique position in Africa. It appears as a true topomorphologic hinge which recorded all geodynamic events which have marked the African continent (since the breakup of Gondwana until the Present), and summarizes in its main features, African reliefs and morphology. This country, from the Mandara Mountains to Cameroon Mountains, overlap the main tropical bioclimatic and morphoclimatic domains. Cups and pediplains bristling with inselbergs and dominated by the concave massive slopes observed in the Sahelian regions of the North, contrasted at the south with large polyconvex flattening and degradation surfaces of south Cameroon forest plateau that surrounded the Atlantic coastal plain. Between these two entities, arise imposing mountain ranges covered by volcanism, which far from being erased human and cultural footprints, have caused and organized the dense human occupation of these mountains while making its become the area of sacrality . These reliefs constrained by lithological and tectonic scarps, cut essentially in the Precambrian basement rocks, are the result of a long evolution marked by the staging surface flattening. This geographical and geological configuration exposed Cameroon at several types of naturals hazards occurring in all regions, following the climate regime and the morphological shape. Among the natural hazards observed in Cameroon, one can include: earthquakes, volcanoes, floods, landslides and drought (fig 1). In the detail, the hazard aspect gives the preponderance to earthquakes, although in vulnerability appearance, volcanism appears more important. However, landslides, floods and drought hazards become more recurrent and this paper attempted to illustrate it by maps. For each type of hazard, the author has used the statistical data collected from various oral sources (collective memory) which he associate existing hazards observed in Cameroon since the 19th century. These risks were then crossed through GIS to the population density (fig 2) of the whole of Cameroon. This mapping gives a general idea of the types of hazards by type of region in Cameroon. It allows establishing a database of different types of natural hazards at the same time it is a starting point for understanding, analyzing and taking into account the risks that may occur in Cameroon. At this level, it can help to organize and compute exposure scenarios of the Cameroon regions to natural hazards



Pop_Cam_Eng:
Population map of Cameroon



risks_cam_eng:
the figure presents a typology of natural risks occuring in the country

P2.47 | **The Impact of Multidimensional Process of Society Pauperisation on the Global Disease Diffusion - an Analysis of the Problem with the Use of a Cartographic Method of the Research** (#916)

Agnieszka Pilarska, **Z. Kozieł**

Nicolaus Copernicus University Faculty of Earth Sciences, Cartography, Remote Sensing and GIS, Toruń, Poland

A full-length version is available and can be opened here:

_extendedAbstract\916_abstract.*

P2.48 | **Administrative planning of territory of the Republic of Kazakhstan by means of cartographic method and Geographic Information System** (#1182)

I. Plachinta, Y. Bentya
Kokshetau State University named after Sh. Ualikhanov, Kazakhstan

A full-length version is available and can be opened here:

_extendedAbstract\1182_abstract.*

P2.49 | **Cartographical support of socio-economical development in Arctic region of Russia** (#769)

S. Belousov

Lomonosov Moscow State University, Cartography and geoinformatics, Russia

A full-length version is available and can be opened here:

_extendedAbstract\204_proceeding.*

Due to the growing rivalry between Arctic countries for natural resources of Arctic Ocean development of Arctic regions of Russia becomes the priority of the Russian economy. Cartographic method of research allows us to determine the current level of development of socio-economical infrastructure, its prospects and mark out regions that are sorely in need of development. This research suggests methodical approach and practical methods for creating maps of socio-economical development of Russian Arctic. A series of analytic maps showing current level of socio-economic development and natural conditions of region was taken as the basis of the work. Based on these maps were calculated group of indexes that show us assessment of possibility of different aspects of socio-economical development, such as construction of industrial or transport facilities, natural conditions for human living and health, indexes that show attractiveness of the territory to different kinds of investments, indexes that show vulnerability of arctic nature and administrative limits for land use. These indexes allow us to make synthetic and assessment maps: attractiveness of the land to investments and development, possibility of industrial and transport development, natural conditions for human living and health, sustainability of socio-economical development. These maps were combined using raster geoinformation methods (overlay and geostatistical analysis) in ESRI ArcGIS 10 to complex synthetic map that shows us primary task in socio-economical development – regions where should be paid serious attention to solve environmental problems and don't permit the overuse of natural resources, regions in which industrial development should be a priority, regions where transport development is the main aim, regions that should be conserved to prevent disappearing of local nations and its cultures, complex regions etc. All maps and thematic layers were combined into ArcGIS geodatabase and allocated on Lomonosov Moscow State University geoportal (www.geogr.msu.ru).

P2.50 | **Provision of Web-based Childcare Support Maps by Local Governments in Japan** (#510)

M. Kukimoto[1], Y. Wakabayashi[2]

[1]Nara Womens University, Division of Humanities and Social Sciences, Japan; [2]Tokyo Metropolitan University, Department of Geography, Hachioji, Japan

A full-length version is available and can be opened here:

_extendedAbstract\51_proceeding.*

The adoption of the Internet as a means of map distribution has fundamentally changed the way spatial information has been communicated since the mid-1990s (Peterson, 2005). With the spread of the Internet and the digitalization of maps, not only private companies but also local governments have been providing online maps containing useful information for residents' daily lives, especially in Japan. Based on data concerning online maps provided by local governments in Japan collected by the Center for Spatial Information Science (CSIS) at the University of Tokyo, Sekimoto et al. (2011) reported that as many as 8,535 maps displayed on websites were provided by local governments in 2009. In particular, online maps for childcare support have shown a rapid increase in recent years. As a result, the ratio of this kind of map accounts for approximately 10% of the entire range of online maps made available by local governments. This is because it has become more important for national and local governments to improve their childcare policies, as Japan faces increased childcare needs caused by an increase in the number of working mothers and the necessity to implement countermeasures to offset the declining birthrate. The objective of this study is to analyse the present conditions and problems with web-based childcare support maps provided by local governments, with particular attention being given to their contents and expression. We sampled web-based childcare support maps in the Tokyo metropolitan area, from the database by Sekimoto et al. (2011) to analyse style, contents, expression, and the map creation process. We classified the maps into three grades. Grade 1 refers to the map provided as a static image of a PDF or image file based on analogue maps, for which users cannot choose the information or change its expression. Grade 2 is the interactive map that uses WebGIS, for which users can choose the information and its expression. Grade 3 signifies the participatory map, for which users can add or share information. An analysis of these maps revealed that grade 1 was 60.8% of the total childcare maps, grade 2 was 34.8%, and grade 3 was 0.7%; 3.7% of the maps was not found or inactive. Most grade 1 maps are uploaded print maps and contain a variety of expressions, including an illustrated map. Their contents consist of childcare facilities (e.g. daycare centres) in each municipality. Some of these maps have characteristics similar to participatory maps, because not only public actors but also private actors such as mothering groups participate in the mapmaking process. Grade 2 maps can be divided into two types in terms of provision style. One type is an interactive map on which users can see all childcare facilities within the municipality at a glance. The other type shows the location of each facility individually on the map. Therefore, the former type can more readily be used to search the facilities from a wider area within the municipality, while the latter type can be used as a navigational tool. In both types, existing Web maps such as Google Maps are used as a background image. As a result, the style and operability of the maps are sufficiently standardized for easy use, although their expression tends to be uniform. Further, some local governments maintain a website for mobile phones because it is common, especially among Japanese women, to use the Internet on their mobile phones. The results reveal that interactivity or user participation, which are major advantages of using the online digital map, are not necessarily realized in Web-based childcare maps in Japan in spite of the increased number of maps. This suggests that digital maps are not being utilized, even with the high Internet penetration rate of 79.1% in Japan, because most providers do not fully understand the advantages or characteristics of digital maps, and users still rely on analogue or print maps.

P2.51 | **Map 2-1: Archaeological, Iron Age, Pre-historic and Historic Sites in Botswana Map – GIS Database -Compiled from Botswana Museum Database and from the archaeological and historical sites list of Botswana** (#1372)

J. G. Maphanyane

University of Botswana, Department of Environmental Science, Gaborone, Botswana

Map on the Archaeological, Iron Age, Pre-historic and Historic Sites in Botswana Map – Compiled using GIS Database and data sourced from Botswana Museum Database and from the archaeological and historical sites list of Botswana, compiled and edited by Neil Parsons, David Kiyaga-Mulindwa and Fred Morton (Parsons et al. 1987)

Botswana Archaeology Map:

: Archaeological, Iron Age, Pre-historic and Historic Sites in Botswana Map

P2.52 | **Cartographic visualisation of the spatial location of external hydrants for the fire brigade purposes** (#791)

&. Wielebski

Adam Mickiewicz University in Poznań, Faculty of Geographical and Geological Sciences, Department of Cartography and Geomatics, Poland

A full-length version is available and can be opened here:

_extendedAbstract\224_proceeding.*

The objective of research was to elaborate a cartographic visualisation facilitating the decision-making process in terms of the spatial availability of external hydrants and the provision of water for rescue and fire-fighting operations. The research project conducted for the city of Poznań was carried out in cooperation with the fire brigade in the form of an application. The large-scale thematic map elaborated following the performance of research contains information about the three basic topographical objects falling within the interest of the fire brigade from the point of view of operational activities undertaken thereby. First and foremost, this concerns the location of hydrants and the buildings secured thereby, as well as the course of access roads. Information about the types of hydrants has been visualised by the application of signatures. Apart from the thematic layers made up by topographical objects, of considerable importance from the point of view of information are the layers that come into being as a result of analyses in the desktop GIS application. The basis for spatial analyses conducted using the geometry of vector objects was the regulation specifying fire-fighting requirements governing the provision of water. The cartographic method of equidistances were used to express the distance of buildings from hydrants. Equidistances constituting lines of identical distances, routed within a spatial interval of 15 metres from the hydrants were generated in the GIS application utilising a tool for designating buffer zones. The interval selection corresponds to the standard length of a section of fire hose. The method of triangulation was used to determine the distances between neighbouring hydrants. The application of Thiessen's polygons, for which the hydrants acted as generators, made it possible to create an irregular network of varying density. The cartographic visualisation containing this information makes it possible to more rapidly find the nearest hydrant of a specific type, and also to initially assess the number and lengths of fire hoses required to carry out an operation. Since the spatial information has been juxtaposed with standards set forward in legal regulations and spatial analyses performed in accordance with these parameters, it became possible to isolate areas where a fire-fighting operation could be conducted with the greatest chance of success. The possibility of displaying the monitor map thus prepared on a mobile device, such as the ever more popular tablet or smartphone with a built-in GPS receiver, means that it can also be used at the location of a fire during fire-fighting activities.

P2.53 | **Assessment the Use of Satellite Imagery for Mapping** (#473)

M. Keskin, A. O. Dogru, N. Uluğtekin
Istanbul Technical University, Geomatics Engineering Dpt., Turkey

A full-length version is available and can be opened here:

_extendedAbstract\301_proceeding.*

Remotely sensed imagery has an enhanced capability of extracting information about small image structures (both artificial and natural objects). Fast, low cost, accurate and spatially rich data can be acquired via remote sensing. For this reason, satellite image mapping is quite common technique and undoubtly, image maps provide a greate contribution to cartography and Geographic Information Systems as data sources. However, there are lots of remote sensing satellites with different kinds of spectral and spatial resolution and they detect different regions of electromagnetic spectrum. One needs to know which satellite image is suitable for which kind of mapping. Mapping which is based on scale and purpose is a procedure containing data collection and symbolization. On the other hand, image mapping which is based on resolution is a procedure including information extraction from pixels. While pixel algorithms and processing methods are suitable for medium and low resolution images, pattern recognition is suitable for high resolution images. Thus, there is a need to evaluate maps according to scale and satellites according to resolution level and see if they are matching or not. This paper aims to produce a multi-scale GIS based satellite image maps, to create the GIS geodatabase for map features and to interprete the end maps by means of efficiency, accuracy, consistency and usability. In this context, first of all, maps are going to be examined in terms of scale and content of the map. A requirement matrix is going to be produced in order to execute the requirement analysis on the content of each map type based on the scale. Secondly, remote sensing images, having different spatial and spectral characteristics (an aeral photo, IKONOS, SPOT and LANDSAT images), are going to be examined in a similar approach and a requirement matrix is going to be formed for determining the data extraction level of remote sensing imagery based on spatial and spectral characteristics. Finally, these two matrixes are going to be integrated for the assesment of the use of the remote sensing images in terms of mapping. A case study is also going to be considered in this study to evaluate the results of the above mentioned method in terms of multi-scale GIS based satellite image mapping.

P2.54 | **Analyzing patterns of land cover change in southern part of the Ganges delta region in India** (#605)

G. Chaudhuri

University of Wisconsin-La Crosse, Geography and Earth Science, 54601, United States

A full-length version is available and can be opened here:

_extendedAbstract\227_proceeding.*

Among the fastest growing economies of the early 21st century world, India stands out as one of the instances where agricultural-based economy has been rapidly propelled into the center of the global economy. Built-up or paved-over areas in these less-developed parts of the world outbid all other uses for land adjacent to the city, including prime croplands. The divergent rates and patterns of LULCC and the increase in poverty in this part of the world are key elements in rising vulnerability of land to the negative consequences of global environmental change. The present study focuses on the southern part of the low-lying Ganges delta region of India. A largely poor but fertile agricultural region, this region has experienced astonishing land use and land cover changes due to a combination of rapid economic development, increased population, industrialization and urbanization. Yet little has been done to map and monitor LULCC of this region. The presently available land cover maps for this region are large scale which lacks understanding the dynamics of land use and land cover change at the regional scale. Thus the objectives of this study are: (i) to map land cover change of the southern part of Ganges delta region using multi-temporal Landsat images; (ii) to understand the relationship between land cover change and socio-demographic change. Characterization of past and present LULCC with socio- demographic variables helps to analyze the causes and the consequences of land change. The study uses 6 Landsat scenes from the same season for years 1990, 1999, 2003, 2005, 2008 and 2010. Images were atmospherically corrected followed by radiometric normalization considering 2003 as the base imagery. Reference data for training and accuracy assessment were collected carefully combining field derived ground truth and high-resolution imagery in Google Earth. Final classification was performed using Random Forest with feature space consisting of Landsat non-thermal bands, elevation, slope and aspect derived from ASTER DEM, enhanced vegetation index (EVI) and contextual measures. The images spanning for 20 years were classified under 6 land cover classes such as built-up area, agricultural, vegetation, wetlands, barren land and water bodies. Post-classification accuracy analysis shows 85% - 87% classification accuracy of all the images. Image to image land change matrix was calculated to analyze the trajectory of land cover change from 1990 – 2010. Preliminary results of the study show that in last 20 years the rate of land cover change has increased which is directly correlated to overall increase in density of population in the region. Spatially, there is a distinct relationship between trajectory of land cover change and distance from an urban center. As the distance from the urban center increases the land changes from natural vegetation to agriculture, and with decrease in distance from the urban centers, the agricultural areas and wetlands are lost to increasing built-up areas. The rate of increase of built-up areas is higher between years 2003 – 2010 compared to between years 1990 – 2003. Overall, though the proportion of agricultural land is higher compared to other land cover classes, but due to increase in density of the population in the fringes of the urban area, especially Kolkata, the land cover is rapidly changing. Further analyses are on progress but from the present results it can be said that rapid land change and modification are threats to biodiversity and human habitability of built-up areas itself because the built-up areas itself gets affected by warmer temperature, sea-level rise, and changes in the monsoon regime. If global change is to be managed for mankind’s benefit, then control and knowledge of LULCC will be paramount, because land use is fundamental to human activities, and policy is the most credible mechanism for influencing patterns and trajectories of change.

P2.55 | **Earth Observation Capacity for Environmental Mapping in Bulgaria** (#630)

P. Penev, R. Vatseva

Petar Penev, UACEG, Sofia, Bulgaria

A full-length version is available and can be opened here:

_extendedAbstract\22_proceeding.*

This report will present the status, opportunities and perspectives of Earth Observation capacity for Environmental mapping in Bulgaria, with special emphasis on its importance and possibilities provided by participation in the international observation systems, for the purpose of climatic changes and environment quality monitoring. The assessment of the capacity is based on the individual geographical, historical and economical trends in Republic of Bulgaria. This report reflects the achievements of Bulgaria's participation in the project OBSERVE/FP7 Program. Earth Observation (EO) starts for almost every country in the world, including Bulgaria, with the creation of the basic national cartographic inventory and the respective maps of Land Use in small and medium scales. The starting dates for the use of Photogrammetry in Map making procedures are placed just before and after the 2nd World War while it is important to remark that in some cases, Remote Sensing Satellite imagery was acquired to help the production of the modern base maps of the whole state. There is not a global policy to use Earth Observation applications for environmental decision making. Although in Bulgaria there are some steps to raise the awareness on environmental issues are attempted. Earth Observation applications can provide great help towards this approach since they can: • provide base maps to support the design of infrastructure projects taking into account restrictions for the protection of the Environment; • protect the Environment by monitoring sensitive areas of great natural beauty and importance; • guide the state to develop financial growth using pollution free or environment friendly strategies; • lead to development fostering, the prevention of forest fires, earthquakes and other natural disasters. Based on different inputs of the project for Bulgaria, the roadmap and strategy plan has been prepared as an important result of the project. The short term and medium term actions have been proposed: · Consider and evaluate ways to participate in international standards bodies and activities in the EO domain (e.g. OGC working groups, GEOSS Architecture Implementation Pilot); · Extend the initiative of a common GEO forum for networking and application exchange from the national to the Balkan region; · Further expand dissemination and stakeholder involvement; · Further promotion of GEOSS data sharing facilities. Organize permanent training courses and workshops in Bulgaria. · Increase cooperation between the Universities in the region (student and teacher exchange; organization of specialized courses, etc.). · Strive for increasing funding for scientific research in the EO field. · Promote GEOSS as a common data platform in the region for data producers, providers and end-users that will allow the sharing and exchange of EO data. · Encourage national bodies to perform market researches on the end-users needs (at the national and regional level) aiming at getting objective information on real needs and achieving a qualitative collaboration between the end-user, EO producers and providers. The report identifies the problems of the Earth Observation mapping of the environment in Bulgaria and indicates the possible ways to solve them.

P2.56 | **APPLICATION OF GEOMATICS FOR MONITORING THE ENVIRONMENTAL DYNAMICS AROUND THE DAM OF CAP BON (Tunisia - North East)** (#1039)

W. Chouari[1], M. Nasr[2], M. Dhieb[3]

[1]Laboratory SYFACTE (F.L.S.H.Sfax-Tunisia), Geography, Tunisia; [2]Laboratory SYFACTE (F.L.S.H.Sfax-Tunisia), Geography, Tunisia; [3]King Abdulaziz University, Faculty of Environmental Design, Jeddah, Saudi Arabia

La géomatique ou la géoinformatique représentent actuellement les moyens les plus avancés et les plus pertinents pour étudier l'environnement et l'écosystème. Ce travail a l’intention de produire des résultats utiles pour comprendre l’environnement et de modéliser l'interaction homme-environnement, en s'appuyant sur l'application de ces techniques. Les objectifs de l’étude sont de surveiller les changements environnementaux de la dynamique morphogénique et de l’occupation du sol à l’amont et à l’aval des barrages de la région du Cap Bon en Tunisie au cours des décennies passées, de modéliser les rapports homme-environnement et de comprendre les causes des changements observés. Le modèle intègre des images multi-temporelles ASTER, des photographies aériennes, des données météorologiques et des données socio-économiques. Le changement environnemental est profondément associé aux activités humaines. C’est seulement en comprenant parfaitement les rapports homme-environnement et en prévoyant les tendances évolutives, que nous pourrons définir les politiques pour une meilleure occupation du sol et gestion environnementale.

P2.57 | **Land cover map of Europe at scale 1:5 000 000** (#194)

J. Feranec[1], T. Soukup[2], J. Cizmar[3], J. Safar[4], P. Kontra[5]

[1]*Institute of Geography, Slovak Academy of Sciences, Department of Geoinformatics, Bratislava, Slovakia;* [2]*GISAT s.r.o., Prague 7, Czech Republic;* [3]*Faculty of Civil Engineering, Slovak University of Technology, Department of Mapping and Land Consolidation, Bratislava, Slovakia;* [4]*TYPOCON s.r.o., Bratislava, Slovakia;* [5]*VKU, stock company, Harmanec 13, Slovakia*

A full-length version is available and can be opened here:

_extendedAbstract\100_proceeding.*

Generation of information about spatial characteristic of landscape objects is often connected with computer databases. The current computer technologies represented by the Geographic Information Systems (GISs) make it possible to acquire varied statistical characteristics of landscape object both in digital and graphic forms. One of such outputs is a map. The aim of this paper is to demonstrate creation of land cover map (LC) of Europe making use of the CORINE land cover (CLC) data and subsequent printing the map by computer technology. Such a map is an optimal tool for presentation of LC characteristics of Europe simultaneously displaying the occurrence of LC classes and relationships between them. The present map, bringing the interpreted part of the content inherent to satellite images, conveys information about the current spatial differentiation of landscape objects in the pan-European context. The topographic base in azimuth equivalent projection consists of: the 5° (degrees) density geographical grid, the bank line, a part of a river network, which is not covered by the CLC data, state borders with their capitals, some selected cities and communications (railways and roads). The scale of the map is ca 1: 5 000 000. The thematic content of the map consists of CLC classes from 2006 on the first hierarchical levels and selected classes on the third level (44 classes of the CLC nomenclature have been aggregated and generalized into 8 classes:

1. Artificial surfaces (all classes 1)
2. Agricultural areas (all classes 2)
3. Broad-leaved forest (311)
4. Coniferous forest (312)
5. Mixed forest (313)
6. Shrub and/or herbaceous vegetation and open space (321, 322, 323, 324, 331, 332, 333, 334 and 335)
7. Wetlands (all classes 4)
8. Water bodies (all classes 5) and the river network from the topographic base.

CLC classes and other map elements are distinguished by colours: 1 – red; 2 – yellow; 3 – light green; 4 – dark green; 5 – medium green; 6 – brown; 7 – light blue; 8 – dark blue; 9 – black – settlements and descriptions; grey – railways and state borders; grey rastered – shaded terrain; magenta – main roads and names of countries (rastered). CLC data is the product of a unique European project, which records changes in LC (and partially also those in land use) already since the 1990s. The CLC data, nowadays obtained under the European GMES service (Global Monitoring for Environment and Security), arise from primarily digital seamless vector layer covering 38 countries of Europe. Regarding the resolution and size of the original vector layer and the subsequent need of generalization, a derived raster layer with resolution 100×100 m distributed by the EEA (European Environment Agency) was used for the purpose of this map. The advantage of the presented map is merging of the topical information mainly about LC with the topographic data and terrain data for the whole of Europe, the circumstance that greatly contributes to its overall readability and makes it rather unique among the maps of the European continent. The digital version of the map will be free to download at http://www.gisat.cz Copies of the map will be printed on the hybrid digital printer equipped with the piezoelectric inkjet printing heads with four levels of shade of grey and a variable size of the print drop from 14 to 42 picolitres. The printer works in the system mixing CMYK colours hardenable by UV radiation with the LightCyan and LightMagenta inks added. The used inks are optimised for printing of firm slab and flexible roll material with high resistance to external effects. The map demonstrates one of possible ways for the production of thematic maps about landscape in the pan-European context by the application of the vector CLC database. The map also provides basic information about occurrence and area of LC classes and their mutual interactions at a concise scale of 1:5 000 000, which may facilitate an overall comprehension of the current European landscape structure.

P2.58 | **Spectro-temporal analysis of physical indices and classifiers of remote sensing images around Olho D' Água Lagoon (Jaboatão Guararapes-PE, Brazil)**

(#1266)

J. C. Cotrim Moreira Filho, J. R. Tavares Junior

UFPE, Cartographic engineering, Recife, Brazil

Remote Sensing is a science that allows the study of the target surface without the need for physical contact only with the use of sensors and techniques specific to each application. Within this concept, this paper evaluates the behavior of targets in the area surrounding the Olho D'Água Lagoon, located in the municipality of Jaboatão Guararapes-PE. This region also displays a heterogeneity interesting for such research. For this study aimed to examine the similarities and spatial and spectral gap between the mappings performed by classification of images. We applied the maximum likelihood algorithm in six different compositions using to define them, physical indices and bands 5, 4 and 3, TM-5 sensor. The evaluation of the results was made from visual observations, and numerical. The latter being used to calculate the Kappa, and overall test accuracy Z. These were distributed graphically, for a better understanding of the situation. Thus were observed Kappa values and overall accuracy in two separate dates, March and September. The values of these indices were observed in bar chart, to understand the differences before the results of different compositions adopted; scatter plot to indicate the existence of major variation in the time interval used, and line chart to find out what the discrepancy or similarity between the results of the compositions adopted, and the composition formed by the three bands 5,4 and the sensor TM. The physical indexes were also analyzed on the spectral distribution of each class. Thus explaining the spectral confusion exists in the compositions formed with these indexes. At the end, it was shown that the best use of compositions for the maximum likelihood classifier, the conditions adopted in this study were the NDBI-IHS and 4-3, which showed better results in most of the evaluations, and a worse outcome, the composition NDBI-NDVI-NDWI. In conclusion, the compositions NDBI 4-3 and IHS applied to the maximum likelihood algorithm, satisfactory results show that the composition which standard 543.

P2.59 | **A METHODOLOGY FOR EDGE DETECTION OF SOBRADINHO RESERVOIR - BA, BRAZIL WITH SRTM AND ASTER IMAGES** (#1283)

J. Gomes Dos Santos, J. R. Tavares Junior

UFPE, Cartographic engineering, Recife, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\383_proceeding.*

This paper reports an investigation of methods of reservoir edge detection using Remote Sensing images in a study case of the reservoir's edges of Sobradinho, Bahia, Brazil. The tests included LANDSAT-5 TM imagery, SRTM-DEM, SWBD edge of the SRTM and ASTER-VNIR-GDEM, and processing were tested operators for opening and closing of Mathematical Morphology and segmentation of band 4 of LANDSAT TM-5 (edge B4). The segmentation of the TM band 4 was the best represented the edge of the reservoir Sobradinho in relation to the tests made with edge operators of Mathematical Morphology applied to the TM band 4, the segmentation using ASTER-VNIR-GDEM, and the edge SWBD SRTM-NASA. The ASTER GDEM-VNIR form a mosaic discontinuous in time resulting in different levels of water Sobradinho (distinct edges) that do not complete. Another problem observed in ASTER GDEM-VNIR available and free to the public is not aware of the date of the images. Regarding the analysis of the results of image processing for edge detection operators of Mathematical Morphology opening and closing generate greater than 30 m pixels degrading the spatial resolution of TM, and does not create a continuous border line. The SRTM-NASA SWBD planimetry differ in the edge SRTM DEM and the edge B4. Altimetric profiles were developed between the edges of SRTM-DEM and radiometric in B4 and it was found: low penetration of imaging the SRTM-DEM in the recesses of the edges of the reservoir, while the highest elevations of the terrain are more prominent than the lower slopes; the hollows and lower slopes are the main causes of the discrepancies between the edge-SWBD SRTM (WBS) and segmentation of the band B4.

P2.60 | **DINSAR TECHNICAL PROPOSAL FOR STUDY OF SOIL SUBSIDENCE THE NEIGHBORHOOD OF BOA VIAGEM, RECIFE - PE, BRAZIL** (#1324)

J. R. Tavares Junior[1], A. L. Bezerra Candeias[1], J. J. da Silva Pereira Cabral[2]
[1]UFPE, Cartographic Engineering, Recife, Brazil; [2]UFPE, Civil Engineering, Recife, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\310_proceeding.*

The overexploitation of groundwater resources can cause several problems, one is the use of wells for situations that require a higher demand on the availability of the well reservoir leading to exhaustion. Another issue is the lowering of soil compaction with the underlying layers of porous, due to water extraction capacity in excess of recharge. This phenomenon is known as subsidence of the soil. A example of subsidence area is neighborhood of Boa Viagem, Recife, Brazil.This article shows a general review of remote sensing technique, namely DInSAR - Differential Interferometry Synthetic Aperture Radar applied to studies of land subsidence. From these techniques it is possible to see the lowering of the ground with the overexploitation of aquifers. The DInSAR technique is independent of other techniques for measuring subsidence, such as geometric leveling and gravimetric method, whereas the sensor system Advanced Synthetic Aperture Radar orbiter is not located in the soil-building. Other types of phenomena (seismicity, ground works, among other ones) can generate subsidence of land, may occur in the same season and region and overlap the overexploitation of aquifers.

P2.61 | **MAPPING AREAS OF ENVIRONMENTAL PROTECTION IN LAGOON OLHO D'ÁGUA (JABOTÃO DOS GUARARAPES – PE, BRAZIL) USING SUBMETRIC IMAGE** (#870)

J. R. Tavares Junior, O. Gomes de MacEdo, A. L. Bezerra Candeias
UFPE, Cartographic Engineering, Recife, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\300_proceeding.*

The population that live in areas typically subnormal have problems with basic infrastructure such as sanitation, water supply, paved roads network proper channels, regular garbage collection, among other services essential to quality of life population. Another aspect of the occupations around subnormal water bodies is disrespectful to the limits of protection indicated by the environmental legislation, situation feature surrounding a lagoon. Methodologies using Remote Sensing are important to map protected areas and areas of irregular occupation. The vectorization of visual areas protection, visual interpretation of satellite images submeter spatial resolution observing the rules of environmental legislation, zoning allows preliminary areas protected by environmental legislation relevant to lagoons and the invaded areas. Given the vast area surrounding the lagoon was chosen a smaller area of study for demarcate tracks provided protection (in relation to shores of the lagoon in the study), and the images demarcate the sectors actually invaded with construction dwellings. This thematic mapping and preliminary updated (scale to allow observation of streets, channels, smaller streams and lagoon) is an essential task for bodies which provide analysis of planning urban and environmental enforcement officers and campaigns municipal governments to respect the educational environment. In the case of lagoon Olho D'água the thematic mapping of the areas of public domain environmental protection and occupations presents the disrespect legislation. Application of Remote Sensing in high spatial resolution images using QUICKBIRD *ortofotocartas* georeferenced and allow visual interpretation and appropriate zoning Areas of Permanent Protection (APP) in accordance with Resolution No. 303/2002 of CONAMA and areas Protection to the Basic Law of the Urban Municipality of Jaboatão Guararapes (Pernambuco, Brazil) Law No. 165 of 11.20.1980. The study area is located around the Lagoon Olho D'Água, City of Jaboatão Guararapes / PE. The results of this work were a *carta imagem* and a thematic map that allowed not only identify the areas occupied irregularly that contradict the legislation and identify the differences of urban growth 1986 and 2005. It also enabled the mapping of protected areas, protected areas irregularly occupied, and free green areas subject to new occupations.

P2.62 | **Object-oriented and Decision tree classifications for LULC using Cosmo-SkyMed, QuickBird and LandSat 7 satellite data: An Example of Erbil/Iraq** (#1457)

A. Al-Hameedawi[1,2], M. Buchroithner[1], N. Prechtel[1]

[1]Institute for Cartography, Dresden University of Technology, Germany; [2]University of Technology, Baghdad, Iraq

A full-length version is available and can be opened here:

_extendedAbstract\436_proceeding.*

Classification of SAR Data and optical remote sensing data is utilised in this paper to make use of complementary mapping potential of SAR data and optical image data. The landuse/landcover LU/LC mapping of the study area in Iraq has been performed using multi-sensor (SAR, optical) data in a combination with different classification approaches. The results have been evaluated on the basis of an accuracy assessment with a reference to substantial ground truth. The applied techniques include object-oriented classification and decision-tree classification. A good accuracy level has been reached. The results provide help and guidance for decision makers in an area with limited available geo-information. The accuracy assessment of classification is not only dependent on which classification techniques used but also on image Pre-Processing techniques used. Therefore, a set digital image processing is made for SAR Data and Optical Remote Sensing Data. These pre-processing techniques were very important to increase features extracted from images, decrease error in interpretation of images and also in order to effectively identify the spatial distribution characteristics of landcover/landuse classes for the city of Erbil. The Analysing and mapping the trend of LULC dynamics within the study area provide a basis for strategic planning, management and conservation decision making of Erbil City.

P2.63 | **Building up an Archeological GIS based on the excavation of the Diana sanctuary in Nemi, Italy** (#556)

S. Peters[1], P. Papakosta[2], A. Donaubauer[3], W. Filser[4]

[1]Technical University Munich, Cartography LfK, 81371, Germany; [2]Technical University Munich, Risk Analysis, 81371, Germany; [3]Technical University Munich, Department of Geoinformatics, 81371, Germany; [4]Ludwig-Maximilian University in Munich, Classical Archaeology, München, Germany

A full-length version is available and can be opened here:

_extendedAbstract\35_proceeding.*

Surveying archeological records is an essential part of the archeological documentation. The archeological records itself can either be single objects or a wider area. The survey must account for the records' respective geometric shape as well as their spatial relations to each other and the topographic and geographic situation of the find spot (Böhler & Heinz). In this work an Archeological Geographic Information System (A-GIS) is build up, in order to support archaeological investigations on the Diana sanctuary in Nemi, Italy. The A-GIS is based on an excavation of the site and thereby generated traditional archeological information (trench sketches, photographs, horizontal/vertical slices as well as longitudinal and cross sections). On the other hand the A-GIS is based on a precise geodetic survey of the site, its topography and of all relevant archeological objects. The A-GIS enable interactive exploration of archeological data. Objects and object attributes can be interactively displayed with appropriate symbology in 2D or 3D. Due to collected object time information, a time-slider helps to animate different stages of the sanctuary. The Poster will present the established workflow, the A-GIS conceptual schema (UML class diagram according to the ISO 19100 series of standards) and the A-GIS implementation as well as exemplary map outputs relevant for archeological research of the sanctuary. Furthermore a future step will be addressed: using Laser scan data for building up a 3D-model which will include the alignment of the A-GIS conceptual schema with the schema of CityGML (Gröger et al. 2008). **Figure**: Posterdraft **References** Böhler W, Heinz G (1998). Vermessungstechnische Methoden in der archäologischen Dokumentation. In: Arbeitsblätter für Restauratoren, Heft 1.1998,Verlag des Römisch-Germanischen Zentralmuseums Mainz. Gröger, G., Kolbe, T., Czerwinski, A., Nagel, C. (2008): „OpenGIS City Geography Markup Language (CityGML) Encoding Standard“ Version 1.0.0, International OGC Standard. Open GeospatialConsortium, Doc. No. 08-007r1.

Archeological Cartographic Information System
Demonstrated for the excavation of the Diana sanctuary in Nemi

Dipl.-Ing. Stefan Peters,[1] Dipl.-Ing M.Sc Panagiota Papakosta[2], Dr.-Ing Andreas Donaubauer[3], Dr. des. Wolfgang Filsner[4]

Technical University Munich, Cartography[1]
Technical University Munich, Risk Analysis[2]
Technical University Munich, Geoinformatis[3]
Ludwig-Maximilian University in Munich, ClassicalArchaeology[4]

Motivation

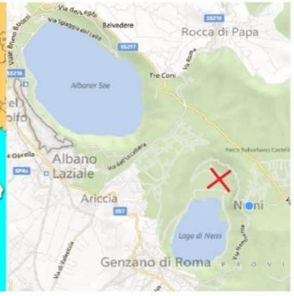
- Surveying the current situation of the uncovered structures at the excavation (Roman temple, Porticus, parts of the old street,...)
- Creating an up-to-date map of the whole area, including streets and walls outside of the main excavation at Nemi
- Using Geo Information Systems as a tool for the documentation of the excavation and its results

Column at the Porticus

Corner of the temple

Location

The excavation of the Diana sanctuary in Nemi is located near the Lago di Nemi in Italy, about 30 km in the south of Rome (red cross in the mini map). The lake itself covers the bottom of an old volcanic crater. The sanctuary is located between the lake and the steep volcanic crater slope.

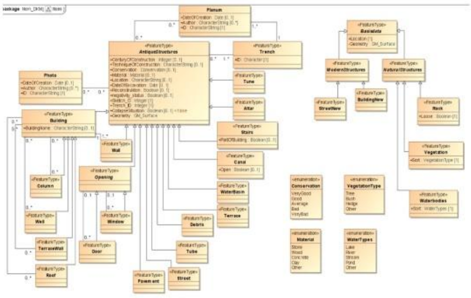


Flow of work

The groundwork of the whole project consists of the creation of an UML model for the structures at the place of the excavation. In addition to the classes, attributes are modeled.

Later at the excavation, the process consist of three main steps:

- First step: Gathering the raw data, this means doing the measurements at the excavation. To link the single standpoints one to another, there was a ring polygon created at the beginning. Standpoints outside of the main excavation were added by GNSS measurements.
- Second step: Loading the measured information into the software Caplan, and calculating the coordinates of the points
- Third step: Modeling the the calculated points with the software ArcGIS, to get maps as a result of the work



Prospect

The project of the Archeological Cartographic Information System for the excavation in Nemi is not finished yet. For the future, there are different things to do, which could improve the whole Information System. In the following, there are a few of these works listed:

- Expansion of the raw data
- Extension of the Archeological Cartographic GIS (data base for pictures, data base for on-site findings,...)
- Calculation of precise transformation parameters
- An adjustment to the open source software Quantum-GIS
- 3-D modeling with the use of a laser scanner

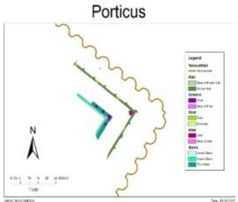
Results

Result of the works explained above are different maps in different scales, as well as a basic data set to the Nemi excavation. Results shown in this poster are:

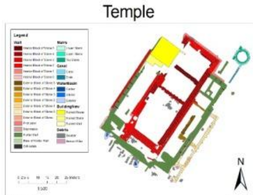
- A complete map of the area of the excavation, as well as of the road parts at the museum and the street
- A detailed map of the temple
- A detailed map of the Porticus

Overview

Porticus



Temple



Posterdraft:
Poster draft

P2.64 | **Focus on Rescue and Emergency Services in Sweden** (#185)

P. Wasström

Lantmäteriet - The Swedish mapping, cadastral and land registration authority, International Services Department, Gävle, Sweden

A full-length version is available and can be opened here:

_extendedAbstract\144_proceeding.*

Lantmäteriet - The Swedish mapping, cadastral and land registration authority - started in November 2009 a user group for actors in rescue and emergency services. The purpose with this user group is to increase the knowledge of the users, their activities and procedures, and current and future needs of geodata. Another purpose is to provide information about Lantmäteriet's geodata (content, quality, structure) among the users. Twice a year Lantmäteriet gathers the representatives for a dialogue, with national focus, to exchange knowledge and experience. This means that Lantmäteriet increase its own and other actors' insight on access needs and demands. In this way Lantmäteriet get knowledge of what actions Lantmäteriet, actors and the market have to take to give the users better and actual geodata. Use of both cadastral and geographic information is very important for hazard management and for the emergency services. The ready availability of current and reliable maps and cadastral information is of vital importance for these services. Common goals in the user group are to increase the understanding about the demands and supply of geodata i.e. cadastral (land) and geographic information. To create a platform for continuous dialogue about common problems and development needs for the national supply of geodata for the emergency operations. In the end the most important thing is that the rescue and emergency services must on the quickest and easiest way "find the correct place“.

P2.65 | **An Algorithm to Extract Building Patterns from Topographic Databases**

(#468)

S. Cetinkaya, M. Basaraner

Yildiz Technical University, Geomatics Engineering, Istanbul, Turkey

A full-length version is available and can be opened here:

_extendedAbstract\114_proceeding.*

Pattern, in a general way, can be described as a distinguishable harmonious system based on the intended interrelationships of component parts. In geospatial domain, Mackaness and Edwards (2002) define it as a property within an object, or between objects that is repeated with sufficient regularity. Buildings can compose patterns on maps/databases with their properties such as geometric positions, semantics, shape, orientation. Building patterns can be formed in a linear alignment, curvilinear alignment, align-along-road, z-shape etc. Cartographic generalisation process is not only a simple reduction of geographic objects (micro level) to satisfy the legibility specification of map (i.e. graphic limits), but also is supposed to preserve spatial patterns, and structures (meso and macro levels), because they are the main characteristics of spatial phenomena (i.e. geographic meaning). Automatic or semi-automatic evaluation of generalisation outputs has to take into account patterns. There are not so much studies on finding building structures. Zhang et al. (2011) try to find building alignments for evaluating generalisation outputs. They use Constraint Delaunay Triangulation (CDT) and Minimum Spanning Tree (MST) as data structure. They develop a set of algorithm to find linear and curvilinear alignments. Weiping Yang (2008) works on z-shape building patterns. These methods use some structural properties of buildings such as orientation, size, proximity, shape derived from topographic data to characterise building alignments. Based on these properties, homogeneity tests are also done. Higher homogeneity values mean good alignments. In our approach, first, we divided the region into blocks which is bounded by road, river, railway etc. Then, we clustered the buildings in each block by using Density Based Spatial Clustering of Application with Noise (DBSCAN) algorithm that is proposed by Martin Ester et al. (1996). While DBSCAN was employed, we used one parameter, proximity. Proximity values are calculated as a nearest distances between building polygons. In each cluster determined by DBSCAN, we constructed MST by using nearest distance values between buildings as well as clustering step. MST network provided us knowledge about not only where we start and stop, which direction we should go to during the extracting of alignments but also neighbourhood relationships of every building. We constructed Delaunay Triangles (DT) between every two neighbour buildings using building vertices. Note that DT was employed just every pair of neighbouring buildings not all buildings. We analysed the incident triangles of which vertices do not belong to just one building. As to characterise the alignments, we used properties such as number of incident triangle, number of identical incident triangles, number of right angled triangle, total triangle area etc. instead of structural properties (shape, size, orientation). The results demonstrate that proposed algorithm and method are feasible to determine building alignments. Because we did not use structural properties, complexity of determining alignments relatively reduced.

P2.66 | **GLOBAL WARMING TEACHING THROUGH MAPS AND DIAGRAMS TOUCH** (#836)

W. Ribeiro[1], A. Coll[2]

[1]Universidad de Sao Paulo, Geografía, Brazil; [2]Universidad Tecnológica Metropolitana, Centro de Cartografía Táctil, Santiago, Chile

A full-length version is available and can be opened here:

_extendedAbstract\420_proceeding.*

Researchers from Argentina, Brazil, Chile and Peru come together in front of a research project led by Chile and supported by the American Institute of Geography and History (PAIGH-OAS), to develop the proposal for teaching blind and deaf students, through tactile maps and plates, the issue of global warming and its impact on natural events. The team of international and interdisciplinary work has been developing the project for the past four years, with the main purpose of children with visual and hearing disabilities understand, through the teaching of geography, the problem of global warming Through the map and didactic diagrams touch, strengthening observation and collection of environment from a sensory standpoint through images, text and speech decoding mapping. To develop the different topics and Print tactile maps were studied program content that students must meet in their respective countries, so as to enable them to use the material in the classroom and learn in a different way the matters treated by teachers. The process of integration touch products has been one of the most laborious and time-consuming steps to address, especially as it is to work with complex textures and reliefs that replace the traditional visual and graphic design, on an issue as complex as "global warming". Therefore, when it is invested more in the evaluation time of the material and subsequent optimization of same, which has generated at least three new versions of tactile material, enabling students to achieve 85% of understanding information represented.

P2.67 | **Compilation of 7 map sheets of the geological map of Morocco at 1:50,000 / 1:100,000** (#1524)

<u>A. Hempel</u>[1], A. Fekkak[2], E. Dickmayer[1]
[1]Beak Consultants GmbH, Freiberg, Germany; [2]Infodigit, Casablanca, Morocco

No abstract or full paper available.

P2.68 | **Assessment of the Topographic Effects on Climate Data** (#919)

A. O. Dogru, M. Keskin

Istanbul Technical University, Geomatics Engineering Dept., Turkey

Surface variables are point source data and defined as quantitative and descriptive values of surface features. Climate parameters are one of the surface variables, and these point source data should be represented by surfaces to be mapped. While estimating surface variables, geostatistical approaches such as spatial prediction or spatial interpolation methods are commonly applied. Many parameters like proximity, elevation, topography, geomorphological and land cover/use characteristics should be considered while estimating the surface variables because point source climate data is naturally depends on those parameters. However surface variable estimation methods are mostly applied in order to estimate two dimensional surfaces based on proximity of point sources. Other parameters should also be considered for increasing the accuracy of the estimated surfaces. This paper aims to investigate the effect of topography on climate parameters such as solar radiation, sunshine duration, surface air temperature, precipitation and wind speed which are vital for renewable energy source management. For this purpose, Sakarya River Basin was selected as the study area in Turkey. Climate data collected at 25 meteorological monitoring stations located within and around the Sakarya River Basin at different heights were used for assessing the topography affect in study area. Firstly, kriging and co-kriging methods -which are based on semivariogram analysis- were applied by including elevation values as a covariate in order to see if the errors on predicted climate parameters are reduced or not when topography is considered. Secondly, multiple regression method was used to understand the correlation between climate parameters and topography. Regression based and weighted-average approach is very useful especially for interpolating a surface variable in a heterogeneous topography with the meteorological stations at different elevations. As the preliminary results of the study it should be indicated that the data quality, number and distribution of the monitoring stations and changing the interpolation parameters highly affected the estimation results. Solid relationships between climate parameters and topography are going to be determined in this study and performances of each geostatistical analysis method are going to be assessed in terms of accuracy assessments. Detailed results are going to be presented in the final paper.

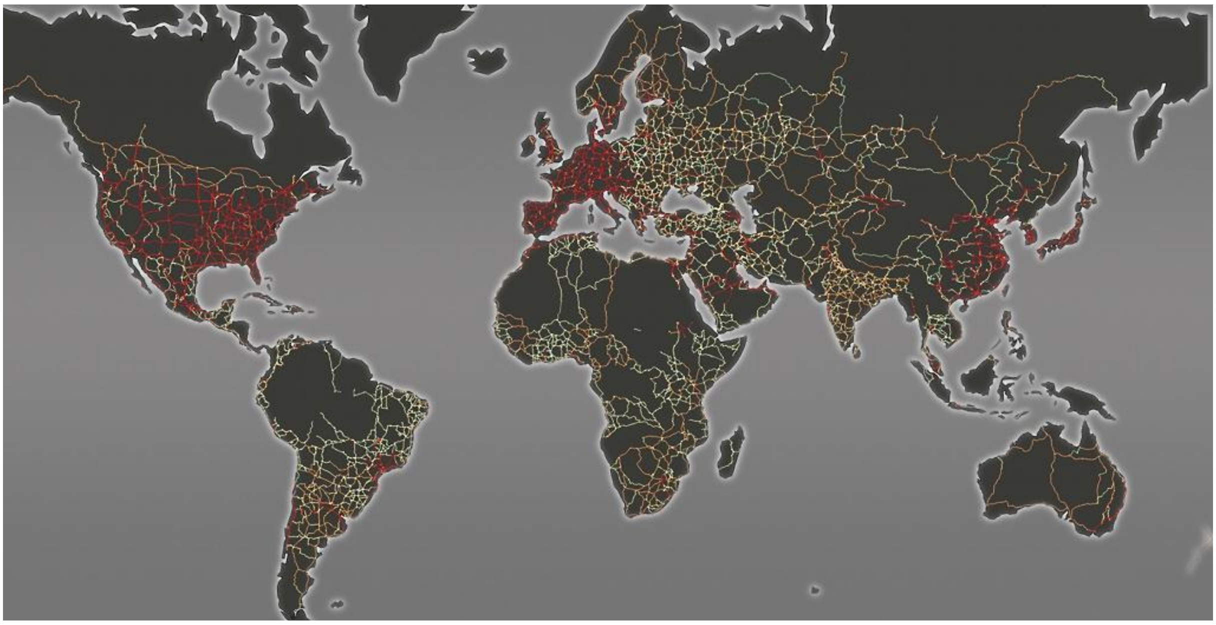
P2.69 | **A method for high-level road network extraction of OpenStreetMap data**
(#1349)

F. Schmid, **H. Janetzek**
University of Bremen, Informatics, Germany

A full-length version is available and can be opened here:

_extendedAbstract\92_proceeding.*

A method for high-level road network extraction of OpenStreetMap data Digital maps require thinning and generalization of the street network especially on low zoom levels. This is required to in order to reduce the amount of visual information and to enhance map legibility. In dense regions in the world, e.g., central Europe it is not possible to just apply straightforward heuristics, such as a selection based on classification hierarchy, as the network is still too dense. In addition to the pure amount of data, it is necessary to show connectivity between the places shown on a specific zoom level. However, the places might not be connected by streets of homogenous classification, and the selection of displayed places is subject to provide meaningful distributions for the geographic context, e.g. sparsely populated areas should be connected by reference places, even if they are smaller than other places on the zoom level. Our method addresses both goals: a meaningful distribution of cities of varying sizes for dense and sparse areas, as well as the selection of the street network between them. First of all we select the places for an even but still adaptive distribution. Therefore we select each city of a given population which does not have a neighbor within a chosen range which has a larger population. Then we span a Voronoi graph around the cities and connect the cities of which the Voronoi cells are within a defined range. This method is intended to limit the number of network connections to the "network neighbors" of a city. Only if the Voronoi cells are adjacent to each other, the cities have a close topological relationship. In the last step we connect the cities by means of a hierarchy based router (OSRM) for OpenStreetMap. With this method we are able to compute a meaningful distribution of places for various zoom levels and a sparse but fully connected street network between them. The results of our street network selection for the complete world is implemented in OpenScienceMap, a mobile vector tile map for Android devices. It can be downloaded from http://www.opensciencemap.org. References: [Gong, H.] Generalization of road network for an embedded car navigation system . [Samsonov, T.E. and Krivosheina, A.M (2012)] Joint generalization of city points and road network for small-scale mapping. [Chaudhry, O. and Mackaness, W. (2001)] Rural and urban road network generalization deriving 1:250000 from OS MasterMap.



Routes:
This Figure shows the result of our street network simplification for the complete OSM data

P2.70 | **The National Land Survey of Finland opened its topographic data** (#1064)

T. Tarvainen

The National Land Survey of Finland, Information Services Centre, Helsinki, Finland

1. Background The National Land Survey of Finland (NLS) opened its topographic data on 1 May 2012. On that day the Topographic database, aerial photographs, laser scanning data and all topographic data in raster format was made accessible free of charge. When the opening was prepared in autumn 2011, the first idea was to open only topographic raster maps. Preliminary studies showed that the data format cannot be the decisive factor in determining open and licensed data. The conclusion was to open all or nothing. The decision of opening was made at the end of 2011. **2. Open data licence** The licence was intended to be very open. However, a proprietary NLS licence was necessary in order to get the terms wanted. According to the terms of the licence it is permitted to copy, distribute and publish the data, modify it and utilize commercially and non-commercially, insert it into other products and use as a part of a software application or service. The Licensee shall mention the name of Licensor and name the dataset and time when it was delivered. Also the Licensee must require any third party to do the same and Licensor may also request the Licensee to remove the name of the Licensor. Some response of the licence has been given, especially of the demand to require third parties to mention the source of the data and the possibility of requesting the removal of the name of Licensor. **3. Delivery of open data** To be able to deliver the data to users without delivery costs, the development of the Open data file download service was necessary. The most important issues in developing were the requirement of storing the data only once (hundreds of terabits of data) and the ability to easily update the data warehouse and also to serve updating information to users. A map user interface was implemented to make the service easy to use. The service was opened on 7 May and was very popular. Also a Beta version of updating the service using an ATOM-feed was launched. The plan is to officially launch this service at the end of this year. **4. Benefits for the NLS** With the opening the NLS gained more positive publicity than ever before. An interview in one of the main news broadcasts, many newspaper articles, radio interviews and so on. On the first day 1 500 orders were made and 33 000 files were downloaded via the Open data file download service. On the first day 276 Gigabytes of data were downloaded and on the second, 650 Gigabytes. These were huge amounts compared to earlier data downloads. Now about 80 000 files per month are downloaded. The amount of questions and need of support has not increased as much as expected. On the contrary, we have been able to decrease resources from data supply. The need for customer meetings has also decreased. Opening brings us to the whole new situation, how are we to keep in touch with our users, how do we handle customer needs in future? We are planning a customer survey of how the data was used and to get feedback about the data. The survey is planned for the end of this year. **5. Benefits elsewhere** Other download services were introduced even before we got our own service in use. Torrent technology was used and the services are maintained mostly by open data communities or other activists. Some services update the data using our updating service ATOM-feed. Even services which have published extensive instructions on how to use our open topographic data have been established. An application to automatically produce orienteering maps using laser scanning data has been made and other examples of interesting innovations using opened topographic data have been seen in the Apps4Finland competition. Interest in opened topographic data has been extensive, but currently we have little knowledge of the actual benefits. We hope to get some more information through the planned customer survey.

P2.71 | **An exploratory visual analysis of twitter data relating to public attractors** (#794)

C. Pettit

University of Melbourne, Architecture, Planning and Building, Australia

Twitter data constitutes a rich source of crowdsourced real-time data. The possibilities of visualising and analysing crowdsourced Web 2.0 data from source such as Twitter, OpenStreetMap, Flickr, etc., are well-known by the research community and there is significant opportunity to apply visualisation techniques to mine such big datasets to better understand behaviours patterns of people as they traverse the urban fabric. In this study, we addressed the possible opportunities emerging from visualising twitter data relating to public attractors, specifically major sporting event and transport modes. We ingested into Google Earth and a Space Time Cube (STC) twitter data posted during the Australian Open 2012 in Melbourne from locations along streets, railways and around railway stations to look at possible patterns, trends and their spatial context. Specifically, we aimed to investigate whether the tweets relate to the locations where the people were at the time or the Australian Open and whether this influenced their tweets. We expected the data to contain information on the tennis tournament but also information on the status of traffic and public transport as well as congestion and delays. Especially, during major sporting events, such as the Australian Open, traffic patterns are difficult to predict and more susceptible to unexpected incidents. Twitter data posted by passengers on blocked trains or even car drivers stuck in congestion are likely to describe their situation as well as their cause. This information may be useful for people intending to enter the city centre in planning their journey. Moreover, twitter data may increase the understanding of car drivers and public transport users while waiting in congestion and contribute in this way to more understanding among delayed traffic users. While Google Earth permitted the visualisation of the entire data set using the spatial-temporal slider bar functionality, it proved difficult to analyse the data in a useful way. The STC allowed the visualisation and analysis of the posts from individuals. Particularly, it conveyed the locations and duration of stay of the individuals as well as the location and point in time when they posted the tweets. These two distinctive visualisation environments have been merged within the Australian Urban Research Infrastructure Network project (www.aurin.org.au). AURIN is tasked with developing e-infrastructure providing access to federated data, modelling and visualisation tools to support the urban researcher community in Australia. As a novel visualisation technique it integrates a STC view within Google Earth to communicate to both expert users (researchers) and decision-makers. By keeping together the twitter posted by each individual the STC view may constitute a valuable visualisation technique for contributing to a better overview when visualising crowdsourced spatio-temporal data in digital globes. However, this study reveals the challenges, possibilities and limitations of visualising crowdsourced Web 2.0 data using a digital globe and STC visualisation tools. The paper is a methods paper outlining technique suitable for visualising twitter data. Specifically, the methods highlighted in this paper warrant further investigation for establishing a real-time traffic and public transport information visualization system based on twitter data. Such a system, for example based on Google Earth may constitute a useful decision making tool for transport planners and passengers alike who may wish to understand and respond to the dynamics of additional people travelling to sporting event such as the Australian Open. The paper concludes by recommending further directions in research and development for the exploration of crowdsourced real-time geoinformation to understand the movement of people through the urban fabric.

P2.72 | **SIGNA Geoportal: Taking advantage of GIS ans SDI possibilities in an integrated environment** (#946)

C. Sevilla, M. Villalón, A. Rodríguez-Pascual, A. González

National Geographic Institute of Spain, Geographic Applications (CNIG), Madrid, Spain

The National Mapping Agencies have the assignment of producing and updating geographical data in a coordinated way, in order to make them available to be analyzed by Geographic Information Systems (GIS), they have also to publish standard web services, to produce analogical cartography, and to prepare data for being downloaded and used by users, experts and non-experts.   On the other hand, implementation of INSPIRE has change the way of providing data among Public Administrations.   Considering all of these, IGN has developed a powerful geoportal called SIGNA (National Geographic Information System), that is a thin client that provides access to all the standard OGC services available at IGN: WMS, WFS, WMTS, CSW, etc. and that also supports GIS analysis combining the best of SDI and GIS fields in only one tool, easy to use for all kind of users.   The present paper shows the functionalities of SIGNA geoportal that exploits data and services in a more efficient manner using standards where is possible.   If we consider that there are two kind of potential users, experts and non-experts, we have to take into account some different requirements. In SIGNA, non expert users will be able to navigate and search geographic information easily, and they can even connect to services and download data without any knowledge about SDIs. SIGNA is also developed for experts that will have some utilities to exploit OGS services efficiently and to analyse information by direct connection to SIGNA database, which contains lots of vector information produced by IGN Spain. Raster data is also available as orthophotos or satellite images.   Therefore SIGNA is the basic tool for the analysis and exploitation of geographical data produced in IGN, using also interoperable and normalized web services, complimented when is necessary with client functionalities and non standard solutions.   Everything is focused on the perspective of an official reference geographic data producer, and a service provider based on that data, following the guidelines drawn by INSPIRE and LISIGE legal framework, implementing ISO 19100 series and Open Geospatial Consortium (OGC) standards and Spanish Spatial Data Infrastructure Working Group (GTIDEE) recommendations.

P2.73 | **CartoCiudad Web Services: Standard Web Services for the location, routing and navigation on official geographic data in Spain** (#974)

A. González, A. Rodríguez-Pascual, C. Sevilla, M. Villalón
NATIONAL GEOGRAPHIC INSTITUTE, GIS DEPARTMENT, MADRID, Spain

A full-length version is available and can be opened here:

_extendedAbstract\359_proceeding.*

CartoCiudad is an official database, with national coverage, of seamless thoroughfare network supplemented with nationwide urban cartography and census and postal districts. This project, launched in 2006, is the result of harmonization and integration of official digital cartography and data produced by the main suppliers of Geographical Information in Spain: Cadastre, Statistical Office, Post Office and the National Geographic Institute (hereafter IGN) which is the manager organization as well. Public organisations from some Autonomous Regions (Basque Country, Navarre, Valencia, Balearic Islands, La Rioja, Andalusia and Murcia) take also part in this data flow with the purpose of decentralizing the data maintenance and ensuring the future sustainability of the project. According to SDI principles, this project has been designed to be acceded through Internet so data are published at CartoCiudad Geoportal (www.cartociudad.es) where they are handled through standard on-line services implemented according to OGC specifications:

- *Web Map Service (WMS 1.3.0 – SLD 1.0):* It allows visualizing data and navigating all over territory as well as asking for layers information shown through the get feature info utility.
- *Web Feature Service (WFS 1.1.0):* To locate entities like addresses (defined from a street name and building number or a road name and kilometre point), census information, postal districts and administrative units
- *Web Processing Service (WPS 0.4.0*): CartoCiudad's GIS topological structure facilitates implementing functionalities like routing between two points throughout Spain, reverse geocode (providing the closest address to a pair of coordinates supplied) and proximity calculation (defining the maximum area around an input point to find specific points of interest).

Another utility of CartoCiudad is a free light web component called *CartoVisor*, which can be embedded in any user web to visualize the cartography and to upload points of interest on it (for instance, a hotel chain can use it to locate its hotels all over Spain). It also allows locating postal addresses and calculating routes throughout Spain. Moreover, the displayer size and language (choosing between Spanish or English) can be customized. Theses easy and free utilities have caused an increase in the number of private and public users which use these data, and their services, as reference data sources (for instance, Spanish Industry Ministry uses it to locate petrol stations, etc.) The project's web service infrastructure has been based since its inception on the use of free software. Thus, WMS has been created with GeoServer 2.1, WFS with Degree 2.4 and WPS with 52 North. In addition, since 2011, the use of open source solutions has been extended to other areas such as quality control, cartography edition and a performance of a pilot test for the database management, with satisfactory results.

P2.74 | SPATIAL ANALYSIS OF AFFECTED AREAS BY EXTREME HYDROLOGICAL EVENTS IN RIO DE JANEIRO (THE HOST CITY FOR THE 2016 OLYMPIC GAMES) - BRAZIL (#1455)

L. A. Beser de Deus[1,2], C. S. M. Santos[1], M. A. V. Freitas[1], P. Menezes[1]

[1]*Federal University of Rio de Janeiro, Brazil;* [2]*Federal Rural University of Rio de Janeiro, Seropédica, Brazil*

A full-length version is available and can be opened here:

_extendedAbstract\406_proceeding.*

The most frequent types of disasters in Brazil are associated with extreme hydrological events. Adding to this situation, in Brazil, there are the extreme sociospatial discrepancies that are historically constructed. Besides, they leave marks in space, making specific areas, for political interest or not, more vulnerable to the different mentioned processes. Anthropic action seems to produce an effect on such system and it is also focused on space, producing great changes that may bring significant impacts (often irreparably) on the own mankind and the nature. On the other hand, the urban space and its different dimensions often suffer the pressures of the growing demand and the lack of planning and infrastructure that are typical of developing countries. Nowadays, it appears that the main impacts of climatic and extreme hydrological events are intensified by deficiencies in urban planning, in regional and local scales and, in practice, in the lack of an integrated view of management, creating irreversible damage to downstream. It should be highlighted that, in general, the regional and local scales require approaches that focus on collective interests. To this extent, the public management should plan actions and, also, it may act in a more holistic way adding new trends, such as, the use of geotechnologies that are applied to environmental management in the realm of urban planning. From a case study in the city of Rio de Janeiro, this paper aims to contribute and draw attention to such issues. It may reach its target through pointing and spatially analyzing which areas are in the most critical situation related to the occurrence of extreme hydrological events. Consequently, these specific areas deserve greater attention from the government and from the planning agencies and the urban management. To achieve this goal, it will be proposed a methodology to inventory the occurrence of inundation / flooding for a certain period, in this case 2001-2008. Besides, the methodology may systematize data and integrate them with other important issues that can support the process of identification and analysis of the most critical areas. Historical aspects of occupation and the most vulnerable socio-environmental aspects will be raised, too, in order to validate the highlighted areas. This integration will be enabled concerning the support of geoprocessing techniques. The result of this integration will subsidize the mapping and spatial analysis of the affected areas in the city and the criticality in relation to the extreme hydrological events. Finally, it may be considered that the identification and analysis of these areas can act as fundamental tools to guide the remaining steps of the process of environmental management within the urban context. It should be observed that the identification of the most critical affected areas does not mean the exhaustion of the subject. The location of these areas is directly linked to the sample that was used as basis for analyses. This data set only represents recorded events by the Municipal Civil Defense respecting the studied time frame. However, the results permit to take notes and raise relevant environmental questions about the roots and the occurred impacts that were originated from the extreme hydrological events, which have being observed in recent decades.

P2.75 | **Proposed Additions to the Cartographic Database of Mars** (#1441)

T. Gangale, M. Dudley-Flores

OPS-Alaska and Tonga International Academy, Tonga

A full-length version is available and can be opened here:

_extendedAbstract\40_proceeding.*

A comparison of the presently approved database of place names on Mars with maps of the late 19th and early 20th centuries reveals that although about 100 of the historical names have been recycled and applied to geographic features revealed in spacecraft imagery, about 400 of the old names for albedo features have not been carried forward. Additionally, while many of the traditional albedo names had their origin in classical mythology and geography, the database of approved names typically merely lists "Classical albedo name" as the origin; it is suggested that more specific information be listed in the database. Additionally, there are about 200 names from science fiction that can be applied to Mars, and in many of these cases it is possible to derive their coordinates from the original literary work or from derivative works. This paper also proposes that craters in the region of Ius Chasma (the Canyon of Law) be reserved for distinguished authors in the field of international outer space law, and proposes an initial list of ten candidates. This paper further proposes that the tropic circles of Mars be named following Beer and Madler 1830. Finally, although a number of towns in Pacific island nations have craters named for them, the Kingdom of Tonga, where the author currently resides, is not represented; this paper proposes the name of a Tongan town to be added to the approved list of names.

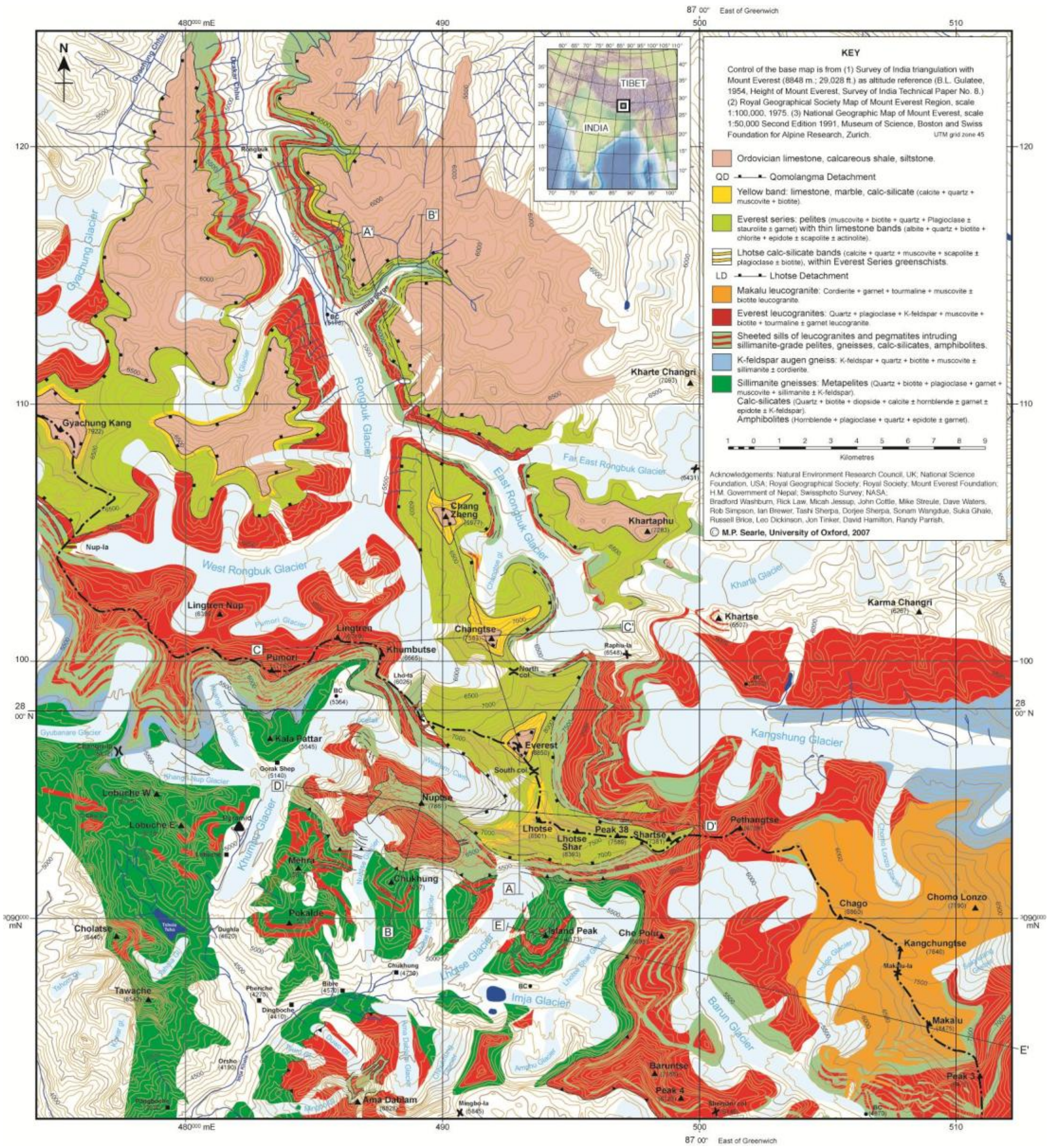
P2.76 | **Multidimensional Geological Map of Mt. Everest in KML for Google Earth** (#963)

<u>G. Bax</u>[1], M. P. Searle[2]

[1]Blekinge Institute of Technology Planning and Media Design, Karlshamn, Sweden; [2]Oxford University Earth Sciences, Oxford, Great Britain

Geological surface and sub-surface information is traditionally presented as printed maps with accompanied descriptions. Thereby visualisation of the spatial distribution of geological units is limited by the 2D nature of the paper media. Furthermore, geological information spans the 4 dimensions of both space and time, but the written geological description has to be squeezed in sequential text, which has only one single dimension! These limitations have been a severe obstacle for the spreading of geological information beyond an inner core of dedicated geological specialists, as “reading” of geological maps requires intensive training as well as spatial conception. Easy access and understandability of geological information is, however, a critical input for decision makers to evaluate the risks and consequences of Geological Hazards.

To visualize geological information interactively in a multidimensional environment, several Virtual Reality approaches have been investigated and will be discussed. For several reasons an implementation in KML (Keyhole Markup Language) on the Virtual Globe of Google Earth (GE) was found to be the best solution. KML was developed for GE, became an international standard of the Open Geospatial Consortium (OGC) in 2008 and can be read by most other Digital Globes and Geographical Information Systems (GIS). GE itself has presently by far the most complete coverage of high resolution imagery and elevation data of our planet and its clients are installed - across platforms - on many million devices. The client server approach of GE might be a drawback in cases of limited internet connectivity, but ensures on the other hand the use of the best available imagery installed on the server side. The Mt. Everest region was chosen due its high vertical relief exposing a complex geological structure that has been previously studied by both authors in great detail.



Geology of Mt. Everest:
Printed Geological Map of Mt. Everest by Searle 2007

P2.77 | **CENSUS/CARTOGRAPHIC ACTIVITIES** (#289)

H. Khan

Government of Pakistan Pakistan Bureau of Statistics, G-9/1, 44000 Islamabad, Pakistan

An accurate and successful Housing and population Census Operation depends upon the Administrative set up and field operation which are based on the following Geographic activities:-

a) Updating of area list.
b) Census Cartography/Field use maps.
c) Delimitation of Census Areas.
d) Geo-Coding of Census Areas.

a. Updating of Area List:
The area list means the list of administrative units in various orders, for which the census results are tabulated and Published in the census reports. The units of higher orders are districts, Tehsils/Talukas and sub-Tehsils. The lower order units, in rural part, are Qanungoi/Superviosory Tapedar Circles(QCs/STCs), Patwar/Tapedar Circles/Union Councils (PCs/TCs/UCs), and Mauzas/Dehs/Villages (settlements in each Mauza/Deh). In urban areas, the units below the Tehsils/Talukas are Towns, Cantonments, Municipal Corporations, Municipal/Town Committees.

b. Census Cartography (Field use maps):
Procedure of preparing maps for census purpose is called census cartography. In a census, full coverage of area and population is a matter of basic concern. Proper delimitation of census areas, particularly census circles and census blocks has a direct impact on the accuracy of census data. Census maps are basic tools to ensure proper delimitation of these areas. For successful conduct of census, maps showing localities in urban areas and Mauza/Deh including settlements in rural areas are used.

c. Delimitation of Census Areas:
To ensure complete coverage of area and population, four types of census areas have been delimitated. These are census districts, census charges, census circles and census blocks(Annex-A).

d. Geo-Coding of Census Areas:
Four types of census areas have been delimited. These are census districts, census charges, census circles and census blocks. A nine digit unique code has been assigned to each census block. Of these, the first there digits 001, onward have been assigned to the Census District. The census district has been divided into charges and two digit codes from 01 onward have been assigned to each Charge. Next, the charges have been divided into circles and circles are assigned two digit codes. The last two digits have been given to the Census Blocks in each circle. In this way each census block identified through a unique 9 digit code.

2. Use of new technologies in Census mapping:
(i) The entire mapping till the last census in 1998 was done through traditional manual techniques.
(ii) Some automation in census mapping has been introduced recently. The software being used by the Pakistan Bureau of Statistics (Census Wing) for mapping purposes is “Maptitude” and “ Arc GIS-10”
(iii) The census districts delimited for coming census have been digitized and the progress of field activities would be monitored through GIS.
(iv) It is planned that census field use maps up to Enumeration areas blocks level for next census would be computer generated.

Annex-A

DELIMITATION PLAN OF CENSUS AREAS FOR 6th POPULATION & HOUSING CENSUS

TYPE OF CENSUS AREA	KHYBER PAKHTUNKHWA PROVINCE	PUNJAB PROVINCE	SINDH PROVINCE	BALOCHISTAN PROVINCE	AZAD JAMMU & KASHMIR, GILGIT-BALTISTAN & ISLAMABAD	F.A.T.A.
Census District	a) Rural Each Tehsil excluding Cantonments b) Urban Each Cantonment	a) Rural i) Each Tehsil excluding Cantonments ii) Cholistan Area iii) De-excluded areas of D.G.Khan & Rajanpur districts b) Urban Each Cantonment	a) Rural Each Taluka excluding Cantonments b) Urban Each Cantonment	a) Rural Each Admn. district excluding Cantonments b) Urban Each Cantonment	Rural Each Admn. district	a) Rural Each Agency
Census Charge	a) Rural i) Each Qanungo Circle in settled area ii) Each Union Council in un-settled area iii) Entire F.R.Kala Dhaka b) Urban i) Part of Former Municipal Corporation ii) Each Former Municipal Committee or its part iii) Each Former Town Committee iv) Part of Cantonment	a) Rural Each Qanungo Circle b) Urban i) Part of Former Municipal Corporation ii) Each Former Municipal Committee or its part iii) Each Former Town Committee iv) Part of Cantonment	a) Rural Each Supervisory Tapedar Circle b) Urban i) Part of Former Municipal Corporation ii) Each Former Municipal Committee or its part iii) Each Former Town Committee iv) Part of Cantonment	a) Rural i) Each Qanungo Circle in settled area ii) Each Union Council in un-settled area b) Urban i) Part of Former Municipal Corporation/Islamabad Capital Territory ii) Each Former Municipal Committee or its part iii) Each Former Town Committee iv) Part of Cantonment	a) Rural i) Each Qanungo Circle in settled areas of AJ&K, NA and Islamabad ii) Each Union Council in un-settled area of NA b) Urban i) Each Municipal Corporation or its part in AJ&K ii) Each Municipal Committee or its part in AJ&K/NA iii) Each Town Committee in AJ&K/NA iv) Part of Islamabad Federal Capital Territory	a) Rural i) Each Tehsil ii) Each Tribal Area adjoining Peshawar, Kohat, Bannu, Lakki Marwat, D.I.Khan and Tank districts b) Urban Each Former Town Committee
Census Circle	a) Rural i) Each Patwar Circle in settled area ii) Group of 5 to 7 Villages of Union Council in un-settled area b) Urban Part of Urban Census Charge containing 5 to 7 Census Blocks	a) Rural Each Patwar Circle b) Urban Part of Urban Census Charge containing 5 to 7 Census Blocks	a) Rural Each Tapedar Circle b) Urban Part of Urban Census Charge containing 5 to 7 Census Blocks	a) Rural i) Each Patwar Circle in settled area ii) Group of 5 to 7 Villages of Union Council in un-settled area of Balochistan b) Urban Part of Urban Census Charge containing 5 to 7 Census Blocks	a) Rural i) Each Patwar Circle in settled area ii) Each Union Council in un-settled areas b) Urban Part of Urban Census Charge containing 5 to 7 Census Blocks	a) Rural i) Each Patwar Circle in settled area ii) Group of 5 to 7 Villages/Sub-Sections or part of Section in un- b) Urban Part of Urban Census Charge containing 5 to 7 Census Blocks
Census Block	a) Rural i) Each Mauza or its part consisting of about 175 houses ii) Each Village or its part consisting of about 175 houses b) Urban Part of Urban Circle consisting of about 200 houses	a) Rural Each Mauza or its part consisting of about 175 houses b) Urban Part of Urban Circle consisting of about 200 houses	a) Rural Each Deh or its part consisting of about 175 houses b) Urban Part of Urban Circle consisting of about 200 houses	a) Rural i) Each Mauza or its part consisting of about 175 houses ii) Each Village or its part consisting of about 150 houses b) Urban Part of Urban Circle consisting of about 200 houses	a) Rural i) Each Mauza or its part consisting of about 175 houses ii) Each Village or its part consisting of about 150 houses b) Urban Part of Urban Circle consisting of about 200 houses	a) Rural i) Each Mauza or its part consisting of about 175 houses ii) Each Village or its part consisting of about 150 houses b) Urban Part of Urban Census Circle consisting of about 200 houses

Delimitation Plan:

Methodology for delimiting Census Areas in Pakistan

PLENARY

Session KN-5

My Discovery of Cartography

Wednesday, 28 August, 2013

14:00 - 14:45

KN-5 | **My Discovery of Cartography** (#1505)

C. Board

, London, Great Britain

No abstract or full paper available

ORAL

Session S9-A

Uncertainty Visualisation

Wednesday, 28 August, 2013

14:45 - 16:00

9A.1 | **Beyond the Surface: Current Issues and Future Directions in Uncertainty Visualization Research** (#1207)

J. Smith[1], D. Retchless[1], C. Kinkeldey[2], A. Klippel[1]

[1]The Pennsylvania State University, Geography, University Park, United States; [2]HafenCity University Hamburg, Lab for Geoinformatics and Geovisualization (g2lab), Germany

A full-length version is available and can be opened here:

_extendedAbstract\379_proceeding.*

As people both reason and make decisions with uncertain geospatial data every day, it is important to understand the complexity of uncertainty, how it propagates through each dataset, and how to best visualize uncertainty to support reasoning and decision-making. When decisions are made from visualized geospatial data without the uncertainty explicitly mentioned or depicted with the dataset, it can lead to an inaccurate or misleading understanding of spatial patterns and processes. While this research area has expanded over the past two decades, much of the attention in evaluating uncertainty visualizations has been focused on identifying and measuring lower level perceptual processes. In contrast, we argue for a shift in attention towards assessing higher-level cognitive processes by keeping the focus on the user from the onset of visualization design to the final uncertainty visualization output. This article outlines two largely ignored research topics that will allow researchers to evaluate and promote these higher-level cognitive processes: identifying **appropriate levels of precision** when visualizing uncertainty and **supporting a deeper comprehension** of uncertainty. Traditionally, classification of geospatial data uncertainty is often chosen and visualized by the map maker based upon the characteristics of the data without lending proper attention to the natural classes users may have for uncertainty or their requirements for making a decision. Depending upon the context, variations in the level of precision (i.e. number of classes and their respective ranges) may be necessary to better support the user in a more informed decision-making process. Some users may prefer to reason about and make decisions with an visualized unclassed dataset (e.g. light to dark red representing lower to higher levels of uncertainty) that depicts a specific variation of the color to a single value of uncertainty. On the other hand, aggregating a range of uncertainty values into classes may not offer enough precision or the right distinctions the user needs to make a more informed decision. Ultimately, finding the right tradeoff may depend upon the context and requirements of the user. A large number of uncertainty visualization research employ evaluations in order to assess the effectiveness of the visualization techniques. We argue, however, that a large number only assess whether participants can attain a surface understanding of uncertainty. These types of assessments related to lower level perceptual processes do not evaluate whether users obtain useful knowledge or utilize higher-level cognitive processes important in decision-making scenarios. When faced with important decisions, it is still under determination as to whether users actually grasp the complexity of uncertainty information, or the deeper implication and intricacies of the data. Many of the attempts to formulate guidelines for communicating a deeper uncertainty do not explicitly consider how visualizations can be used to deepen *understanding* of uncertainty. Currently, there is a lack of comprehensive empirical work that attempts to cognitively assess uncertainty visualization and decision-making through a human factors standpoint. A behavioral research approach addressing uncertainty classification and deeper uncertainty can provide a necessary and significant contribution for more intuitive representations in current uncertainty visualization and research.

9A.2 | **Assessing the Impact of Design Decisions on the Usability of Uncertainty Visualization: Noise Annotation Lines for the Visual Representation of Attribute Uncertainty in Maps** (#1098)

C. Kinkeldey[1], J. Smith[2], A. Klippel[2], J. Schiewe[1]

[1]HafenCity University Hamburg, Lab for Geoinformatics and Geovisualization (g2lab), Germany; [2]The Pennsylvania State University, Department of Geography, University Park, United States

A full-length version is available and can be opened here:

_extendedAbstract\400_proceeding.*

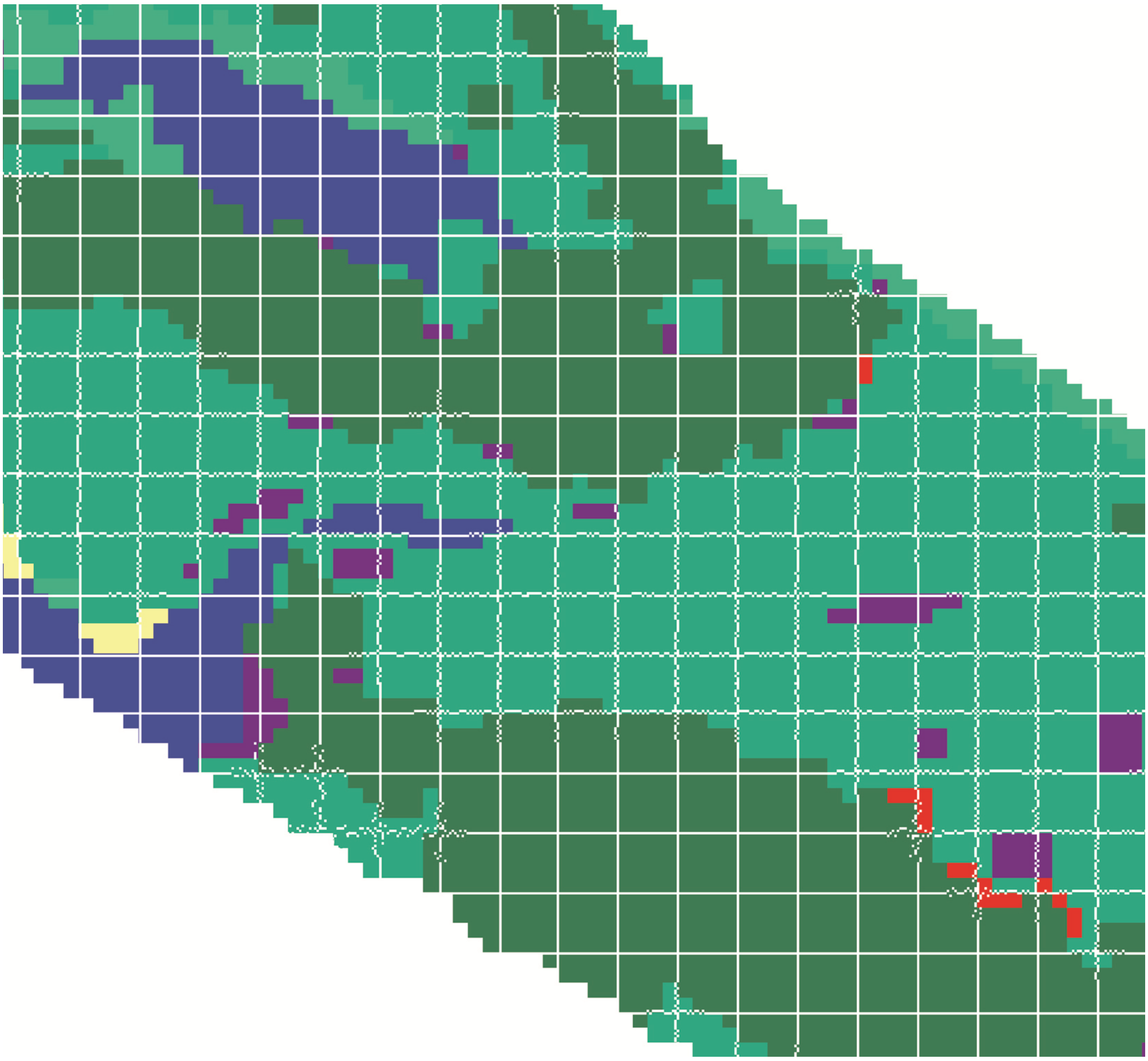
A wide range of methods have been developed for the visualization of uncertainty information in maps, but the evaluation of their usability is still subject to research. Most common techniques belong to the group of *intrinsic* approaches, often utilizing visual variables to express uncertainty (e.g., varying color saturation in a choropleth map). *Extrinsic* approaches visualize uncertainty by adding new objects to the display (e.g., glyphs), thus being more independent from map content than intrinsic approaches. *Annotation Lines* are an extrinsic approach introduced by Cedilnik and Rheingans (2000) under the term "Procedural Annotations". A regular grid is placed onto the map and is distorted locally to represent the degree of uncertainty at each grid point. Varying the cell size of the grid allows for a compromise between accurate representation of the uncertainty information and minimal occlusion of the underlying content. In small-scale overviews, a grid with larger cells creates a coarser representation of the uncertainty distribution, whereas in larger map scales a finer grid provides more detailed information (i.e., *scale-dependent adaption*). This adaptiveness to scale makes this method promising for use in maps. Another reason is the visual separability of the regular grid from the background, allowing the user to see through to the underlying content while perceiving uncertainty information. Despite its potential advantages, the technique has not been evaluated thoroughly yet. This contribution aims at providing guidelines for annotation lines to visualize attribute uncertainty in maps. From the four types of annotation lines (width, sharpness, noise and amplitude), we have chosen the noise technique for further investigation for two reasons: First, noise appears to be an intuitive metaphor for uncertainty, an idea reinforced by our pre-tests. Second, it occludes the underlying data less than the line width variation, for instance. A number of design decisions have to be made to implement this technique:

- *Width*: Maximum width of the noise band
- *Grain*: Size of noise particles
- *Transparency*: Transparency of noise particles

We make the assumption that these decisions may affect the usability of the technique. Thus, the following questions arise:

1. What is the impact of each design parameter on the usability of noise annotation lines as a representation of attribute uncertainty in a thematic map?
2. What is the maximum number of categories of uncertainty that can be distinguished using different designs?

In order to address these questions, we will conduct an experiment using thematic maps containing noise annotation lines displaying uncertainty and representing a number of different design parameter combinations. Participants will be asked to perform map reading tasks, while their accuracy and responses time will be measured. Collected data will enable us to evaluate the influence of design parameters on the usability of the technique and develop guidelines for making design decisions in its use.



Noise annotation lines:
The distortion of the grid represents the local degree of uncertainty

9A.3 | **Evaluation of Uncertainty Visualization Techniques for Decision-making in a Bushfire Scenario** (#166)

L. Cheong[1,2], S. Bleisch[1], M. Duckham[1], A. Kealy[1], K. Tolhurst[3], T. Wilkening[4]

[1]University of Melbourne, Infrastructure Engineering, Parkville, Australia; [2]Bushfire CRC, East Melbourne, Australia; [3]University of Melbourne, Forest and Ecosystem Science, Creswick, Australia; [4]University of Melbourne, Economics, Parkville, Australia

A full-length version is available and can be opened here:

_extendedAbstract\243_proceeding.*

Making safety-critical decisions in potentially life-threatening hazardous situations is difficult, due to the time pressures involved with such a decision. Additionally, the uncertain nature of the relevant information available adds to the complexity. In Australia, there is a policy where it is the personal choice of the individual to vacate their home in the instance of a bushfire, rather than through the issuance of compulsory evacuation orders by the government. Thus, it is important to communicate predicted bushfire likelihood to a wide audience, from emergency response professionals to the general public, to aid in the decision of whether to stay or leave. This work is concerned with applying several different visualization techniques and evaluating them for decision-making in a bushfire setting. It utilises PHOENIX Bushfire Modelling software (which predicts fire spread and outputs burn likelihood prediction areas) and examines different visualization techniques and their suitability for representing the uncertainty associated with this data. The visualization techniques chosen for this study include two well-known representations used in the fire services sector today. The first of these is the visualization used to represent the current output from the PHOENIX model[1], which is represented as a hard line showing the highest burn likelihood, followed by a dashed line for the lowest burn likelihood. The second is the representation used by FS PRO Prediction Model[2] which consists of bands of colour to represent burn likelihood, with no clear value message. In addition, we use three more visualization techniques that are commonly used for communicating uncertainty, and are reported to be suited to representing quantitative categorical information. These techniques - Transparency, Texture and Colour value - have not been previously evaluated for decision-making in bushfire situations. A text based description of the predicted bushfire likelihood is also included, to evaluate whether representing uncertainty through visualizations is more effective for decision-making, compared to text based descriptions. Whilst there is past experimental research into the effects of uncertainty visualization for decision-making in the context of natural hazards, it has largely concentrated on experts and novices in situations such as avalanches[3], tsunamis, floods[4], seismic hazards and hurricanes[5]. From a bushfire decision-making situation there is no existing empirical research into testing the effects of uncertainty visualization. This research evaluates the above outlined visualization techniques with human subjects in a bushfire context. The scenario used for testing these visualization techniques is one that is commonly encountered in bushfire situations – whether the information that you have been presented with influences a decision of whether you "Stay" or "Leave" your place of residence. Thus, users will be presented with scenarios where their house is marked on the display; together with the burn likelihood represented using one of the above techniques. This research relies on a methodology for an objective human subjects experiment, presenting users with different scenarios and focusing on the decisions made from these different visualizations. This paper explores and evaluates the practical implications of the chosen techniques for communicating uncertainty and provides suitability measures and guidelines for the practical use of these visualization techniques for decision-making in bushfire situations.

[1] Currently used by the Department of Sustainability and Environment and the Country Fire Authority in Victoria, Australia

[2] Developed and used by the United States Department of Agriculture Forest Service in their Fire Decision Support Systems

[3] (Kunz et al., 2011)

[4] (Trau & Hurni, 2007)

[5] (Pang, 2008)

ORAL

Session S9-B

VGI: Effects

Wednesday, 28 August, 2013

14:45 - 16:00

9B.1 | **On the Influence of Geospatial Context on Mobile Microblogging Content**

(#1172)

S. Hahmann, D. Burghardt

Institute for Cartography, Department of Environmental Sciences, Dresden, Germany

A full-length version is available and can be opened here:

_extendedAbstract\62_proceeding.*

Since the micro-blogging service Twitter has been launched in 2006, it has become very popular among a wide community of users. It is estimated that as of 2012 there are over 500 million users who generate approximately 350 million posts per day. Public posts may be queried by an API provided by Twitter. About 1% of all posts are tagged with GPS coordinates. This makes them an interesting source for the field of geographical analysis with user generated content (UGC). Figure 1 visualises this data in the area of Dresden. Within recent years, a major focus has been on Flickr photo data in the field of geographical analysis with UGC. The monthly, daily and hourly temporal distributions of georeferenced Flickr photos and Twitter posts ("Tweets") collected in Germany (Figure 2) show that both activities – taking photos and micro-blogging – have peaks at different times. While taking photos is an activity that strongly correlates with daylight periods, this trend cannot that clearly be observed for Twitter usage. The peaks within time for the date taken of photos are in the afternoon, at the weekends – when more people have spare time during daylight periods – and during the summer months. Contrarily, the hourly distribution of Twitter usage has a peak during the late night hours. Moreover, Twitter usage is almost equally distributed from Mondays to Sundays. This shows that both activities are at least partially done within different contexts of the contributing users' lives. This may have implications if micro-blogging contents are used as an alternative information source of UGC for geographical analyses. One application scenario within this field of research is the description and modelling of vague places with UGC (cf. e.g. Jones et al. 2008, Hollenstein and Purves 2010). Preliminary analyses show that a certain amount of posts has a relation to the location where they have been generated. For example, posts related to traffic can be found near to train stations and motorways and posts related to movies can be found near to cinemas. However, the micro-blogging service Twitter has properties of both, a social network and a news media (Kwak et al. 2010). Java et al. (2007) suggested a taxonomy of intentions of Twitter user posts: daily chatter, conversation, information sharing, news reporting. This indicates that communication plays a crucial role in Twitter usage. This implies that Tweets do not necessarily need to be influenced by or related to the location where the Twitter users post their messages. This needs to be considered by any geographical analysis approach using Twitter data. In our research we seek to develop a machine learning approach that allows us to predict locations where posts that relate with these specific locations can be found. Moreover, we want to use a taxonomy that categorizes different types of Twitter posts and relate these to different types of points of interest. References Hahmann, S. & Burghardt, D. (2011): Maple – a Web Map Service for Verbal Visualisation Using Tag Clouds Generated from Map Feature Frequencies. In: Advances in Cartography and GIScience. Selection from ICC 2011, Paris, Springer, 3-12. Hollenstein, L. & Purves, R.S., (2010). Exploring place through user-generated content: Using Flickr tags to describe city cores. In: Journal of Spatial Information Science, 1 (1), 21–48. Java, A., Finin, T., Song, X. & B. Tseng, (2007). Why We Twitter: Understanding Microblogging Usage and Communities. In: Proceedings of the 9th WebKDD and 1st SNA-KDD workshop on Web mining and social network analysis. Jones, C.B., Purves R.S., Clough P.D. & H. Joho (2008): Modelling vague places with knowledge from the Web, International Journal of Geographical Information Science, 22 (10), 1045–1065. Kwak, H., Lee, C., Park, H. & S. Moon (2010): What is Twitter, a social network or a news media? In: Proceedings of the 19th international conference on WWW, 591-600.

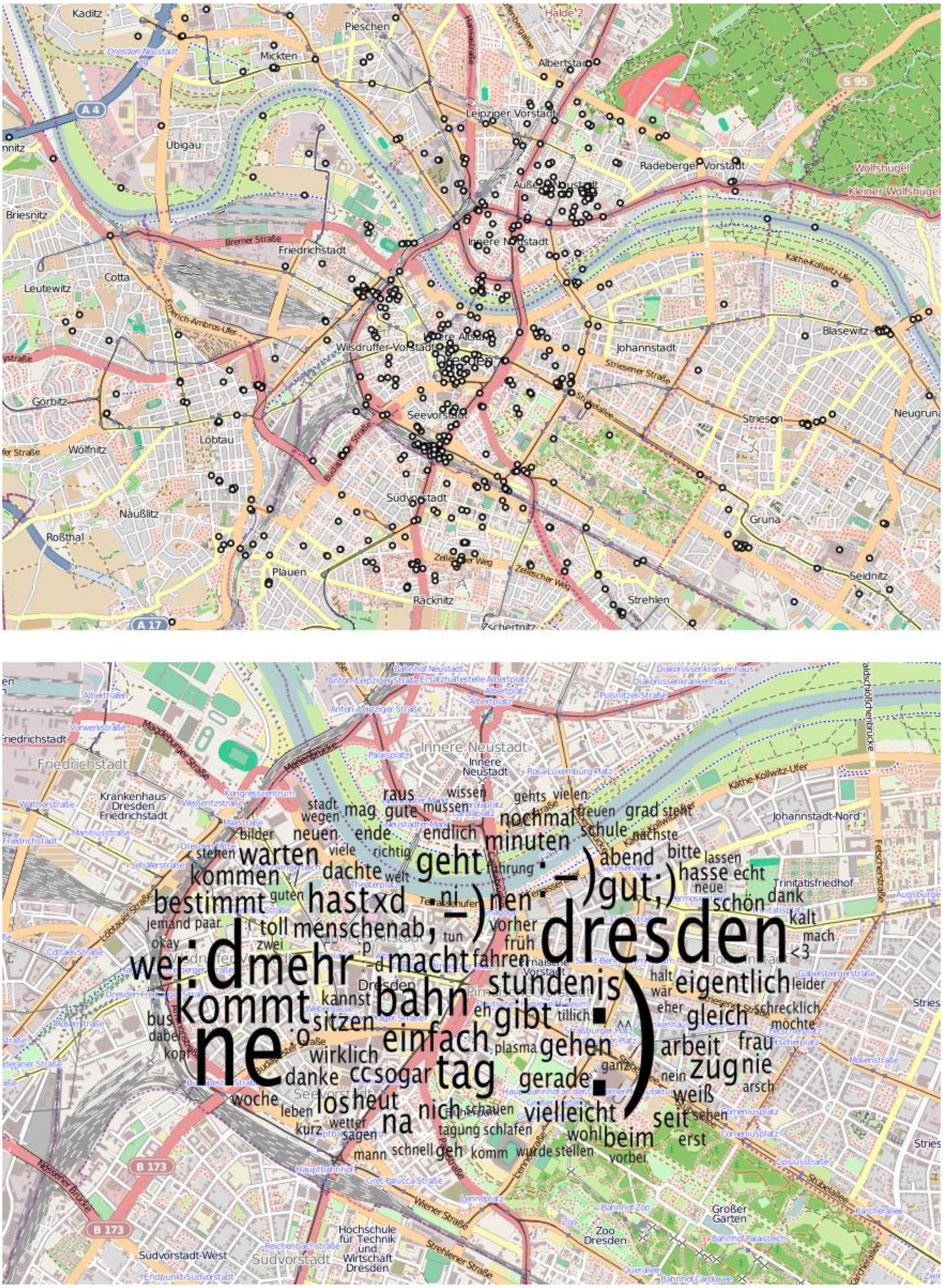


Figure 1:
Top: Distribution of recorded georeferenced posts (German language only) in the area of Dresden, Bottom: A word cloud that visualises the contents of the posts within the given map extent – a method introduced by Hahmann & Burghardt (2011).

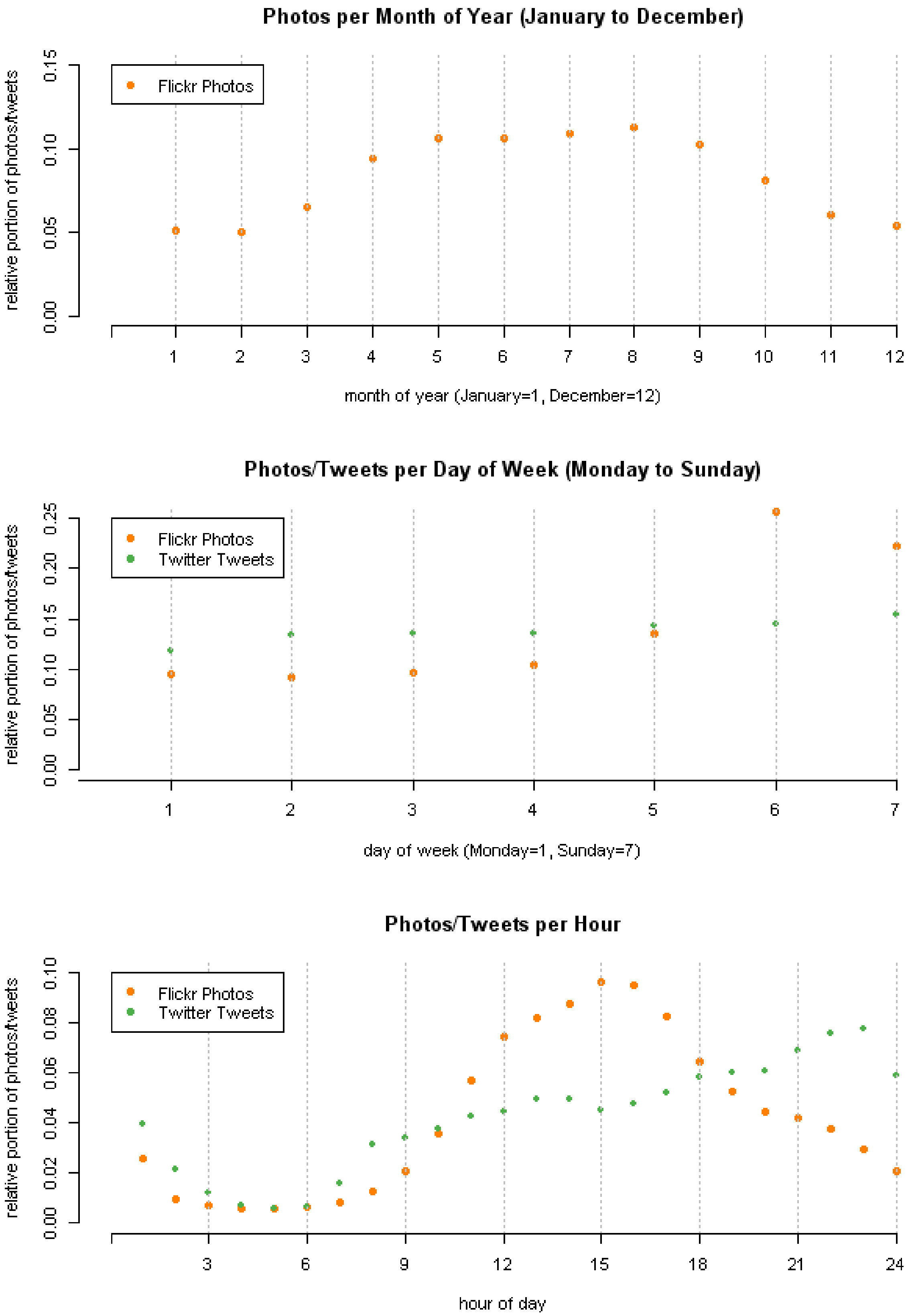


Figure 2:
Monthly, daily and hourly temporal distribution of georeferenced Flickr photos and Twitter posts.

9B.2 | **Mapping Sense of Place: Online Participatory Mapping for Indicating Landscape Values** (#1256)

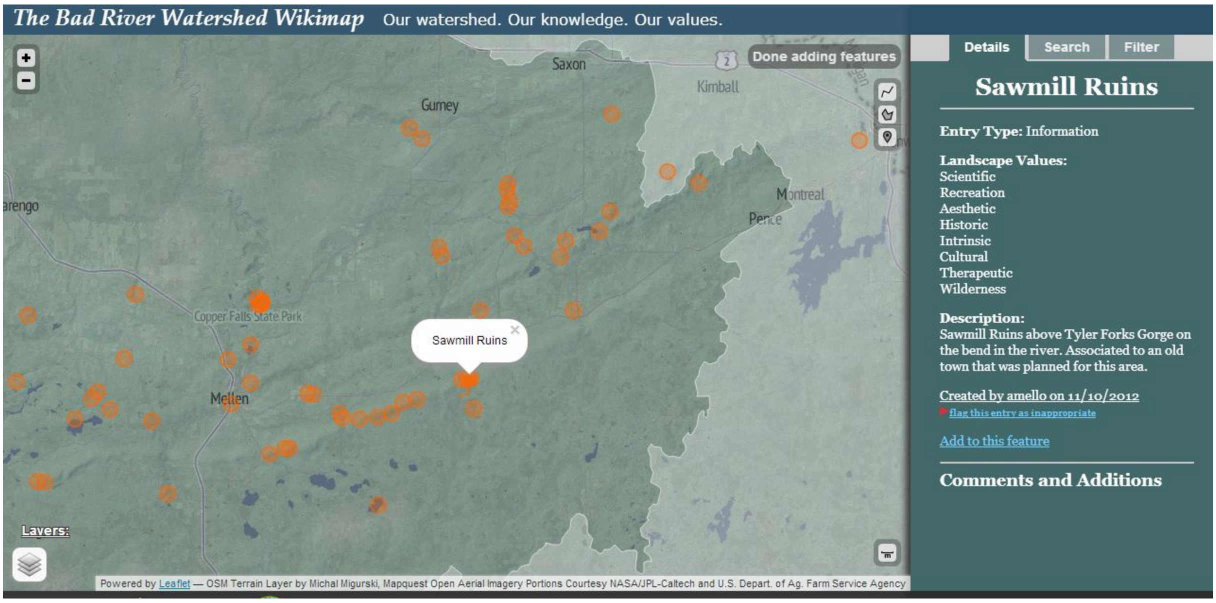
C. Sack

University of Wisconsin-Madison, Geography, United States

A full-length version is available and can be opened here:

_extendedAbstract\293_proceeding.*

BACKGROUND: The past decade has witnessed the immense growth of interactive online 'Web 2.0' applications and the rise of the 'GeoWeb' that uses them for the generation and sharing of geographic information. The increasing involvement of non-specialists in the GeoWeb has been interpreted as destroying elitist Cartographies and reviving recognition and empowerment of every human's innate mapping ability. But this assertion may belie the multitudinous and even conflicting goals of different forms of volunteered geographic information. If VGI applications truly empower the user, how do they do so, and how might they be built more responsively to the user's needs and goals? This paper proposes *Online Participatory Mapping* as one use for VGI that fits with the ideal of citizen empowerment in Neocartography. It is defined as the public, collaborative synthesis and presentation of volunteered geographic information to support the goals of a community. **OBJECTIVES:** This paper describes how GeoWeb technologies can be combined with participatory development practice to indicate what landscape values are present in a rural area. Landscape values are the symbolic meanings and instrumental uses that people associate with certain places. Communities wanting to assert local tenure over natural resources and land may use participatory mapping to show what places are important to them and why. Online Participatory Mapping adds powerful digital multimedia tools that can express landscape values through stories, information, photos, audio, and video shared with a wide audience. A case study was conducted to test which of these tools and the cartographic interactions involved in their use were privileged by users, with the goal of informing the design of similar future wikimaps. **CASE STUDY AND METHODS:** An Online Participatory Mapping application, or 'wikimap,' was created for a watershed in rural northern Wisconsin, USA (Figure). A user-centered design process was undertaken to build the application, including needs assessment interviews with local stakeholders and participant feedback on subsequent stages of development. Public workshops and presentations were used to maximize the diversity of application users, in an attempt to challenge the 'digital divide' between those with and without easy access to high-speed internet. User interactions with the wikimap were logged to determine which cartographic interactions were privileged by users, with the goal of informing the design of similar future wikimaps. **RESULTS:** Results were summarized according to five sub-topics related to Online Participatory Mapping: goals, users and stakeholders, information types and control, cartographic interactions, and landscape values. The goals elicited from participants during the interviews included having a central information repository, fostering dialogue on land and natural resource use, and building a regional identity. Local governments, a local indigenous tribe, and a local NGO were seen as key stakeholders, and outreach through these entities was necessary to promote use of the wikimap. "Story" and "Scientific Observation" were key user entry types included in the wikimap by request of interview participants, but a third category—general "Information"—was also included and turned out to be the most utilized to date. A mechanism for moderating user-contributed information was requested by government agency and tribal stakeholders and was included. Useful cartographic interactions identified by participants included the ability to zoom, pan, and overlay different layers of information on the map. A typology of fifteen landscape values was utilized, with users selecting each value for multiple locations on the map, and certain values privileged over others.



Wikimap:
A screen capture of the Bad River Watershed Wikimap

9B.3 | **Where Do Tourists Go? Visualizing and Analyzing the Spatial Distribution of Geotagged Photography** (#913)

B. Kádár[1], M. Gede[2]

[1]Budapest University of Technology and Economics, Department of Urban Planning and Design, Hungary; [2]Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary

A full-length version of this contribution has been published in: Cartographica, Vol. 48, Number 2 (Summer 2013, Title:"Selected Papers from the 26th International Cartographic Conference, Dresden, Aug., 25-30: The Challenges of Visualization"), Pages 078-088

With the spreading of Web 2.0 several photo-sharing sites can be found on the internet, where users can upload their photographs and share them with the public. Most of these sites offer the possibility of "geotagging" the photos, i.e. adding information about their geographic position and sharing them also on a map interface.

This method of storing photography meets the motivations of tourists wanting to preserve, revive and share their memories related to their travels. It was assumed that most of the photographs shared this way are touristic images, even if the author lives in the same city, as the ability to search for images in a defined geographical area is relevant only in cases representing concrete sights and places, memorable for some reason.

To verify this assumption and to be able to make place specific deductions from the spatial distribution of geotagged photography a new method of visualization was needed.

A few photo-sharing sites allow access to its data via an API (Application Programming Interface) that can send the data of photos of a given geographic quadrangle upon the appropriate request. Using this feature we can download the data of a specific area, and store it in a specially designed database which can facilitate the further data processing and visualization. Taking advantages of the visualization possibilities of modern web cartography

it is possible to show the gained information in three dimensions on the surface of a digital globe application, which makes the correlations of the photo density and geographical objects of a given area expressive. It is also possible to differentiate pictures taken by locals or visitors with rather good estimation examining the temporal distribution of a specific user's photos within a given area.

Examining these "photo-distribution maps" did reveal interesting correlations between the touristic offer of the area and the number of photos taken there. In the case study of Budapest, most photos are geographically related to the known tourist attractions. Tourists took photos only in the areas of the main tourist attractions, the number of which diminishes if we analyze only tourist images with a reduced time-span between each user's photos. Locals photographed also recreational spaces or interesting sights not advertised for tourists. The development of recreational infrastructure is also visible in the case of the most recent projects.

9B.4 | **Cartograms of self-organizing maps to explore user-generated content**

(#171)

A. Bruggmann, M. M. Salvini, S. I. Fabrikant

University of Zurich, Department of Geography, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\184_proceeding.*

Wikipedia and Twitter are two well-known examples of crowd-sourced information sources that have not only become an integral part of our everyday lives, but they increasingly play an important role as data sources for more traditional scientific investigations. The re-structuring of these massive text and graphic-based datasets for systematic analysis has become a major scientific challenge, which has already been approached by an interdisciplinary scientific community, including cartography and GIScience experts. In this context, cartographers may significantly contribute to the development of perceptually salient visual analytics strategies, firmly rooted in the long tradition of map making, for the effective and efficient depictions of massive crowd-sourced databases. In this paper, we present a cartographically inspired methodological framework for the systematic visual investigation of semi-structured semantic data extracted from Wikipedia. The innovative approach combines self-organizing maps with the long-standing cartographic tradition of cartograms. This new approach extends the cartographically inspired spatialization approaches presented by Skupin & de Jongh (2005) and Fabrikant & Salvini (2011) at prior ICC meetings. This extended framework is put to rigorous test in a case study to uncover the latent functional structure of the regional organization in the Eastern parts of Switzerland, based on more than 2000 Wikipedia articles. The semantic corpus thus consists of titles and standard category descriptions of these articles. First, the semantic similarity between articles is quantified automatically employing *Probabilistic Topic Models* (Steyvers & Griffiths 2007). The resulting document similarity matrix is projected onto a 2D self-organizing map, applying the *Self Organizing Map Analyst* toolbox in ArcGIS (Lacayo-Emeri 2011). The U-matrix of the self-organizing map (SOM) contains information about the semantic similarity of neighboring neurons, and this information is used as input to generate a cartogram with the *Scape Toad* software (Andrieu et al. 2008). When generating a cartogram, neighboring neurons which are very similar in semantic content, are, unlike the traditional SOM, also depicted at graphic distances closer to one another than dissimilar neurons. This approach thus pays tribute to the empirically verified distance-similarity metaphor in spatialization (Fabrikant et al. 2006). To further group similar articles, an established social network cluster algorithm is employed (Blondel 2008). Group labels in the map are automatically identified with the tf-idf method, and thus correspond to the most relevant terms in the article clusters (Manning et al. 2008). Finally, common cartographic generalization techniques are applied to enhance the perceptual saliency of the map. To evaluate our approach, the distribution of the Blondel clusters in the distorted SOM is compared to the Blondel cluster distribution in a network spatialization, following the validation approach of Fabrikant & Salvini (2011). In other words, we expect to find most Blondel groups clustered in homogeneous regions in the cartogram-SOM, similarly to the homogenously clustered groups in the network spatialization. However, we also expect differences across the two spatialization approaches. These differences should reveal the effect of the different metrics employed by the different algorithms, as well as articles with content that is difficult to capture systematically. With this contribution we intend to illustrate how cartographers can contribute to the visual analysis of massive crowd-sourced databases using long-standing cartographic theory, coupled with effective cartographic depiction methods.

ORAL

Session S9-C

Maps in Decision Making

Wednesday, 28 August, 2013

14:45 - 16:00

9C.1 | **Maps in Decision Making: Why Almost Every Negotiation Starts and Ends With a Map?** (#1368)

F. Rufino Atkocius

Universidade Estadual Paulista, International Relations, Franca, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\19_proceeding.*

Since ancient times Cartography has been used as a way which the political elites could understand their territorial possessions; therefore maps sometimes have been the only way to reach reality, as the policy makers normally are in distant places from where the actions are being taken. Through this thinking, who has more precise information about reality sees more opportunities during decision making process. Constructivism states that the reality exists and who gives sense and logic to it is the human mind. When thinking about the reason which led the U.S. to go in a war with Iraq in 2003 researchers and analysts primarily stated that the main objective of the conflict resided in securing Iraq's oil resource under the "western influence". Later this statement as changed due to geopolitical research. Observing the Eurasia map, researchers concluded that Iraq is in a territorial position which is a frontier to the Chinese and Russian political and economical influence. Therefore, for these scholars Iraq is a territory which has more than an economic meaning. In this case reality was expressed through maps, since they are scientific productions which seek precision, although what people realize from the cartographic production changes accordingly to interests and culture. It does not mean that people make of maps what they want, it means that naturally each person can have a different conclusion over it when a map is correlated to a specific situation. Charts can be produced as a representation of a terrain (topographic chart), ethnics distributed in a territory, States' political border etc. In order to explain a situation to a policy maker normally a map is used from the start to the end of the discussion. Charts are used during almost every political process, although within the International Relations studies they are only used to locate a place. It is difficult to reach the knowledge that can be achieved integrating map knowledge and the political analysis. This presentation discusses how the International Relations' Constructivist Theory understands the relation between political decisions and maps. Within a modern epistemological perspective and a post-modern ontology, constructivism considers reality as existent, i.e., it exists as an object independently from human thinking although it gains sense and logic when it is interpreted by someone. People who look at the same piece of reality perceive it through their senses and construct their conclusions over the object of analysis; therefore it changes accordingly to their culture and social practices. Maps in politics means knowledge and almost every action, negotiation and discussion start by using a specific map, this presentation also brings historical and political examples in order to demonstrate how maps have shaped the international politics.

9C.2 | **How to measure and visualize emotion when using maps** (#105)

S. I. Fabrikant

University of Zurich, Geography, Zürich, Switzerland

Maps are used in various decision-making contexts, also where the influence of emotional responses to decision-making might be critical, such as under stress (i.e., real-time navigation using a mobile device, search and rescue missions, etc.), or due to varying user motivations (i.e., survival, boredom, leisure, fun, etc.). While cartographers and others have begun to systematically explore how display design, user background, and varying usage contexts might interact with spatio-temporal inference making, almost no research exists that investigates the role of human emotion in map-based decision-making (Griffin and McQuoid, in press). In this paper, we propose a methodological extension to a previously suggested framework, aimed at quantitatively capturing the effect of emotion in human-map interactions (Fabrikant et al. 2012). Specifically, we propose to visualize human emotion captured in empirical map studies, for further systematic evaluation. Our promising preliminary results suggest that first, human emotions can be systematically captured using a skin conductance sensor coupled with the eye movement data collection method, and second, quantitative emotion data can be meaningfully analyzed to investigate aesthetic effects of display design decisions, specifically when coupled with other evaluation methods (i.e., questionnaires, etc.). We additionally demonstrate that human emotion measurements can be visualized, using standard cartographic depiction methods. With this contribution we hope to provide cartographers with a sound method to capture emotional and affective aspects of human-display interactions, specifically when empirically evaluating the aesthetic qualities of visual displays used for spatio-temporal inference making. **Cited works:** Fabrikant, S.I., Christophe, S., Papastefanou, G., and Maggi, S. (2012). Emotional response to map design aesthetics. Proceedings (Extended Abstracts), GIScience 2012, Columbus, OH, Sep. 18-21, 2012. Griffin, A.L., and J. McQuoid. (in press). At the intersection of maps and emotion: The challenges of spatially representing experience. Kartographische Nachrichten (to appear DEC 2012).

9C.3 | **Maps as Decision Support Tool in Political Decision Processes** (#811)

A. Reinermann-Matatko
Universität Trier, Kartographie, Germany

A full-length version is available and can be opened here:

_extendedAbstract\12_proceeding.*

ORAL

Session S9-D

Map Projection Reconstruction

Wednesday, 28 August, 2013

14:45 - 16:00

9D.1 | **Estimation of an Unknown Map Projection and its Parameters from the Map** (#1248)

T. Bayer
The Charles University in Prague, Applied Geoinformatics and Cartography, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\332_proceeding.*

The detection and estimation of an unknown cartographic projection an its parameters from a map represents a problem belonging to the category of cartometric analysis. Such a kind of analysis is beneficial and interesting for historic maps, old maps or current maps without any information about the used map projection; it could improve georeferencing. This information is also useful for further studies of the national cartographic heritage, land use or land cover applications. From both cartographic and algorithmic points of view this issue can be considered remarkable; it combines methods from several existing areas, particularly robust statistics, computational geometry and mathematical cartography. We bring new methods for detection and estimation of an unknown cartographic projection and its parameters based on genetic algorithms and minimum least squares adjustment. Taking into account the financial and time constraints, an entire map could not be assessed at once. Therefore, only analysis of a subset of map features will be performed. Our approach finds a relationship between sets of 0D-2D features in an analyzed map and in a reference map with known projection. The proposed solution combines multiple detections, to improve the results, sampled meridians or parallels are taking into account. Depending on the results of the analyses, the following parameters are estimated: a map projection type, a map projection aspect given by the cartographic pole K coordinates, a true parallel latitude, a map scale and a map rotation, radius and additional constants. Applying known cartographic assumptions and patterns only the relevant values of parameters are determined. Some map elements can be affected by gross errors; therefore it is important to locate, find and exclude those blunders automatically from further cartometric analysis. All algorithms were implemented in new detectproj software using GNU/GPL licence which supports more than 50 map projections and several operating systems.

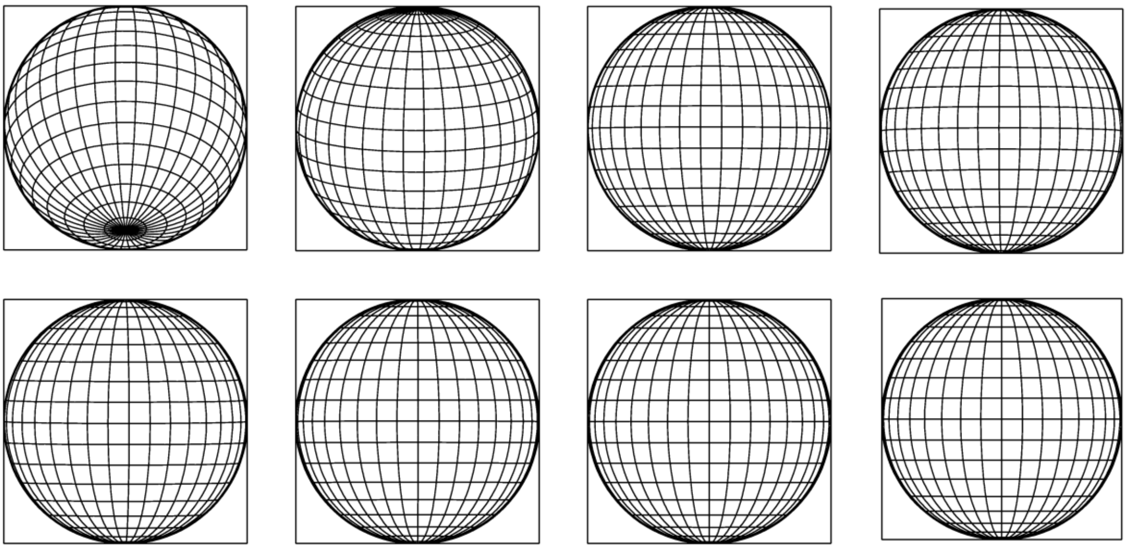


Fig 1.:
Detection of the map projection in transverse aspect using the genetic algorithm

9D.2 | **Old Maps Georeferencing – Overview and a New Method for Map Series**

(#808)

J. Cajthaml

Czech Technical University in Prague, Faculty of Civil Engineering, Department of Mapping and Cartography, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\104_proceeding.*

9D.3 | **Map Projection Reconstruction of a Map by Mercator** (#1250)

M. Rajaković, I. Kljajić, M. Lapaine

University of Zagreb, Faculty of Geodesy, Croatia

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 031-044

The paper describes the beginning of research on Mercator's map *Sclavonia, Croatia, Bosnia cum Dalmatiae parte*. This map has many editions and shows a great part of present-day Croatia. Zagreb, the capital of Croatia, is shown in two different places on the map. Naturally, this raises the question of its accuracy. One of the first steps in the research process was finding the mathematical basis, i.e. the map projection used to create the map. The research results showed it was a trapezoidal projection, but there are no references as to where an appropriate derivation of the equations can be found. Therefore, on the basis of Mercator's own description, cited in this paper, the derivation of the equations for his trapezoidal projection is given. He used this map projection to produce the map *Sclavonia, Croatia, Bosnia cum Dalmatiae parte*, as well as many other maps.

9D.4 | **DATA GENERALIZATION IN THE CARTOGRAPHIC MATERIALS OF GENERAL LAND SURVEY** (#242)

A. Golubinsky, O. Shalashova, I. Alyabina
Moscow State University, Russia

A full-length version is available and can be opened here:

_extendedAbstract\365_proceeding.*

General Land Survey was one of the most ambitious administrative and economic undertakings of Catherine II. Being a land cadastre in the first place, it was also one of the most detailed descriptions of economy, demography, land use, and even environment in the Early Modern Europe, and the first attempt of large-scale mapping of the territory of Russian Empire. A large number of text and graphic documents of land surveying remain deposited in the archives. For now, the Survey Archive in the Russian State Archive of Ancient Documents (RGADA) stores over 1.3 mln archival units, being the largest documental complex of pre-revolutionary Russia. Cartographic materials of General Land Survey have three levels of generalization.

1. Dachas plans. These primary plans were directly based on the field measurements of land surveyors and have scale 1:8400. Being the documents which officially certified the land property, these plans cover the whole territory where the Survey was held. They contain the following data: borders of the manors and the official data of the field measurements, including the lengths of the edges, and "rhombic" and "astrolabic" angles), name and status of the landlord, the adjacent plots, the areas of ploughed fields, hayfields, woods, and wastelands, also the image of water covered territories and roads. Any type of the land use was reflected in the plan by means of a specialized system of the notational conventions.
2. Uezd (district) plans and atlases have scale 1:42000 were compiled after all the dachas plans were finished. They contain a lot of information about the location of the land and land use conditions.
3. Maps of provinces (scale 1:420000) are much more generalized, containing information on major cities, administrative borders, main roads, large villages and rivers.

The objective of our research is the comparison of information on dacha plans with the information on general uezd plans and estimation of data generalization extent during their offsetting. The research was carried out using seven dacha plans of Balakhninsky uezd of Nizhegerodsky province and several uezd and provincial plans of the late XVIIIth century. All historical cartographic materials required additional preparation as they consist of the separate parts often displaced to each other; many of them contain lacunas and worn spots. Dacha and uezd plans were converted to vector format and processed in GIS MapInfo after processing in the graphics editor. The comparison of dacha plans with the plan of Balakhninsky uezd revealed slight differences between the cartographic materials of different levels of generalizations. Graphic information that is the land boundaries while offsetting from plans on scale 1:8400 to plans on scale 1:42000 remains practically invariable (taking into account some discrepancies typical for maps of the XVIII century). At the same time, the attributive, semantic component of the plans can differ considerably: the significant part of agrarian information on uezd plans disappeared, being kept only as digital index in specific documents - Economic descriptions of dachas and other materials. The conversion of historical cartographical documents into a digital form, the use of GIS methods allowed estimating quantitatively an extent of data transformation from dacha plans to the plans of uezds during the General Land Surveying at the end of the XVIII century. Further research will give us the opportunity to create extensive maps of land-utilization covering almost all territory of European Russia. Overlay of maps of environmental management and maps of other purpose (for example, Dokuchayev's soil map, 1886) will become available to researchers on the basis of GIS technologies. *The research is supported by RFBR, project 12-06-33035*

ORAL

Session S9-E

Image Classification

Wednesday, 28 August, 2013

14:45 - 16:00

9E.1 | **Modular classification and change analysis of vegetation encroachment using object-based image analysis** (#637)

E. Krätzschmar[1], J. Sehner[1], H. Klemm[1], A. Böhm[2], J. R. Phillips[3]

[1]IABG mbH, Geodata Factory, Dresden, Germany; [2]US ARMY, USAG Hohenfels, DPW-Environmental Division, Germany; [3]PARSONS, Richmond, United States

Protection of endangered species plays an increasing role in cultural landscape, dominated by mono-cultures and artificial use. The importance to preserve complex plant communities growing on large contiguous areas is evident and will be demonstrated on the area of JMRC Hohenfels. The military training area, used for more than 60 years is situated in a karst region. Broadening of blackthorn was initiated by reduced military training use in the past decade and presents a huge problem endangering the natural dry meadow vegetation with hundreds of Red List species in a large portion of the open land. Early reduction and containment is an important cost factor. Blackthorn (lat. Prunus Spinosa) is a pioneer plant on limy soils and spreads fast via shallow root trees. Solitaire trees become up to 5m high and form typical transition zones with medium high to young stands, typically mingled with other florae such as fast growing grass species and herbs. Mapping the actual situation and previous changes will be presented using WorldView2 data (2012) and aerial imagery (2007) supplemented by LIDAR terrain and surface models of both years. The overall object-based concept is founded on three sub-approaches: analysis of spectral information, LIDAR data and texture. WorldView2 data provides high spectral resolution using 8 bands. Detailed information on reflectivity gets analyzed and equivalents towards the aerial imagery will be identified. Differences in resolution and spectral derogation result in variance of the data. However, the characteristic overgrowth of blackthorn and other young shrubberies with grass causes considerable limitations in a robust assignment of spectral behavior with real plant occurrences. They result in uncertainties in class definition and therefore in limited accuracy. The analysis of LIDAR 2007 (1m) and 2012 (0.5m) demonstrates the combined use of absolute and relative height information. Even though both data sets were taken in March (before growth of leaves) a direct numeric comparison of natural structures is not feasible due to different resolution, the nature of LIDAR and variances in post-processing. Within the investigation emphasis is put onto the combination of height classification and the class-dependent generalization approach as a preparing step for a suitable change analysis. Following the nature of fast blackthorn spreading (mingled occurrences and overgrowth) texture plays a complementary role in identifying the species under focus, especially when EO data with different origin gets applied jointly. The study combines 3 sub-approaches and investigates in possibilities and advantages towards a modular and stable classification technology. Restrictions in seperability due to the nature of class and data result in three individual under- and overrepresented classifications with geospatial reference. With reference to the extensive EO data collection of Hohenfels it is possible to test and value various approaches in order to identify a best suitable technique. The information content of the explained classifications get combined and allows extending the feature towards sub-objects close to fulfilling primary class requirements. According to final use class-dependent generalization which takes context information into account gets applied on an iterative basis. The quality assurance concept follows a multilevel methodology regarding the law of error propagation. It will be presented on behalf of the final comparison between on-ground situation and the classification results achieved. The study shows exemplarily how mono-temporal classification and change detection can be applied on a modular approach in order to provide suitable results for the entire area. This technology can be of high importance to planning and performance of containment activities within the environmental context, specific challenges as well as advantages will be pointed out.

9E.2 | **Rice Yield Estimation by using Objective Yield Survey (OYS) and Remote Sensing (RS) methods; Case study in Singburi and Angthong Province.** (#1450)

J. Nontasiri

Ministry of Agricultural and Cooperatives, Office of Agricultural Economics, Bangkok, Thailand

A full-length version is available and can be opened here:

_extendedAbstract\253_proceeding.*

Nowadays government and private agency in Thailand increase using satellite data in many aspects such as landuse, forestry, agricultural, etc. Office of Agricultural Economics (OAE) is one agency that use satellite data for making and public agricultural data by classify agricultural area in economic crops and this year OAE have pilot project to estimate rice production by using Objective Yield Survey (OYS) and Remote Sensing (RS) methods in 2 provinces (Singburi and Angthong Province). The satellite data use Small Multi-Mission Satellite (SMMS) in CCD format. The objective of this study following as 1) to create paddy field area database and reflectance value in each growing stage from satellite data 2) to study relationship between reflectance value that derive from satellite data and spectrometer equipment and OYS data derive from field survey and 3) to create rice forecasting model. The growing stage of rice are defined in 5 stages including sowing/transplanting, tilling, panicle initiation, flowering and harvesting duration approximately 105-120 days depend on rice species. In 2 provinces we defined 10 plots (5 plots/province) to measure both 2 methods –OYS and RS methods in every stage. OYS method is the technique that measure growth of rice in every stage such as height, number of leafs, number of stem per bunch, length &width of leaf, awn length, number of rice grains and weight of rice. This methods we define 2 sample (sample size is 1m2) in each plot for measure that refer above and on the harvesting step we use crop cutting all production in this sample. Besides, RS methods we defined 5 sample in the corner (4 samples) and the center (1 sample) to measure. Every stage we count the rice stem in 1m2 and pull rice stems amount 2 percentage of stems in this plot to measure width and length of rice to calculate LAI and baked rice stem to find biomass. Every stage shifting distance for pulling rice stems is necessary to avoid digital number (DN)/reflectance error. For creating rice estimation model model1 we check correlation VI including NDVI and EVI which one is high correlation to create model Yield = Yieldtrend+Yieldvi and model2 we calculate Yield = biomass x harvest index. Afterwards we calculate production by yield multiply with acreage. Moreover for this study we analysis reflectance value to create spectrum library in standard format. And the next step, we plans to collect field experiment data in same area at least 3 years to adjust model and expand to other province of country to validate model.

9E.3 | **Image Classification towards Mapping of Vegetation Structure: A practical approach** (#1268)

E. Pretorius
University of Pretoria, Geography, Geoinformatics and Meteorology, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\131_proceeding.*

ORAL

Session S9-F

Orienteering Maps

Wednesday, 28 August, 2013

14:45 - 16:00

9F.1 | **Implementation of Cartographic and Digital Techniques in Orienteering Maps** (#414)

L. Zentai

Eötvös University, Cartography and Geoinformatics, Budapest, Hungary

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 019-030

Orienteering maps are very special maps, because not only they are using the same specification all over the World, but also the users themselves create these maps regularly. This paper summarizes the implementation of the most important cartographic techniques of the last decades including the application of the information technology.

9F.2 | **Automation in orienteering map production – fiction or reality** (#1323)

D. Petrovič

University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia

A full-length version is available and can be opened here:

_extendedAbstract\372_proceeding.*

Orienteering maps are maps, specially designed for orienteering sports disciplines. Since the aim of these maps are to familiarise the competitor with the area where control points are positioned in the terrain and where he should find the optimal route, they have to be detailed, presenting all major terrain features that can serve as a place for putting control points and also those that influence on the correctness of the competitors decision about the fastest route to next control point. Therefore production of orienteering maps has taken a lot of field work since ever. The amount of field work in general depends on complexity of the terrain and quality and detainees of available source data, where use of lidar data as a source data brought a significant advantage in preparation of base map, a template for the field work. But, nowadays we are faced with some applications that enable the use of lidar data as the only source for completely automated creation of orienteering maps. Such created maps naturally can't follow all the standards and requirements that have to be performed and such maps can't be used for orienteering competitions, but of those applications propose such automated produced maps for trainings. The aim of our research is to evaluate the quality and usability of automated produced orienteering maps. Positional accuracy, thematic correctness, legibility, use of map generalization's principles will be discussed, based on comparisons between existing orienteering maps (based on field work) and automated produced ones. Some comparisons will be done in the office while in some case test will be done in the field. We assume, that automated produces orienteering maps on most of the terrains could never adequately replace the traditional ones, based on field check, while for some specific terrains or for some orienteering disciplines (eg. SKI-O or MTB-O) those maps might be recognised as suitable for use.

9F.3 | **Vegetation height maps derived from digital elevation models – the next innovation in the production of orienteering maps?** (#491)

<u>T. Gloor</u>

OCAD Inc., Baar, Switzerland

Nowadays, digital elevation models (DEM) are essential in the production of orienteering maps. Not only contour lines or relief shading can be derived, vegetation boundaries can be extracted as well. The cartographic software OCAD – the leading software to produce orienteering maps worldwide – has extended its functionality with two new DEM analyse functions, to create vegetation height maps. The experience made by the map makers of the World Orienteering Championship 2012 in Switzerland shows that the time consuming field work was reduced impressively and was shifted into the drawing process of orienteering maps at the office. Today the extraction of contour lines from digital elevation models is almost standard for orienteering map projects, if DEM's are available. Since the introduction of digital cartography 15 years ago, it is the most important innovation for the production of orienteering maps. In former days, contour lines were measured with compass bearing and pacing or were plotted from aerial photos with a 3-D stereograph. The first method was time consuming and not precise, the second was efficient and accurate in open areas, but in very sketchy in dense forests. With the use of data from airborne laser scanning (LiDAR), this gap could be filled: millions of emitted laser pulses spread through dense forests and are reflected from the soil surface. These laser pulses – also known as last reflected bullets – are stored in the digital terrain model (DTM). From this, contour lines in any height interval can be calculated (Fig. 1). But this is not the only information which can be derived. Relief shadings are useful information for the production of orienteering map as well because trail and track alignment can be recognized. Relief shading images in higher resolution can even represent ditches, dry gullies or small depressions. Moreover, slope maps are especially valuable for the detection of rock faces. Not all laser pulses emitted from the aircraft are reaching the earth surface. They are reflected by the canopy of the forest. These laser pulses – also known as first reflected bullets – are stored in a digital surface model. The differences from the DSM and the DTM calculated at the same location results in a vegetation height map. In meadows, glades and clearings, the height difference is almost zero, in growth with young trees between one half to two meters, and in forests even more than 10 meters. To create such vegetation height maps, the two new functions “DHM calculate differences” and “classify vegetation heights” have been introduced in a very early stage while developing OCAD 11. First experience had been collected by the cartographers making the maps for the World Orienteering Championships (WOC 2012) in Switzerland two years before the competition. Their made experience shows, that based on such vegetation height maps, they could vectorize vegetation boundaries at their desk and not in the often difficult terrain, which increases the accuracy and efficiency of the production of orienteering maps (Fig. 2). Airborne laser scanning has revolutionized the orienteering map production. It can be used for different topics of orienteering maps, such as contour lines, ditches, knolls, trail and track network, rock faces, vegetation boundaries. Properly used, it reduces the fieldwork in the terrain impressively and results in more accurate and efficient map making. Nevertheless, the classification of thickets according to their runability is a very important issue of orienteering maps and still remains to be solved. The development of laser scanning technology goes even further, especially of terrestrial laser scanning. It might in a few years be possible that map makers with a terrestrial laser scanner on their head or with a remote control for octocopter laser scanners walk through the forests classifying thickets according its runability.

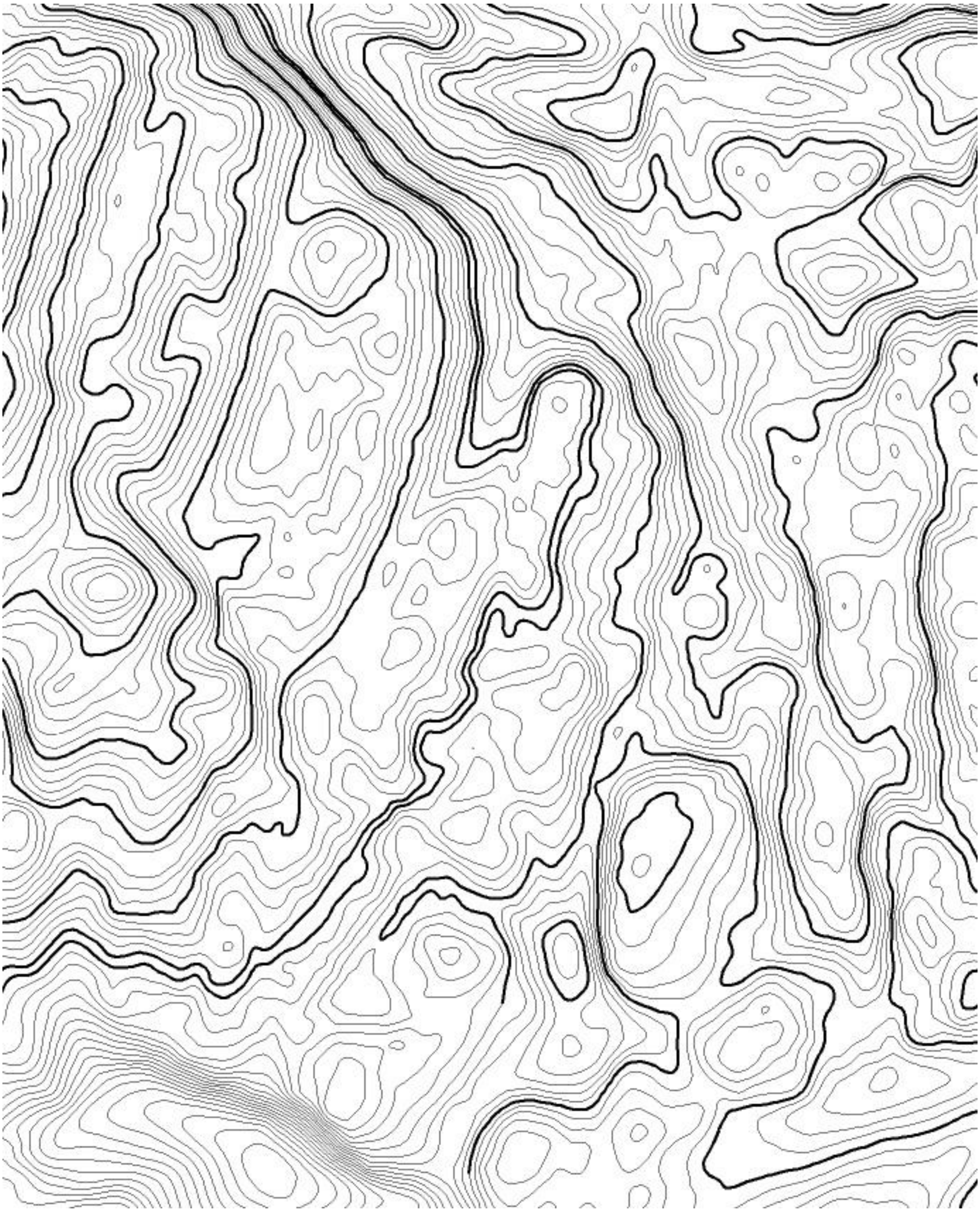


Fig. 1:
Contour lines derived from LiDAR data

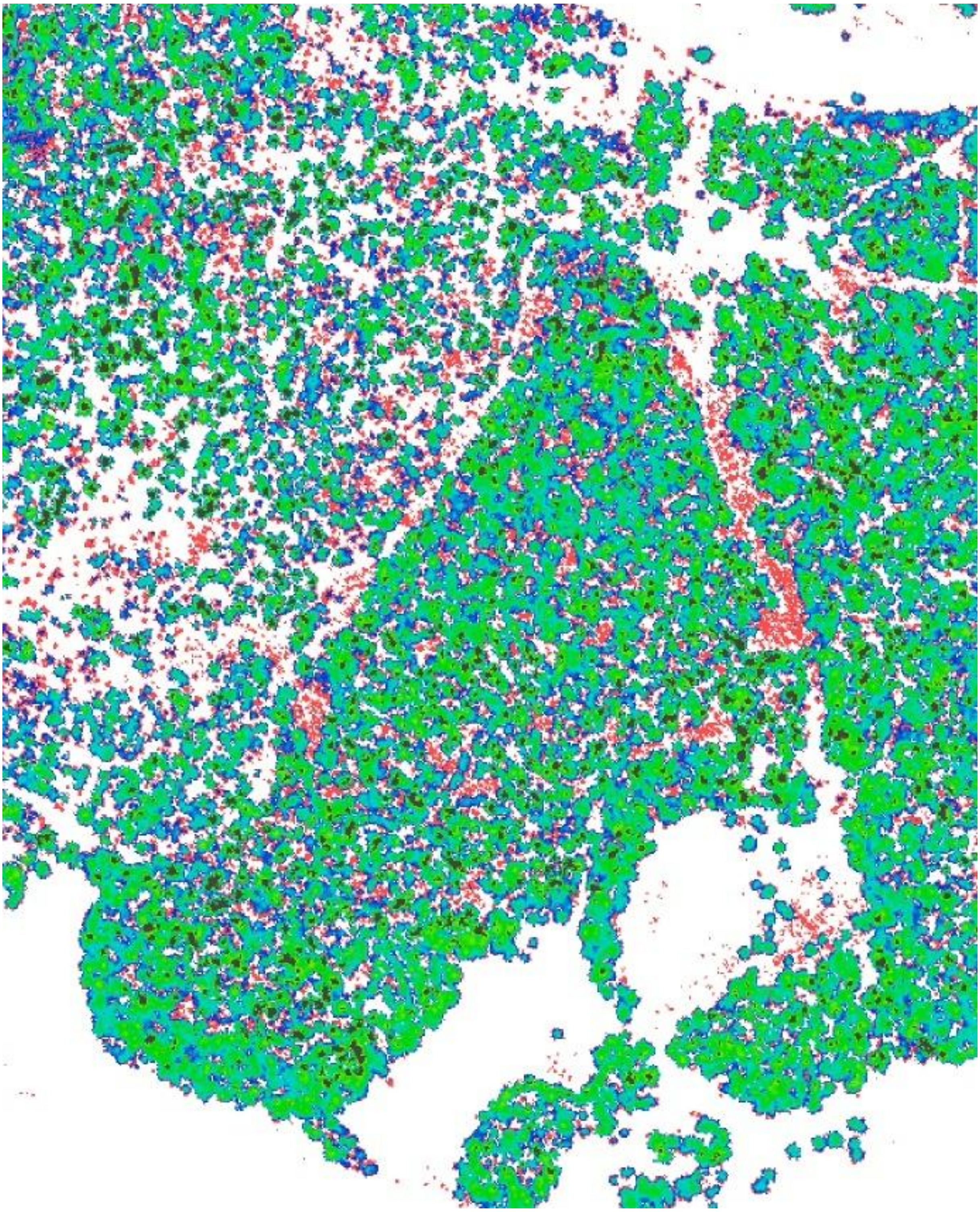


Fig. 2:
Vegetation height maps derived from LiDAR data

9F.4 | **Orienteering moves indoor** (#712)

T. Midtbø

Division of Geomatics, Norwegian University of Science and Technology, Trondheim, Norway

A full-length version is available and can be opened here:

_extendedAbstract\140_proceeding.*

Today there is a trend that that many sports are moving indoor. Ice hockey moved indoor many years ago, and speed skating is today mainly an indoor sport. Athletics are in many cases considered as an indoor sport during the winter. We have also seen examples where Biathlon is arranged indoor, and several full scale football stadiums are built as indoor arenas. Orienteering is maybe considered as one of the most typical outdoor sports that exist. Orienteering maps over large wilderness areas have usually formed the basis for orienteering competitions. However, some years ago the sprint distance was introduced in orienteering. This moved orienteering out from the woods and into the cities. Since maps over built up areas include quite different details, compared to conventional orienteering maps, a new standard for sprint maps were established (International Specification for Sprint Orienteering maps (ISSOM), 2005). While other sports usually depend on some kind of built sport facility, orienteering is based on one crucial facility; the map. Consequently, facilities for orienteering can be established in many different areas, as long as a map can be made and the area is accessible for sport activities. One more “exotic” branch within orienteering is when the event is moved indoor! This opens for new possibilities and new challenges both when it comes to the competition and to the making of the map. For example will indoor orienteering in a multi-storey building extend the sport into 3 dimensions, and the navigation in 3 dimensions based on 2 dimensional maps might be quite a challenge. This paper will look closer into challenges when it comes to making orienteering maps for multi-storey buildings. Problems that will be discussed are: Is there any good way to present 2 dimensional maps for several stories? Is it possible to include several stories above each other in one map? If not, how can the connection between stories be imparted to the map reader. For conventional maps the colour use is based on long traditions and associative qualities of the colours. This is also true for orienteering maps where the map signs and colours in addition is given through international specifications. When it comes to colours on indoor maps there are fewer traditions and no specifications for orienteering maps (so far). This paper will propose the use of colours in general and give some advices for colours and symbols on indoor orienteering maps. The paper will also look into what kind of buildings that might be suitable for indoor orienteering. Obviously it must be possible to arrange the event without getting in conflict with the normal indoor activities in a building. This will in particular be limiting for large building complexes. However, it is also possible to arrange events in a smaller limited part of a building. In this case there might even be necessary to use a different cartography, the cartography for indoor map on the “micro-level”.

ORAL

Session S9-G

NMCA - European Authorities Introduce Web Services

Wednesday, 28 August, 2013

14:45 - 16:00

9G.1 | **Standardization as a vehicle towards e-government** (#225)

F. Nissen[1], J. Hjelmager[2]

[1]*National Survey and Cadastre, Spatial Data Infrastructure, Copenhagen, Denmark;* [2]*National Survey and Cadastre, Defense and Emergency, Copenhagen, Denmark*

A full-length version is available and can be opened here:

_extendedAbstract\77_proceeding.*

The development in Europe in recent years in public services has dealt with building-up the data resources, the infrastructure and application of e-government services. Latest the Danish way has been driven forward by the 2012-2015 mutual authority strategy of digitalisation of the public services nationally and locally. The National Survey and Cadastre in Denmark (KMS) has contributed to this process by offering geodata as a means to (1) discover and find public data sources put into a title: "The Place as the Entry for Public Service Management" and (2) register and administer public values by connecting the geo-object to the registered object attributes of a domain specific public data source. The future needs for developing and applying public administrative IT-based functionality by self-service is a prerequisite of the presentation. This caused by present finance difficulties and demography developments. The presentation will cover the challenges, solutions, work and results that have been achieved this far and future work to come – not to forget mentioning the emerging needs for governance. Also the distribution strategy, data models and perspectives will be disseminated. Work done by the European Commission and the implementation of the INSPIRE Directive has been helpful along with a long tradition of international standardisation within the field of geographic information. The authors: Jan Hjelmager and Flemming Nissen are senior staff members of KMS, working with national standardisation, ISO and development related to SDI and business.

9G.2 | **Automation of Data Quality Validation based on Common Rules for Pan-European Geoinformation Production** (#1089)

M. Beare[1], A. Hopfstock[2], A. Jakobsson[3]

[1]1Spatial Group Ltd., Cambridge, Great Britain; [2]Bundesamt für Kartographie und Geodäsie, Geoinformation, Frankfurt am Main, Germany; [3]National Land Survey of Finland, Helsinki, Finland

Access to a cloud based automatic Data Quality (DQ) service is planned in the European Location Framework project (E.L.F.) currently being negotiated with the Commission. In this 36 month project we will provide a cloud based DQ service for the NMCAs enabling them to carry out a consistent set of DQ checks and any remedial work required before providing the data to EuroGeographics. This will follow the principles of a new technical specification ISO 19158 (Quality Assurance of Data Supply) and will work on establishing a standard rule based quality language that would enable transfer of the rules between different software implementations. EuroGeographics is responsible for the coordination, collation and provision of pan-European reference data sets to organisations such as Eurostat and the European Environment Agency. Based on data contributions from National Mapping and Cadastre Agencies (NMCAs) all across Europe, the aim is to provision data that is current, consistent and seamless across borders and of the highest quality required to meet the needs of the data consumers. Different data capture methods, national specifications, maintenance environments, publication processes and evaluation techniques across NMCAs all contribute to potential inconsistencies in the quality of data across Europe, which impacts on the time and effort it takes to coordinate the collation of a common pan-European product. In 2011, the European Spatial Data Infrastructure best practice Network (ESDIN) project presented guidelines for the implementation of standards based data quality management procedures and developed concepts for automated rule-driven data quality evaluation services that could bring uniformity and efficiency to the assessment approach. From 2011 to 2012, EuroGeographics and 1Spatial have furthered these concepts and developed rule sets for the automatic evaluation of EuroRegionalMap data, with respect to its key data themes. The rule sets now comprise over 200 measures that can be applied rapidly and repeatedly to all datasets from all data contributors. In just a few days, data from all 32 data contributors can be automatically assessed in terms of topological connectivity; domain accuracy and cross-border consistency. This removes the need for manual sub-sampling, which is neither time efficient nor complete in its coverage of assessment. The automated approach presents full data quality metrics in convenient statistical form, aggregated for management, to give assurances that the data is fit for purpose and provide executive guidance to where maintenance activities should focus to best improve the data in future. Additionally, targeted error mark-up layers can be used to visualise and guide operators to specific data instances that require improvement, assisting the maintenance process. This means the scope of the existing validation process for ERM is broadened from supporting the production processes to provide quality measures for usability evaluation. The uniform application of quality rules on all national contributions enables the ERM production management team to make informed qualitative assertions on the dataset quality for three major themes – hydrography, transportation and settlements – as well as between national contributions. Deploying the developed DQ validation methodology to an accessible cloud based service will have a great benefit to data consumers and will also introduce significant savings for the NMCAs. We also believe that this methodology is the key enabler of building the E.L.F. and INSPIRE.

9G.3 | **European Location Framework - One Reference Geo-Information Service for Europe** (#1004)

A. Jakobsson[1], A. Hopfstock[2], R. Hellesjø Mellum[3], D. Kruse[4], C. Portele[5], S. Urbanas[6], J. Hartnor[7], A. Bray[8], L. Aslesen[3], O. Ostensen[3], D. Lovell[6]

[1]National Land Survey of Finland, Development Centre, Helsinki, Finland; [2]Bundesamt für Kartographie und Geodäsie, Frankfurt, Germany; [3]Statens Kartverk, Hønefoss, Norway; [4]Kadaster, Apeldoorn, Netherlands; [5]Interactive Instruments, Bonn, Germany; [6]EuroGeographics, Brussels, Belgium; [7]Lantmäteriet, Kiruna, Sweden; [8]Netrius, BAGSHOT, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\377_proceeding.*

The European Location Framework project will during the next three years deliver the first implementation of the European Location Framework (E.L.F.) - a technical infrastructure which harmonises national reference data to deliver authoritative, interoperable, cross-border geospatial reference data for use by the European public and private sectors. The project consortium consists of 30 partners: 16 data providers (National Mapping and Cadastral Agencies), 4 application developers, 4 commercial software providers and 6 organizations representing user groups and regional bodies. Today access to authorative geoinformation is mostly national. INSPIRE directive will set up services that may be used for creating cross-border and pan-European services. In the ESDIN project this scenario was examined and the conclusion was that there is a need for setting up geo-tools and additional spefications for creating working cross-border and pan-European services. The E.L.F. project will set up these services and specifications. The E.L.F. specifications based on extensions to existing INSPIRE rules and guidelines will be agreed and then applied via geo-tools to existing local national services to enable cross-border interoperability. The E.L.F. platform's Geo-tools will be based on extensions to existing services (as developed in ESDIN) for the required data transformation, validation, generalisation and edge-matching. The output E.L.F. reference geo-information datasets will be published via cloud GIS service platforms, which will be available and maintained for valued added application development. Some valued added services based on pre-existing services in the domains of the Health Statistics, Emergency Mapping, Insurance and Real Estate will be developed during the project demonstrating the capability of the E.L.F. platform. However any kind of VA services could be developed on the top by stakeholders. Additional (non-NMCAs) geo-information will become available enabling the integration of existing services from national SDI's, other commercial and non-commercial sources. Their inclusion will be negotiated via agreements in order to maximise the number of INSPIRE themes available via the E.L.F. Platform. To provide a full multi-lingual capability, the E.L.F. Platform will make use of the INSPIRE feature concept dictionary and extend the existing 'EuroGeoNames' service to the GeoLocator service. The project is aligned well with the Digital Agenda for Europe, the European Interoperability Framework, eGovernment and Cross border service initiatives, GMES, Eurostat and SEIS requirements, INSPRE and PSI principles, and with the Intelligent transport, Agriculture and other EU policies and initiatives. Project will work on sustaining the developed services by creating the necessary agreements and engaging the political decision makers. The project will provide a critical mass of content and coverage as 15 Member States' national INSPIRE data will be made available from a single point connecting the E.L.F. platform to the European Commission INSPIRE geo-portal and the Commission Internal portal run by Eurostat. Hopefully covering the full range of INSPIRE Annex I,II and III themes, these datasets will provide full national coverage of the rich content available from national and regional spatial data infrastructures.

9G.4 | **PDOK Kaart, the Dutch mapping API** (#881)

H. van der Vegt

Cadastre, Land Registry and Mapping Agency of The Netherlands, Strategy and Policy, Apeldoorn, Netherlands

A full-length version is available and can be opened here:

_extendedAbstract\113_proceeding.*

This paper describes the cartographic possibilities of the web facility PDOK (public services on the map), unlocking geographic information of the government for both public and private users. PDOK is a partnership of a number of Ministries and the Kadaster, working together to build a central repository of reliable, accessible and efficiently managed location based information of the government. With INSPIRE being one of the biggest drivers behind this programme, the aim has been to 'invent the infrastructure wheel' only once and use the solution many times, serving INSPIRE and other data to society, sharing common space. Being an important part of the National Spatial Data Infrastructure, webservices are made available, showing and providing nation wide topographic and thematic maps of all kind, from INSPIRE to Key Registers. The underlying data are nearly all open data and therefore free of charge, as well as the webservices. It has a service oriented architecture, complying with the INSPIRE implementing rules and the Dutch interoperability framework, guaranteeing a high availability service level and user support. As a single point of access for governmental geodata, it can be considered as a fundamental building block for creating added value services and applications for society. In the PDOK webportal, all the available PDOK data and services can be searched, viewed and downloaded. It gives you important documentation about the services, as well as examples of how these services can be integrated in real world applications. Besides serving the national (also INSPIRE) geographic metadata register and an ArcGIS extension to easily find and use the available data and services, one of the most eye-cathing functionalities offered by this portal, is the mapping API (application programming interface), the so-called "PDOK Kaart" API. It is a simple tool to integrate your own map in your website or web application. It gives you the ability to add cartographic symbols and markers and combine it with other cartographic map layers. Using the underlying webservices of PDOK, this mapping API is a free, for anyone to use tool. PDOK kaart is also free of advertisements, making it a valuable mapping tool within the government.

ORAL

Session S9-H

Technologies in Cartographic Education

Wednesday, 28 August, 2013

14:45 - 16:00

9H.1 | **The State of GISc Education and SDI Implementation in the SADC Countries: A Comparative Study** (#304)

<u>S. Eksteen</u>, S. Coetzee
University of Pretoria, Geography, Geoinformatics and Meteorology, South Africa

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 471-482

Most of the counties in the Southern African Development Community (SADC) are poor countries but rich in various natural and agricultural resources. The vision of SADC is a common economic well-being, improved standards of living and quality of life for all people in the member states. Geographical information science (GISc) plays a vital role in managing the natural and agricultural resources to achieve the vision of SADC. Spatial data infrastructures (SDIs) facilitate access to geographical information and provide policies to manage access to geographical information. These are key success factors for finding sustainable solutions to the challenges of all member states. In order to implement SDIs and to strengthen the use of geographical data in solution finding, these countries need GISc education to train the necessary professionals and scientists. The objective of this study is to investigate if there is a relationship between the availability of GISc education and SDI implementation in the SADC countries. To our knowledge a similar study has not been undertaken. Previous studies have been conducted to determine the current state of GISc education and SDI implementation respectively on the African continent. In this paper we compare the findings of the two studies to determine if there is a relationship between the availability of GISc education and the state of SDI implementation in SADC countries. The results indicate that SDI implementation in SADC is not influenced by the availability of GISc education.

9H.2 | **New Technologies as Educational Resources for Teaching Cartography: A Case Study in Guinea-Bissau** (#341)

I. Mário Nosoline[1], A. Carvalho di Maio[2], D. Domingos Rodrigues[1]

[1]Universidade Federal de Viçosa, Civil Engineering, Brazil; [2]Universidade Federal Fluminense, Análise Geoambiental, Niterói, Brazil

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 483-496

This work aimed to explore and measure the effectiveness of using geotechnologies to instigate students of elementary and secondary schools, in Guinea-Bissau, to learn more about the issues related to spatial representation. An educational methodology was developed and evaluated in order to provide educators and students with access to digital maps and satellites images. As part of the methodology, questionnaires were applied to teachers with the purpose of identifying and selecting the subjects that were part of the digital educational modules and the content of the databases to be used in Terraview GIS. To evaluate the instructional materials produced, the methodology was applied in four schools including an institute for teachers. The results pointed to the benefits of using new technologies as auxiliaries tools to traditional teaching, the insertion of geotechnologies in the schools activities has facilitated the understanding of the studied subjects, scale and geographic coordinates, thus providing a significant gains in students' performance, which also contributed to the process of digital inclusion and in reducing the lack of teaching materials in Guinea-Bissau.

9H.3 | **A Survey of Books for Potential Use in SDI Education and Training in South Africa** (#415)

V. Rautenbach, S. Coetzee
University of Pretoria, Centre for Geoinformation Science, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\24_proceeding.*

Session S9-I

Business Meeting of the Commission on Maps and Society

Wednesday, 28 August, 2013

14:45 - 16:00

Session S9-J

Business Meeting of the Commission on Open Source Geospatial Technologies

Wednesday, 28 August, 2013

14:45 - 16:00

ORAL

Session S10-A

Symbols in Map Design

Wednesday, 28 August, 2013

16:30 - 17:45

10A.1 | **Sharing and Discovering Map Symbols with SymbolStore.org** (#249)

A. Robinson, S. Pezanowski, J. Stevens, R. Mullins, J. Blanford, R. Bianchetti, A. MacEachren

The Pennsylvania State University, GeoVISTA Center, Department of Geography, University Park, United States

A full-length version is available and can be opened here:

_extendedAbstract\295_proceeding.*

1. Introduction One of the most critical cartographic challenges is to determine the means for representing geographic features. This task is often supported through the careful selection of ready-made symbols provided in mapping and graphic design software, or through the drafting of new symbols. Current mechanisms for discovering and sharing symbols rely on symbol distribution through GIS software and informal sharing through set-specific websites and personal exchanges. While a great deal of effort has gone into developing new symbol standards to support map interoperability, much less progress has been made toward ensuring that symbols can be easily discovered and shared. Here we present our progress toward developing a web-based platform for sharing and refining map symbols that we call the Symbol Store. The Symbol Store supports users who wish to search for available point symbol designs using keywords, category names, and other metadata. While our initial work with the Symbol Store has focused on developing basic methods to support web-based symbol sharing, our current efforts are aimed at integrating an iterative process for standardizing domain specific symbol sets. The following sections outline our progress toward supporting both areas of concern. **2. Sharing Symbols** To support cartographers who wish to easily discover new symbols and share the symbols they have already collected, we developed a web-based platform for sharing symbols called the Symbol Store. The Symbol Store allows users to search for symbols by keyword, browse for symbols by associated category names or contributing groups, and preview selected symbols on realistic maps (Figure 1). In addition, users can contribute their own symbols to the Symbol Store to share their collections with a wider audience. The Symbol Store (accessible at SymbolStore.org) currently houses over 2400 symbols collected from major government symbol sets as well as public domain sets designed by independent cartographers. To help users select symbols, an interactive map preview allows users to test a set of symbols on realistic maps (Figure 2). Once the user has found and previewed a set of useful symbols, they can be downloaded for immediate use in a range of common formats. The selected symbols are bundled together in a.zip file which includes PNG images in three common resolutions, an Esri .style file for use in ArcGIS, and SVG vector graphics that can be used in graphic design software**. 3. Refining Symbols** Our most recent additions to the Symbol Store are features that allow communities of mapmakers to iteratively refine and enhance their symbol collections. These new features build on prior work to develop an asynchronous, round-based approach for refining and formalizing domain specific symbol sets. In that research, we created a web-based platform called the e-Symbology Portal, based on a customized Drupal content management system. The Symbol Store now directly interweaves with the e-Symbology Portal so that users engaged in our iterative process for refining map symbol standards can select sets of symbols to review, enhance and refine their associated metadata, and identify new symbol design needs while using the best features of both platforms. **4. Next Steps** Looking ahead, we envision multiple new opportunities for extensions to our work to develop new means for sharing and refining map symbols. Specifically, we are planning to evaluate the Symbol Store and e-Symbology Portal integration mechanisms with DHS mapmakers, with the goals of enhancing existing functions designed to support symbol refinement and to identify new means to support collaboration and interoperability around symbology.

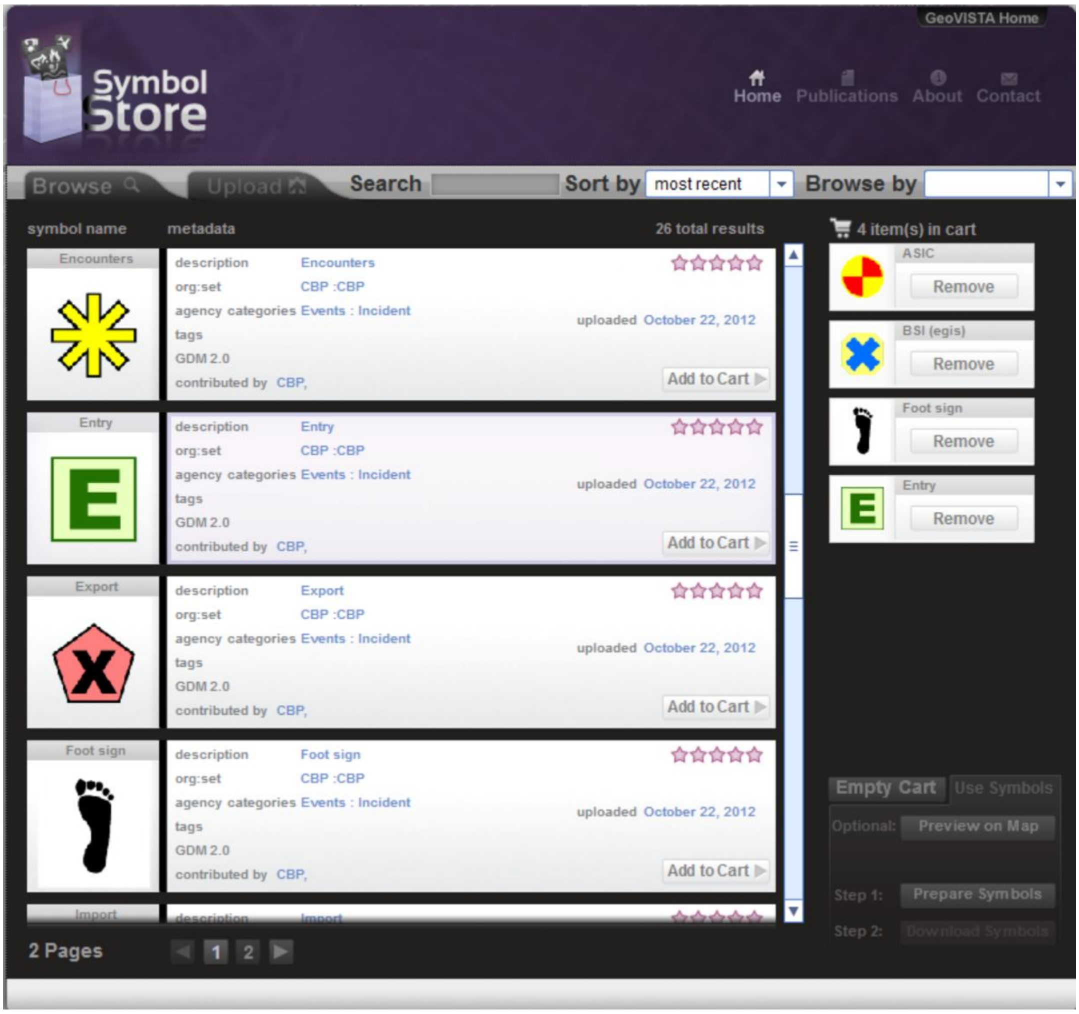


Figure 1:
The main SymbolStore.org interface for browsing and selecting symbols.

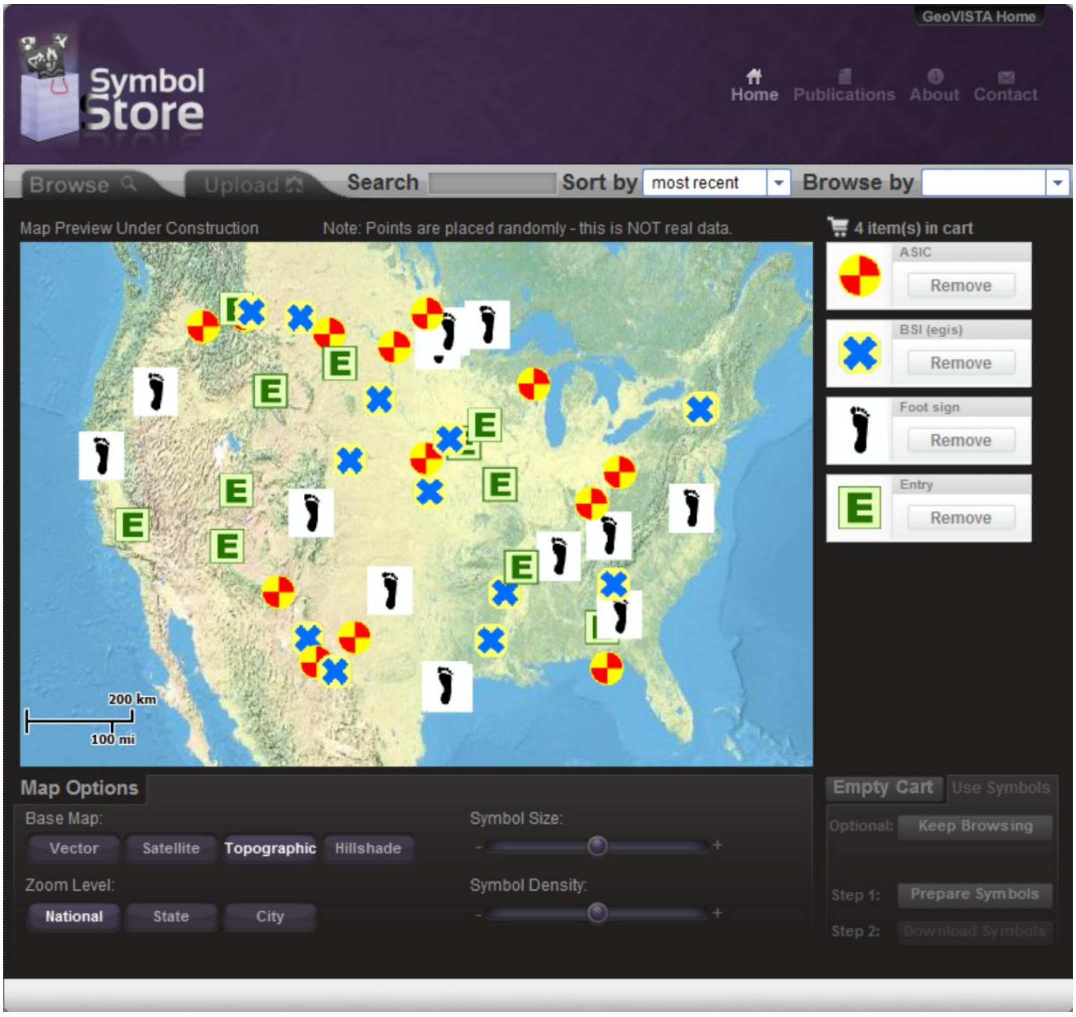


Figure 2:
The SymbolStore.org interactive map preview interface for testing symbols.

10A.2 | **Designing Map Symbols for Mobile Devices: Challenges, Best Practices, and the Utilization of Skeuomorphism** (#1201)

J. Stevens, A. Robinson, A. MacEachren

The Pennsylvania State University, Department of Geography, University Park, United States

A full-length version is available and can be opened here:

_extendedAbstract\356_proceeding.*

Symbolization plays a vital role in the use and effectiveness of maps. First responders, emergency managers, and other professionals who disseminate maps related to crises and disasters rely on symbolization to communicate mission-critical information. These professionals commonly use map symbology to depict the presence, stage, type, and severity of hazardous events. Others use map symbology to indicate places of interest, important locations, or their own position to be shared with peers. Misinterpretations of symbols related to emergency management or disaster relief efforts can cost valuable time, lead to the misallocation of personnel and other resources, or put lives at risk. Since the design of map symbology can influence the way and accuracy with which users interpret these symbols, it is crucial that symbols be designed effectively. For this reason, map symbology has been the focus of a number of studies that have investigated the perceptual influence of symbol size, color, shape, iconicity, figure-ground relationships with base maps, and many other properties. More recent studies have evaluated these properties with respect to small screen mobile devices that are becoming increasingly ubiquitous among professionals in the field and society at large. The combined literature in these areas contributes to a greater set of knowledge, guidelines, limitations, and new research directions that we have explored more fully. In doing so, we have identified a set of recommendations for symbol design and two primary aspects of mobile symbology that have received relatively little attention by others. The first area in which research on mobile map symbols has been scarce is in the role of interactivity and gesturing. Despite many mobile devices supporting one or more touch-based interactions, few studies have investigated the relationship between interaction and visual design. The ability to be touched, clicked, or dragged not only affects the minimum size of the displayed symbols but also how these interactions are indicated by the symbol design. Our research argues that designers of mobile map symbols must consider these interactions along with visual perception in order to maximize the effectiveness of their symbology. The second area of research that has been scarce is related to the role of skeuomorphic cues that facilitate interactivity. Skeuomorphism, or the inclusion of design features that were requisite in previous tools but are only ornamental in new versions, has been a topic of debate and uncertainty among designers. While purely aesthetic skeuomorphs have been the source of criticism, we contend that skeuomorphic cues may have benefits when used appropriately. Affording touch-based interactivity is one example of skeuomorphism that we investigate within the context of mobile symbology. In this work, we make four contributions. First, we present a compilation of the current state of mobile symbology and best practices based on previous empirical findings. Second, we demonstrate the design of a new set of map symbols for mobile devices based on these guidelines. These new symbols were developed for comparison with an existing standard used by emergency management and disaster relief professionals. Third, we discuss the role of skeuomorphism and its application to interactive affordance in map symbol design. Lastly, we present the results from an empirical evaluation of the newly designed symbols and the success of skeuomorphic cues for the purpose of indicating interactive behaviors. We believe this work advances the science of mobile symbology and sheds light on the emerging practice of skeuomorphic design in modern applications.

10A.3 | **3D Symbolization and Multi-Scale Representation on Geo-Information**

(#601)

W. Yongjun[1], J. Guojie[1], C. Yingdong[2], H. Peng[3]

[1]*Xi'an Institute of Surveying and Mapping, information, xi,an, China;* [2]*Institute of Geographic Sciences and Natural Resources Research, informarion research, beijing, China;* [3]*Institute of Geographic Information Research, information research, beijing, China*

A full-length version is available and can be opened here:

_extendedAbstract\17_proceeding.*

10A.4 | **Semiological aspects of urban maps: A case study from the Holy city of Mecca** (#660)

D. Mohsen

King Abdulaziz University - Faculty of Environmental Design, Department of Urban and Regional Planning, Djeddah, Saudi Arabia

A full-length version is available and can be opened here:

_extendedAbstract\85_proceeding.*

ORAL

Session S10-B

Applications in Sustainable Development

Wednesday, 28 August, 2013

16:30 - 17:45

10B.1 | **Automatic Derivation of Urban Structure Types from Topographic Maps by Means of Image Analysis and Machine Learning** (#1174)

R. Hecht[1], H. Herold[1], G. Meinel[1], M. Buchroithner[2]

[1]*Leibniz Institute of Ecological Urban and Regional Development Germany, Dresden, Germany;*
[2]*Institute for Cartography, Technical University Dresden, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\362_proceeding.*

Urban geography and urban planning require detailed information about the functional, morphological and socio-economic structure of the built environment. The building stock is the most important component in settlement areas. It directly affects urban structure, e.g. urban form, density of housing and distribution of population. Studying the built environment as an interdisciplinary research object requires a common spatial working basis. One approach are the so called *Urban Structure Types* (UST). It is a domain-independent concept that describes spatially homogeneous regions in terms of land use, building type, building density, etc.. Urban structure types on mid-scale level (e.g. statistical block level) can thus be used for interdisciplinary studies, e.g. quality of housing, material flows and energy consumption or other socio-economic and ecological aspects. Despite of the great importance of the understanding of urban structure for science, planning and politics, there is no nation-wide data base on block level. Mapping USTs is still mostly based on visual interpretation of aerial photographs and maps and is a very time consuming process. Automatic approaches based on remote sensing data can offer an efficient alternative. However, such approaches have been tested on selected cities only. They also presuppose the availability of radiometrically homogeneous images which are costly. Topographic maps at scale 1:25,000 are a low cost alternative. They are nationwide available and comprise of very homogeneous data. Their temporal coverage reaches back to the very beginnings of large-scale topographic mapping. Therefore they allow studies on dynamics and developments of settlements over much longer periods then satellite imagery. This paper presents a method for automatic derivation of urban structures types with focus on residential areas. It is based on scanned topographic maps and a given urban block geometry. The procedure consists of several steps: (1) definition of a typology of urban structures, (2) extraction and characterization of building footprints (3) computation of measurements to describe urban structure on block level (4) classification based on the measurements. In order to make the buildings in the scanned maps explicitly available in Geographic Information Systems (GIS), methods of cartographic pattern recognition and image analysis have been applied. For the classification different measurements (features) are derived by means of image processing techniques and spatial analysis. In contrast to remote sensing imagery, topographic maps contain discrete map objects and no spectral information. Therefore, only geometric, topological or neighborhood features can be used. Since a user-specific typology is given, a supervised machine learning strategy for pattern recognition has been preferred. In a model selection process different machine learning classifiers such as *Support Vector Machines (SVM)* and *Random Forest (RF)* have been tested and compared. Based on a given UST mapping of the City of Dresden, Germany, an accuracy assessment has been carried out. Our approach offers an efficient and low cost way to map residential urban structures. Additionally, topographic maps provide the basis for multi-temporal mapping. Therefore, the presented method could be of particular interest for spatial sciences (e.g. studying urban form and dynamics) as well as planning (e.g. infrastructure planning, urban and regional planning).

10B.2 | **From sensor data to the perception of phenomena: Software architecture for online access and offline analysis** (#994)

N. Cheaib, A. Ruas, O. Gaborit

French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR), MACS, Marne la Vallée, France

A full-length version is available and can be opened here:

_extendedAbstract\166_proceeding.*

10B.3 | **Mapping Potential Metro Rail Ridership in Los Angeles County** (#36)

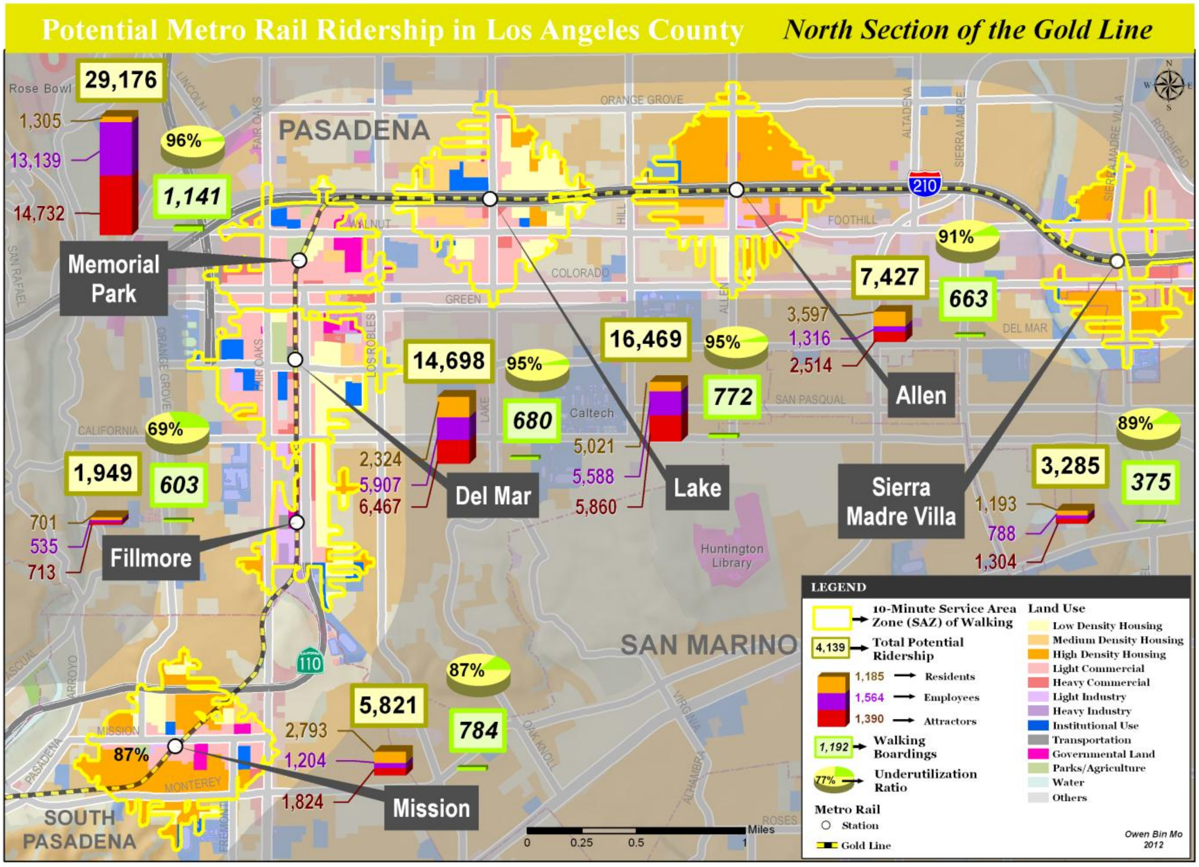
<u>B. Mo</u>

LACMTA, Long Range Planning and Coordination, Los Angeles, United States

[A full-length version is available and can be opened here:](#)

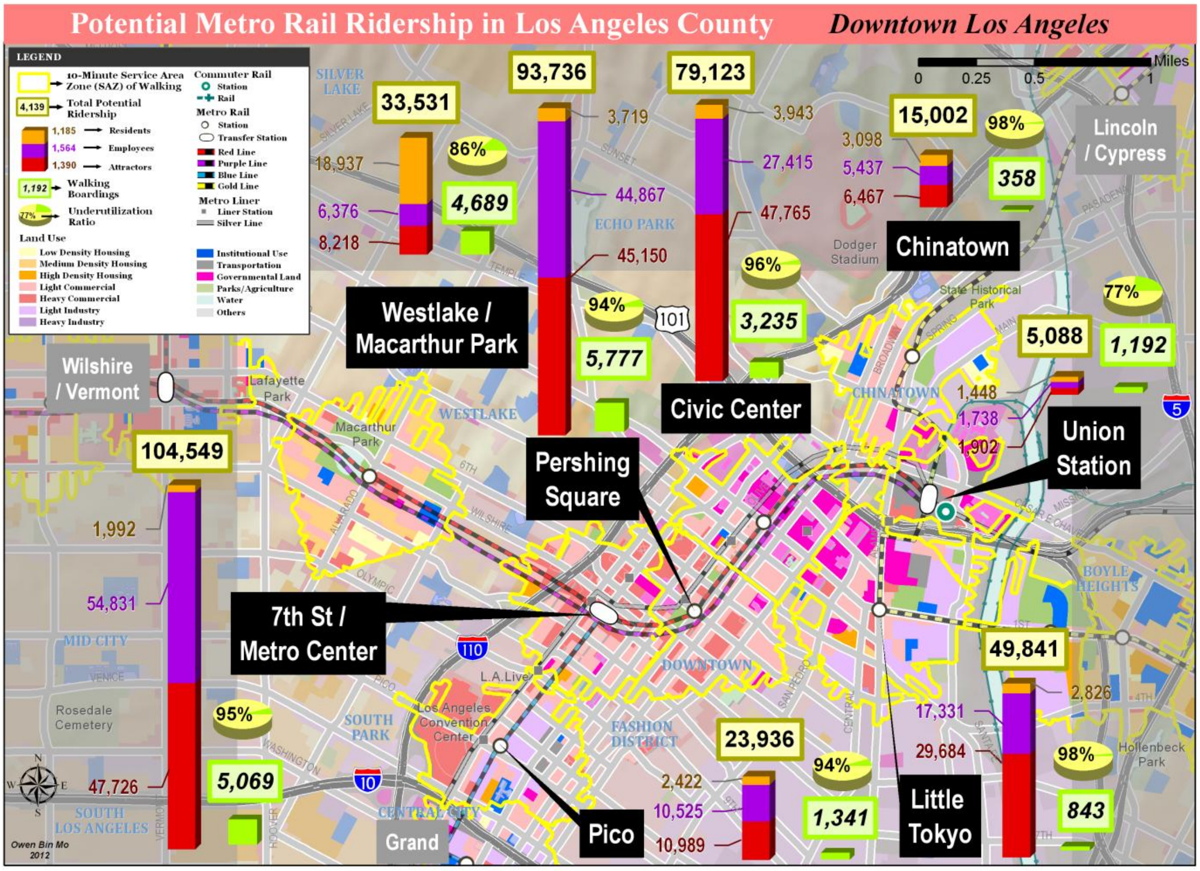
[_extendedAbstract\124_proceeding.*](#)

Los Angeles County, as in many metropolitan areas, is coping with increasing street and highway traffic. Public transit, and particularly rail, often is regarded as a strategy to help reduce urban traffic congestion, especially in these times of economic downturn, rising gas prices, and growing awareness of global climate change. The objectives of this paper are to identify the potential ridership and current utilization of the Metro Rail of Los Angeles County using the process of 'Trip Generation', a travel demand forecasting model, and to present the results of the Trip Generation analysis in the *Atlas of Potential Metro Rail Ridership* to support visual planning about public transit. The potential ridership produced and attracted to each station is estimated using Origin-Destination (OD) flow patterns from residential and employment regions. Estimation of the number of potential riders accessing the Metro Rail System involves a spatial analysis of the location of current Metro Rail stations serving populations in a reasonable access time by walking. Service Area Zones (SAZ) then were delineated and mapped to indicate the areas that the potential riders could be served by existing stations within a ten minute walking interval. The potential ridership was measured to be approximately one million, a figure ten times larger than the present level of Metro Rail utilization. The analysis results across stations were compiled into the *Atlas of Potential Metro Rail Ridership* for the purpose of ridership promotion, system forecasting, and service planning.



Potential Ridership:

Potential Metro Rail Ridership in Los Angeles County (North Section of the Gold Line)



Potential Ridership:
Potential Metro Rail Ridership in Los Angeles County (Downtown Los Angeles)

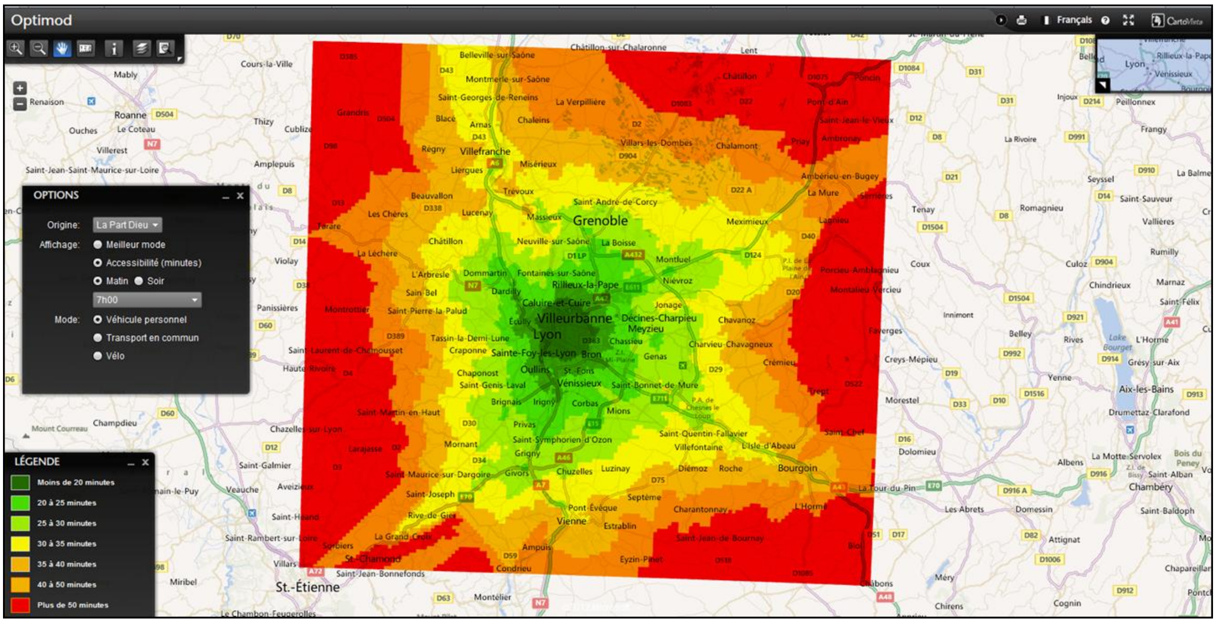
10B.4 | **MOSART : A DECISION MAKING TOOL FOR MODELLING SUSTAINABLE DEVELOPMENT WITH SPATIAL ACCESSIBILITY ANALYSIS**

(#1321)

N. Ovtracht[1], G. Foliot[2], D. Bouchard[3], Y. Crozet[1], A. Mercier[1]

[1]Transport Economics Laboratory - LET, Lyon, France; [2]Centre de Calcul IN2P3, Domaine Scientifique de la Doua, Villeurbanne, France; [3]DBx GEOMATICS inc., Gatineau, Canada

In France during the last 15 years, urban transport policies have moved from the objective of offering a higher travel speed to an environmental friendly mobility seeking to optimise urban space consumption. This new focus on space land use leads to reconsider travel time gains. Time gains are no more the main objective of local public policies. Even if it is more a rationale of “traffic calming” than a “return to slowness”, there is clearly another set of priorities changing the relative share of public space attributed to the different modes of transport. The new preference for surface public transport network, with the implementation of tram-lines, has been done at road network expense. This policy reorientation aims not only to solve congestion problems but to impact spatial structures and land-use planning increasing densities (Genre-Grandpierre 2007). In this context, the concept of accessibility and namely gravity accessibility (Hansen 1959, Koenig 1980, Geurs 2004…) associating both travel times and land-use component, is pertinent to understand past evolutions and future challenges of urban mobility. Facing environmental and spatial constraints, an accessibility based analysis assesses urban dynamics on opportunities reached by individuals using the transport system and on urban spatial structure (Gutiérrez 1999). The objective of the paper refers both methodology and analysis of the new tendencies of urban transport policies using methods and tools issue from geomatic, web-mapping and spatial economics. • The first part presents the modelling platform “MOSART” . MOSART has been implemented as a Geographical Information Systems in Transportation producing accessibility analysis. It has been improved to a modelling platform for planning sustainable mobility introducing gravity-based analysis in a second version. A web-mapping application have been added for the accessibility modelling results. Many databases, spatial or not, are integrated in the GIS. Integration of an urban transport model system associated to updated land-use data at a very detailed zonal division make easier dynamic analysis of different transport policy scenarios. An innovative aspect of MOSART refers to an analysis on both urban speed issues and land-use patterns. Combining these two interrelated aspects, MOSART is well adapted to assess past and future transport policies. The second part presents some example of accessibility analysis done with the platform MOSART in the Optimod project. The main purpose of the Optimod Project is to develop sustainable mobility with ITS systems in Lyon urban area. Facing the challenges of “sustainable mobility paradigm” (Banister 2008), what will be the next developments of the local transport policy? To address this issue, the Optimod project tests different transport policy scenarios using MOSART on Lyon Urban Area. It proposes alternative options for a sustainable mobility under environmental and financial constraints. The assessment of these different policies is made referring access measures to jobs in peak hour. Accessibility is measured for different transport mode users (car users, public transports users, bicycle users etc.). The Optimod project leverages the CartoVista software map engine (thematic web-mapping software) and its Software Development Kit (SDK) for the display of the accessibility modelling results. The different accessibility maps are displayed based on a specific origin, time and the mode of transportation (By Car, Bus or Bike). The map grid data is presented with a series of interactive vector layers that are very small and optimized to enable quick layer switching as well as map animations. The grid data is classified and grouped together into individual layers by a simple database process. The map features advanced mouse-over and data tips functionality so that the end user can get information on the time calculations and ranges for any area on the map.



Accessibility by car:

Accessibility to the CBD by car on peak period

ORAL

Session S10-C

Generalisation 3

Wednesday, 28 August, 2013

16:30 - 17:45

10C.1 | **TileGen - An open source software for applying cartographic generalisation to tile-based mapping** (#699)

R. Klammer

Dresden University of Technologies, Institute for Cartography, Germany

The visualisation of maps in the internet has received an enormous impulse since the method of tile-based visualisation is applied to web maps. This technique facilitates a fast and efficient display of scale- and slidable maps in web browsers which are intuitively usable even for inexperienced users and is by now the most common and widely used method of web mapping. The development of base technologies (e.g. standards, server technologies) is primarily focused on improving performance while cartographic aspects, like geometrical accuracy or legibility, are assigned to secondary relevance. Cartographic generalisation is currently scarcely deployed in practical implementations of tile-based mapping especially because the automatic methods for processing, serving and updating map tiles restrict the feasibility for that. On the one hand the abstract, text based definition of symbolisation parameters (e.g. SLD- & SE-standard) imply the formalisation of cartographic knowledge on why, when and how to generalise. On the other hand generalisation operators for spatial transformations can only be processed automatically within the fully automated process flow of tile-based mapping. In result, the most available tile-based maps can only be used with low graphical requirements, especially because none of the available open source software products contains any possibility for explicitly defining the appliance of cartographic generalisation. However, recent developments aim at providing automatic generalisation functionalities via Web Processing Services (WPS). These Web Generalisation Services are well suitable for the integration to tile-based mapping as generalisation operators can be applied generic but also shared and developed in cooperation. TileGen is an open source software that addresses these issues by supporting the definition of symbolisation parameters but also by combining the open source rendering library Mapnik, most frequently used for rendering map tiles, with the Web Generalisation Service WebGen-WPS. Basically, TileGen helps to apply schematic transformations by providing the map author with an immediate preview of the specified map parameters. That supports the design process for tile-based mapping in relation to the manual definition of user-oriented symbolisations. Additionally, TileGen offers an automatic detection of topological problems within the final map visualisation by providing an interface for collecting ancillary information (e.g. density, minimum distance) on certain feature types. A concrete example of detecting and avoiding minimum distance violation will demonstrate how the combination of information retrieval and map preview supports the design process of tile-based maps. Moreover, TileGen provides a user interface for integrating spatial transformations to automatic tile-based mapping by requesting generic algorithms of Web Generalisation Services. TileGen acts like an analysis tool in this relation. It enables the map author to apply different spatial transformations and to prove their usability by integrating and viewing the resulting geometries within the map preview immediately. That allows the map author to observe the effects of the applied spatial transformations on the final map visualisation permanently. Afterwards, the approved functionalities can either be applied to pre-process geometries, for storing them as multiple forms of representation, or the corresponding request of the external generalisation service can be saved within a specific configuration script. This script, adapted to Mapnik, can be exported and integrated to the process flow of tile-based mapping, whereby different spatial transformations are applicable on-the-fly within the automatic rendering of the single map tiles. An example on the appliance of a line smoothing algorithm, requested from WebGen-WPS, will demonstrate the resulting process flow of tile-based mapping with integrated automatic spatial transformations.

10C.2 | **Investigations into partitioning of generalization processes in a distributed processing framework** (#1398)

F. Thiemann, S. Werder, T. Globig, M. Sester

Leibniz Universität Hannover, Institut für Kartographie und Geoinformatik, Germany

A full-length version is available and can be opened here:

_extendedAbstract\395_proceeding.*

Processing of large spatial data sets often poses specific demands on computation time and allocation of resources. For an efficient processing, a partitioning of the whole task into subtasks is needed, which is mainly achieved by creating a spatial partitioning of the whole scene. There are several partitioning schemes which can be applied (Werder and Krüger, 2009). A simple approach uses rectangular tiles, other approaches use the object structure in the data to separate different parts, e.g. the street and / or river network (Regnauld, 2001). The general processing approach is composed of the following steps: cutting the whole data set into different adjacent parts, processing the parts separately and integrating the result. For simple applications such as raster operations in images, this method can be applied in a straightforward way. However, often operations have influence on neighboring tiles; then this has to be respected in the strategy. This is especially true for generalization operations which often depend on the local context. The paper presents a framework which addresses two problems in generalizing large data sets: first of all, a strategy for tiling and combining the data in the whole process is presented. This strategy relies on the introduction of a buffer area around the tiles, which allows modeling the influence of the neighborhood implicitly. The size of the buffer depends on the expected influence range of the operation. In the final step of combining the separate tiles, also the expected deviations during the processing have to be taken into account. The second contribution of the paper is the processing of generalization operation in a parallel computing framework, in this case the Hadoop framework (White, 2012). The implications of applying the MapReduce algorithm are discussed concerning both distributed computation and storage. The possible options for the integration of legacy code into Hadoop are also discussed. In the paper, three different generalization operations will be investigated: simplification, enlargement and aggregation of buildings, simplification and aggregation of landuse polygons (Thiemann et al. 2011), and displacement (Sester, 2005). The same underlying processing framework will be used, however, the approaches and the necessary parameters for the tiling and buffering will differ. Several experiments will be presented, together with an evaluation of the results both in terms of runtime and quality of the results. References: Regnauld, N.: Contextual Building Typification in Automated Map Generalization, Algorithmica 30: 312–333, Springer-Verlag New York Inc, 2001. Werder, S., Krüger, A.: Parallelizing Geospatial Tasks in Grid Computing, GIS.Science 3, p. 71-76, 2009. White, T.: Hadoop: The Definitive Guide, 3rd Edition, O'Reilly Media Sebastopol CA USA, 2012. Sester, M.: Optimizing Approaches for Generalization and Data Abstraction, International Journal of Geographic Information Science, vol. 19 Nr. 8-9, p. 871-897, 2005. Thiemann, F., Warneke, H., Sester, M., Lipeck, U.: A Scalable Approach for Generalization of Land Cover Data, Advancing Geoinformation Science for a Changing World, p. 399 - 420, Heidelberg, 2011

10C.3 | **Clutter Reduction Methods for Point Symbols in Map Mashups** (#1056)

J. Korpi, P. Ahonen-Rainio

Aalto University, School of Engineering, Department of of Real Estate, Planning and Geoinformatics, Finland

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 257

Map mashups are often visually chaotic and methods for solving this chaos are required. We introduced the clutter reduction criteria for evaluating methods to reduce clutter in map mashups. We made a synthesis of cartographic generalization operators used in the generalization of point data and clutter reduction methods used in information visualization and evaluated the methods against the criteria. The resulted evaluation table can be used in finding suitable clutter reduction methods for cases of map mashups with different primary criteria, and more specifically in finding methods that cover each others' limitations.

10C.3 | **Preservation and Modification of Relations Between Thematic and Topographic Data Throughout Thematic Data Migration Process** (#708)

K. Jaara[1,2], C. Duchêne[1,2], A. Ruas[3]

[1]IGN France, Cogit laboratoiry, Saint-Mandé, France; [2]Université Paris-Est, Champs-sur-Marne, France; [3]French Institute of Sciences and Technology for Transport, MACS laboratory, Paris, France

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 103-118

Nowadays, users often use topographic data to reference their own thematic data. When reference data are updated or if the user wants to replace the reference, the thematic data have to be processed in order to maintain data consistency. We call this processing thematic data migration. This paper proposes an updated version of a previously proposed thematic data migration process, which includes the case where the relations between thematic and topographic data have to be modified between the initial and the final state. A model to describe the relations and their modifications is proposed. A multi-criteria decision method is used to relocalise the thematic data on the topographic data guided by the described relations. The whole process is illustrated on a running example, on which obtained results are presented and discussed.

ORAL

Session S10-D

User Issues in Map Production

Wednesday, 28 August, 2013

16:30 - 17:45

10D.1 | **Designing a map using Open Data coming from different sources. Methodology, problems and solutions concerning the 1:100.000 map of Prefecture of Magnisia, Greece** (#445)

C. Boutoura[1], A. Tsorlini[2,1], V. Zografopoulou[1], E. Tsipis[1]

[1]Aristotle University of Thessaloniki, Department of Cadastre, Photogrammetry and Cartography, School of Rural and Surveying Engineering, Greece; [2]ETH Zurich, Institute of Cartography and Geoinformation, Department of Civil, Environmental and Geomatic Engineering, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\399_proceeding.*

There are a lot of parameters which should be taken into account when designing an accurate printed paper map, useful and easily read by all its future users. The main concern in the map compilation is to ensure the reliability of its geometric content in combination with its geometric infrastructure i.e. map scale, geodetic and projected reference system, by the evaluation and the homogenization of the available geometric and thematic features, which are going to be used. On the other hand, map design is also significant, meaning typology, symbolism (colours, symbols, typefaces) used for every feature in the map, as well as the layout for printing. Map production using digital cartographic methods and techniques, having as goal not only the digital composition and presentation of the maps, but also their high quality printing has started in the Department of Cadastre, Photogrammetry and Cartography of the School of Rural and Surveying Engineering of Aristotle University of Thessaloniki (Greece) since the mid 1990's and continues until today, giving specific emphasis on the production of standard sheets of the country's prefectures in scale 1:100.000. The geometric background used for the composition of these maps was principally the paper 1:50000 (1974-1980) map sheets compiled by Hellenic Military Geographical Service, which were scanned, georeferenced in its projection system, digitized and then, corrected and updated from other more recent sources, usually from satellite images covering the area. Recently, digital geodata produced by different public services is provided free, online, to users through the National Geospatial Infrastructure, a system established by the National Cadastre and Mapping Organization, in the frame of INSPIRE – Infrastructure for Spatial Information in Europe. In this paper, the production of the prefecture of Magnisia map, in scale 1:100000 is presented, based not only on the existing topographic map sheets by Hellenic Military Geographical Service and on other maps or satellite images, but also on the recently available geodata provided digitally through the National Geospatial Infrastructure, emphasizing to the importance of (a) the initial evaluation of the accuracy and the reliability of geodata coming from different sources, (b) the necessity of their correction and update, based on other maps or satellite images and (c) the transformation of all data in a common projection system. For this reason, a geodatabase was built, in order to store the updated data correctly, in a uniform projection system, aligned properly to each other. Various difficulties encountered in every step of the procedure are reported together with the solutions provided in each case, in order to get finally a map in scale 1:100000, geometrically accurate (as its scale requires) and graphically "readable", depicting the physical characteristics of the prefecture highlighting areas of special environmental interest.

magnisia_map.jpg:
Map of Prefecture of Magnisia, Greece in scale 1:100000

10D.2 | **Legal Issues in Czech Cartography in Relation to the International Cooperation** (#776)

A. Vondráková

Palacký University Olomouc, Department of Geoinformatics, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\346_proceeding.*

The aim of the activities of many professional societies and initiatives of individuals in the field of cartography and geographic information systems (GIS) is to clarify the issue of copyright law. There was realized a research focused on the legislative framework for the field of cartography and GIS in the Czech Republic with regard to the international cooperation. Also there were defined non-legislative aspects dealing with legal issues such as historical or ethical issues. There is defined the current situation in the area of author's law in the field of cartography and GIS in the Czech Republic, characteristics of copyright, the definition of basic concepts and historical context from which problems can originates. Copyright protection in the Czech Republic is generally on a very high level, but the area of cartography and geoinformatics is not sufficiently detailed and addressed in the Czech legislation. This has resulted in different interpretations of laws and worse enforcement rights of the author. Similar approaches are in the countries of the European Union and in the countries where it the Berne treaty has been ratified. In the work there are also included case studies. These cases relate to the use of cartographic products and the geographic information system in the comparison with current legislation. They are commented where there are conflicts with copyright law or where are violated only a matter of ethical-moral principles or socio-cultural rules. Discussion suggests concrete ways to solve certain problems and can become as an inspiration for legislative adjustments to existing copyright laws. There are presented some topics for further investigation - for example whether it would be appropriate to release the copyright for the spatial component of the state map series, or whether the issue of copyright in cartography and geoinformatics is addressed by the copyright law sufficiently. Any impact on the production of cartographic and geoinformatic works can have a planned provision in the new Czech Copyright Act relating to public licenses. This provision is inconsistent with the principle of open source licenses, which aimed to simplify the publication and use of works without the influence of collective management of copyright works. Printed cartographic production can be influenced in the event of approval of the amendment, because the published version will include the provision establishing a new way of charging for printers and photocopiers. On the contrary, digital cartography and geoinformatic products on the internet may involve restrictive measures on the Internet. Cartography and Geoinformatics is developing very quickly, on the basis of new needs and new knowledge as well as to the advent of new digital and information technology. To ensure the inviolable protection of copyright works in printed or digital form is basically impossible. Therefore, rather than a restriction, on the future applicability and enforcement of copyrights of geoinformatic and cartographic products should have the status and attitudes across society. So what should not be generally tolerated by companies, there will be the applicability of copyright definitely higher than in the situations where the violation of copyright law protection take for granted that nobody should be surprised.

10D.3 | **Formalization of cartographic edition rules to automate topographic maps quality control** (#1292)

A. de Las Cuevas Suárez, A. Maldonado Ibáñez, J. García García, J. González-Matesanz, J. Hernández Enrile

National Geographic institute, Madrid, Spain

A full-length version is available and can be opened here:

_extendedAbstract\392_proceeding.*

Nowadays edition tasks are laborious but, at the same time, an essential job done by a cartographic institutions when publishing its maps. The objective of these tasks is to detect and to solve some of the cartographic edition mistakes such as misunderstandings, difficult interpretations, incongruities or lack of cartographic elements.   At the National Geographic Institute of Spain this meticulous work is carried out by cartographic operators with a high knowledge in map edition. Acquiring this knowledge requires a large process of learning, which is only achieved through many years of experience in this specific work. It is a fact that just a few experienced people are able to satisfactorily review maps, furthermore this labour takes too much time for each map.   For this reason, IGN has decided to start a new project which will be applied to the MTN25 reviewing: formalizing edition rules with the help of expert operators, in order to be further implemented in a automatic revision process.   The present paper aims to describe how we are conducting this experiment, which has mainly the two following results: On one hand, the gathering and formalizing of the operator's knowledge about map revision. Until now this knowledge hadn't been defined in any systematic way, and it used to be transferred in a spoken way from the expert operators to the apprentice ones. And on the other hand, automatic map revision leads to an objective and harmonized result, as well as it decreases the production times. We are carrying out our challenge through the execution of the following stages: (1) Meetings and interviews: edition knowledge is collected from the cartographic operators in this first stage. (2) Defining rules: Rules are defined from the transmitted knowledge by means of criteria evaluating the cartographic elements. (3) Quantifying criteria parameters that measure the criteria fulfilment over a map (i.e. distances, overlaps areas, tolerances) (4) Implementing the defined rules in a software application (FME). (5) Feedback: Cartographic operators check the implementation, evaluating how the automatic revision works, and proposing changes in the rules and parameters. (6) Loop to stage three until the implementation satisfies the operators. Then it is an iterative process which calibrates the parameters characterizing the rules.   Currently more than 100 rules have been defined to evaluate some aspects of a map, such as the legibility (i.e. element overlaps), aesthetic (i.e. dispositions and distances between elements), or the lack of and excess or incoherencies in the information.   These rules have been classified in eight kinds of errors, such as "Distance" (i.e. a river not going through a watercourse), "Overlaps" (i.e. Overlap between cartographic symbols), "Disposition" (i.e. bad situation of a text regarding to its corresponding element), "Completion" (i.e. high density of elevation points), "Shape" (i.e. symbols not keeping the correct proportions), "Format" (i.e. bad written texts), "Orientation" (i.e. symbols with a wrong orientation), "Categorization" (i.e. text with a incorrect font according to its classification).   About 80 rules have been implemented up to the current moment, and they are included in the production process.

ORAL

Session S10-E

Globes

Wednesday, 28 August, 2013

16:30 - 17:45

10E.1 | **Maps vs. Globes - Distance Estimation on Flat and Spherical Displays**

(#599)

F. Hruby[1], A. Riedl[2]

[1]University of Guadalajara, Department of Geography, Mexico; [2]University of Vienna, Department of Geography and Regional Research, Austria

A full-length version of this contribution has been published in: KN (Kartographische Nachrichten), Vol. 63, Number 4 (Summer 2013), Pages 205-209

Understanding spherical displays as platforms for visualizing geospatial data has gained increasing importance due to recent developments in the software and hardware (e.g. hyperglobes) sector. However, there is still a lack of empirical analysis of the advantages of spherical compared to flattened representation (i.e. of globes to maps). This article presents a study comparing distance estimates on spherical and flat displays: participants memorized object positions on a spherical and flattened layout, then participated in recall and distance estimation tasks. Ordered-tree analysis was used to break down the spatial structure of the positions memorized. The results indicate that flattened layouts are learned faster than spherical ones but generate more problems in estimating distances correctly. Border effects reproducing map margins in the structure of spatial memory seem to cause - or at least contribute to - estimation errors.

10E.2 | **Hypsometric Globe of Mars – 3D Model of the Planet** (#610)

Z. Rodionova[1], J. Brekhovskikh[2]

[1]Sternberg State Astronomical Institute, Lunar and Planetary Investigation, Moscow, Russia; [2]Space Research Institute, Moscow, Russia

A full-length version is available and can be opened here:

_extendedAbstract\446_proceeding.*

10E.3 | **Virtual Globes Museum 2.0 – Adding the Power of Community** (#356)

M. Gede, Z. Ungvári, L. Zentai
Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\174_proceeding.*

10E.4 | **Lunar and planetary globes in the holdings of the Austrian National Library's Globe Museum.** (#212)

J. Mokre

Austrian National Library, Map Department and Globe Museum, Vienna, Austria

The Austrian National Library's Globe Museum is the only one of its kind in the world. Among its holdings there is a remarkable collection of old globes of the earth's moon and of various planets. This collection bases mostly on the former private collection of Dr. Karl Heinz Meine (1928-1993), a German cartographer, map and globe historian, and NASA collaborator. The *Meine collection* consisted of around 400 maps of the moon and of planets, and celestial charts, as well of 50 lunar and planetary globes. These globes were presented in the Globe Museum as a long time loan of the owner from 1980 onwards. The Austrian cartographic publishing house *Freytag-Berndt und Artaria* bought Meine's globes and donated it to the Austrian National Library' Globe Museum in 1988. In the same year, Dr. Meine donated the maps and charts of his collection to the Austrian National Library's Map Department. Subsequently, the Globe Museum enlarged its collection of lunar and planetary globes whenever possible with old but also with new objects. Today it owns 56 lunar and planetary globes: 43 globes of the moon, 1 globe of planet Mercury, 2 globes of planet Venus and 10 globes of planet Mars. After a short introduction of the Globe Museum as the world's only institution dedicated to collecting, studying and presenting to the general public terrestrial and celestial globes, globes of the earth's moon and of various planets, as well as globe related instruments (armillary spheres) and instruments in which globes are a component (planetaria, telluria, lunaria), the paper will give an overview of the development of lunar and planetary globes. Furthermore the most remarkable lunar and planetary globes, presented in the Globe Museum, will be discussed. Because the Globe Museum collects not only old and valuable but also contemporary globes, this paper could follow Jeanna Rodionova's contribution on the new hypsometric globe of Mars.

ORAL

Session S10-F

Maps and Society

Wednesday, 28 August, 2013

16:30 - 17:45

10F.2 | **Telling stories with web maps** (#865)

K. Field

Esri Inc, Redlands, United States

Both the London Olympic Games and the Presidential election in 2012 provided the impetus for official organisations, news media and individuals to turn the vast amount of data into map form in order to tell their stories. This paper explores some of the cartographic highlights (and one or two lowlights) that the Olympics inspired and how different cartographic approaches were taken to mapping the results of the election. There were some great maps on view and also some interesting trends emerging, particularly in terms of web maps and web maps used as infographics. During the summer of 2012 it was almost impossible to follow any Olympic coverage in person or through the media without seeing maps of some form or other from branded official products, innovative media mapping, individual efforts, mashups of live data feeds and everything in between. Maps were crucial to event planning, for transport, emergency management and to simply locate the new facilities for those lucky enough to have acquired a ticket. They have also been part of the ongoing story throughout the event as virtually every media outlet has used maps in a multitude of forms to report everything from the location of countries and athletes home towns, to world maps of medal counts that update as winners cross the finish line. Likewise, the Presidential election spawned a multitude of different maps that showed the results in vastly different ways. The ubiquitous red/blue choropleth map at State level was in evidence but yet others developed more nuanced maps that took account of differences in geography and the electoral college system. Maps have always been vehicles for story-telling and this paper shows how these events prompted different stories based on the mapping alone and how, crucially, the story could be told in different ways. For web maps/information graphics the Olympic Games and Presidential election provided a rich reservoir of potential for professional and amateur map-makers alike to get their creative juices flowing. Web maps were clearly the preferred choice of information dissemination and hard to beat given the ease of production and appetite for consumption of maps to present data created in rapid real-time. The rise of the online infographic is particularly apparent. Maybe we're seeing a move towards these more diagrammatic forms of mapped representation with increasing use of online as a way of publishing information? Perhaps the traditional mapped view of the world simply isn't seen as attention-grabbing enough to be the preferred choice any more. Certainly, with such short web surfing attention spans, the more visually stimulating you can make your map/infographic the stronger the chance people will stop, read and re-visit. This is a key dimension to web mapping and this paper reflects on the way in which design plays an important role in shaping the story. By the time we get to the 2016 Olympic Games in Rio and the next Presidential election in the same year, web mapping will have developed further and cartography will flex its creative muscles once more. Web mapping is helping to tell stories of such events more rapidly and more readily to a world eager to consume visualizations. They play an indispensible part of the modern mapping landscape and provide a powerful, compelling narrative.

10F.3 | **POLITICAL CONSIDERATIONS IN CARTOGRAPHIC MAPS** (#435)

H. Srebro
SURVEY OF ISRAEL, Tel Aviv, Israel

A full-length version is available and can be opened here:

_extendedAbstract\109_proceeding.*

Maps are graphic descriptions of the real world. Professional maps follow strict recognized rules. They express mathematic-geometric relations between the presentation of the features in the map and their location in the real world. In the far past before the development of the cartographic science, maps were kind of drawings that were not used for reliable measurements but for relative graphical description. Maps and image maps are important and widespread. Professional users of a map are interested in its geometric accuracy and in the glossary in order to understand the standards and rules used in the preparation of the map and the limitations of its use. Non cartographic charts and sketches that are sometimes used for propaganda or for illustrations are not discussed in this article. Cartography integrates today advanced technologies in the creation of maps. The outcome may be a physical map, a political map or a thematic map. This article deals with political maps and with political considerations in physical and thematic maps. The relevant basic factors characterizing a map include: a recognized grid of coordinates and a nominal scale to enable precise measurement of features on large and medium scale maps (small scale maps may use projections which keep some properties while distorting others); accuracy, following recognized standards; landscape features, the selection, richness, density, generalization and position of which define the quality of the map; map symbols, that represent real world features and other entities, the relative size, line thickness, color and position of which may influence strongly the interpretation of the map user; map generalization which distorts the nominal ratio between the real world and the map presentation diverging from the defined map scale; and the names and other verbal information which are very important regarding the political aspect of maps. The cartographer, editor or publisher of a map may give a political interpretation and definition of a territory by using cartographic means, including place names, symbols, colors, types of lines etc. The location on the map may also be very important. For example: the use of a different color of a territory on a political map will be interpreted as a different state (e.g. the states formed after the disintegration of the Soviet Union and Yugoslavia); the use of different names for the same territories by different publishers (e.g. Israel and Palestine, Falklands and Malvinas, Persian Gulf and Arab Gulf). Political interpretation on maps regarding boundary lines may be shown by marking a delimitation line or by the absence of it; by the location of the line on the map; by the marking of more than one line; by the symbol and type of line used in the map, whether it represents an international boundary or temporary line like a cease fire line or a line under dispute followed by a special remark. All these options are elaborated in the article and examples and illustrations of maps from all over the world are given. Maps are considered controversial evidence by International Courts and Tribunals. They are weaker evidence than agreed coordinates or agreed physical boundary markers. Their value increases in the absence of stronger evidence. Their value increases if they were accepted by both disputed states. Their value increases with reliability: larger scale and higher quality standards represent improved reliability. They should be contemporary with the relevant historic period. Old maps may lose sense along time because of poor quality and not being updated. The article gives examples of cases in which the value of maps as evidence was discussed and evaluated by ICJ and International Tribunals.

10F.4 | **Analysis of street names regarding the designation of cities** (#733)

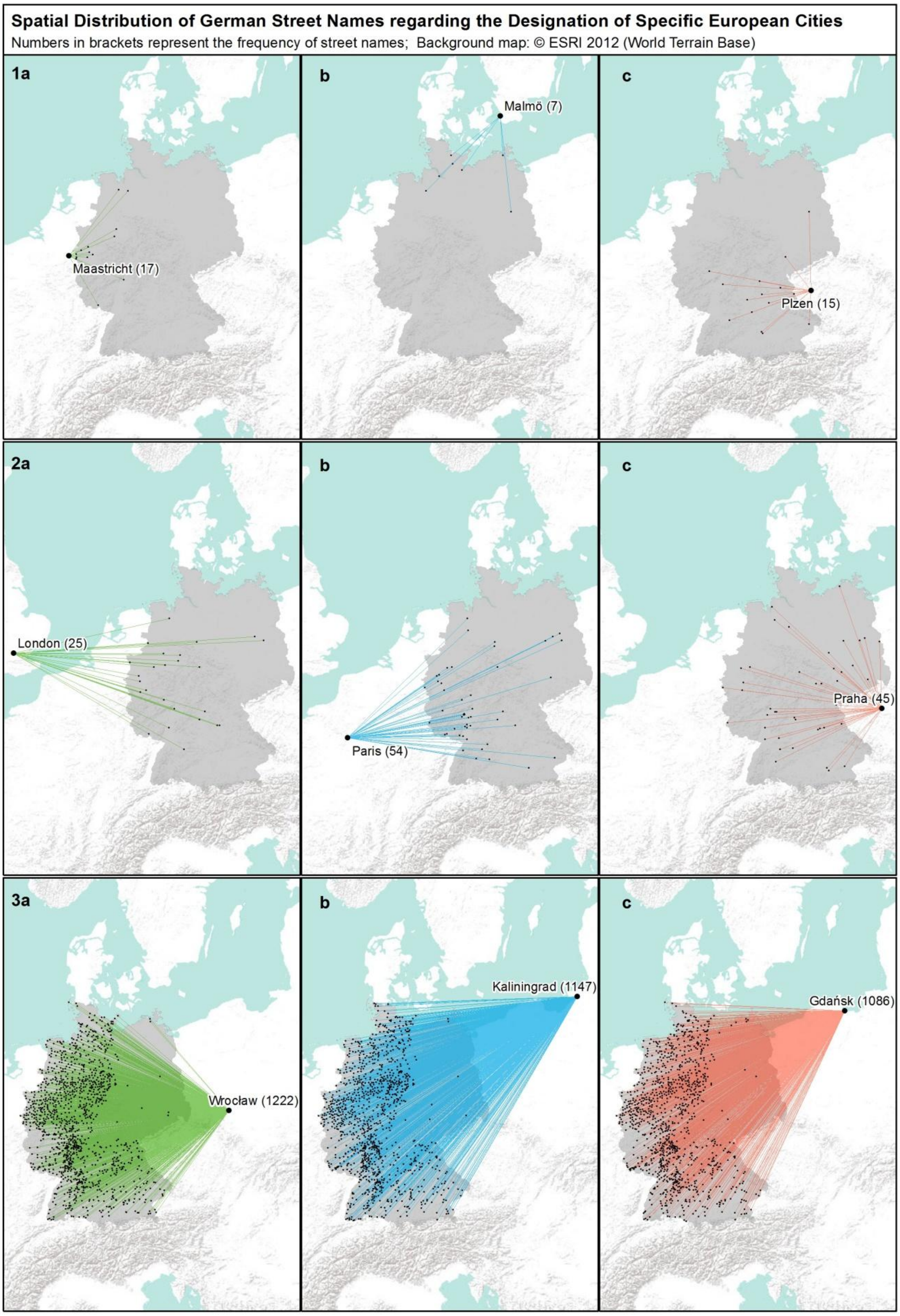
S. Thiel, K. Pippig, D. Burghardt

Technische Universität Dresden, Institute of Cartography, Germany

A full-length version is available and can be opened here:

_extendedAbstract\107_proceeding.*

"Everything is related to everything else, but near things are more related than distant things." (Tobler 1970) This citation, known as Tobler's first law of geography, is a well-recognised law within spatial science for analysing and describing spatial correlations. Motivated by this, we suggest that correlations between cities would be reflected in street names. Our research objective is the analysis of patterns and relations underlying the designation of European cities within German street names. We investigate if the designation of cities in street names is only determined by spatial proximity (Tobler's law) or if other factors (e.g. importance) influence the frequency of street names as well. Here, the central place theory by Christaller (1933) is considered. Christaller emphasized a hierarchical structure of places. Every place has a certain degree of importance, but central places of a higher order have more amenities and thus a surplus of importance. Applied to street names, it can be assumed that important cities are termed more frequently. OpenStreetMap was used as initial data for the analysis. All streets within Germany which are named after any European city were selected. Therefore, a list of all cities with more than 100,000 inhabitants was used as a gazetteer and ambiguities were revised. The revision was carried out interactively to assess ambiguities of streets with names of other places, rivers, or persons in the spatial context. In many cases, there exists semantic similarity between adjacent streets which refer to places of the same region. Based on the selected streets, the geospatial distribution of streets named after each city is determined automatically. It was possible to appoint, for example, where there is a "Pariser Platz" (Paris Sq), "Pariser Straße" (Paris St), or "Pariser Ring" (Paris Cir). The specific distribution patterns were analysed regarding the theories of Tobler and Christaller. As a result of the analysis, a distribution according to Tobler's law could be found, especially for smaller cities where their names occur primarily in municipalities located nearby (Fig. 1a-c). The influence of spatial proximity according to Tobler is superimposed by other factors like the degree of importance. Cities with a surplus of importance (Christaller's theory) are more frequently named in street names. Their spatial distribution is widely spread. Examples are London, Paris, and Prague whose distributions can be seen in figures 2a-c. Their names occur in many German streets, but the density of streets named after one of them increases with a closer distance to the respective city. In addition to our expectations, political motivation is a dominating factor in street naming and influences the frequency and distribution of specific street names. Former German cities like Wrocław, Kaliningrad, or Gdańsk (Fig. 3a-c) are widely referred to in street names in Western Germany; they rarely occur in Eastern Germany. The same applies to Eastern German cities. They are frequently mentioned in Western German streets, while Western German cities occur less often within Eastern Germany. This inhomogeneity can be explained by different political attitudes after WW2. Other influencing factors like bilateral or historical relations of cities (town twinning, university cooperation or connection via transport axis) are relevant only for selective cities and can be seen as noise. Summarizing, the anticipated spatial patterns could be identified; nevertheless, the political factor has important influence and is dominant for selective cities. It is assumed that political influence on street naming is also expected outside Germany. We assert that it can also be reflected in other applications of GIR. The results are usable, for example, for solving ambiguous street names: "Breslauer Straße" (Wrocław St) in Frankfurt refers to Frankfurt(Main) with a higher chance than to Frankfurt(Oder), although the latter is closer to Wrocław.



Figures 1-3:
Spatial Distribution of German Street Names regarding the Designation of Specific European Cities

ORAL

Session S10-G

Mixed Session

Wednesday, 28 August, 2013

16:30 - 17:45

10G.1 | **Illustrating Ubiquitous Data** (#1212)

N. - C. Fritsche

TU Dresden, Architektur, Germany

Mapping the world always poses one riddle: The more data, the harder it is to visualize it. The flood of data has to be processed, revised and updated. Accuracy and comprehensibility face each other. While cartography has always been producing a wide array of maps, now almost any information can, and often has to, be mapped. While it is generally accepted that information does not equal knowledge, it is the sophistication of cartographic tools that has to compete with, or against, tangibility. The poster child of these tools, the automotive navigation system, succeeds in two fields of consideration: information is crystallized and visually replenished for maximum appeal to a wide audience. One common way is to provide real-time 3D information whereas maps used to be 2D, and with rare reprints. Another way is to borrow from the arts, to delve into the spectrum between sophisticated diagrams of complex data and illustrations for children's books. From Pole to Pole, so to speak, is to mediate between sheer data, the geographic tool box and the average user. Is that to quote the semiotic triangle and other fundamentals of the cognitive sciences? Mediating poles should also aim at the user's capacity to comprehend cartographic data in various contexts. It confirms the two-way traffic in cartography, i.e., to generate data and to reverse engineer it for an ever-increasing range of applications.

10G.2 | **A DL-based Approach for Detecting Semantic Relations in Geo-Ontology Matching** (#245)

Z. He[1], A. Hu[2], J. Li[1], Q. Zhu[1]

[1]*Wuhan University, School of Resource and Environmental Science, China;* [2]*Ministry Of Communication of China, Second Highway Consultant Co. Ltd, Wuhan, China*

A full-length version is available and can be opened here:

_extendedAbstract\101_proceeding.*

Nowadays, geographic information is widely used to exchange and share within different application domains, and integrating different geospatial information between interoperating systems has become a hot topic in many scientific disciplines. However, owing to different data standards and incompatible terminologies for expressing spatial information in geographic information science (GIScience), it is not easy to establish shared explicit formal vocabularies in different sources. One of the main obstacles is semantic heterogeneity. Geographic ontology is an explicit formal specification of the conceptual model in geographic areas. It is regarded as a powerful tool to solve the multi-source spatial information semantic heterogeneity. To detect relations among geo-ontology entities, such as equivalence, subsumption, overlap and disjunction, has been the challenge of ontology research. Ontology matching produces mapping relations between elements of two ontologies and it is a basic problem in geographical information integration. At present, most studies are based on all kinds of semantic similarity between the semantic entities to measure ontology mapping relations. For instance, if the similarity between Ti and Tj is in close proximity to one, namely Ti and Tj are same in essence at recall high probability and satisfy synonymy relation; if the similarity between Ti and Tj is approaching zero, namely Ti and Tj must not satisfy the synonymy relation and inheritance relation, may be considered as two different concepts. Moreover, these measures are not sufficient due to only detecting equivalence relation of compared ontologies, these results also fail to take into account potential restriction conflicts, and syntax analysis and semantics reasoning techniques. In addition, evaluation studies have shown that general precision and reality can only cover a fraction of the semantic matching ontology involved and inevitably exists error-prone problems. Description logic, based on the first-order predicate logic, is a kind of ontology description formalized tool. This approach, which takes semantic interpretation as input, can avoid the grammar matching shortage of containing only equivalence relation .Therefore, relative to other measures, it can detect or compose relations among ontologies more accurately. This paper presents a DL-based method for detecting semantic relations in geo-ontology matching. First, a description logic knowledge base K is constituted by the TBox T and the ABox A, denoted as a pair K=(T, A), The TBox is an axiom set to induce the terminology, i.e., the vocabulary of an application domain, while the ABox contains extensional knowledge, i.e., some assertions and relations about named individuals in terms of this vocabulary. Take the fundamental geographic information for example, some vegetation types such as farmland, woodland, grassland and their embranchments all belong to TBox, but the settlement places such as Fa Si Town and Hu Si Town in the experimental area belong to ABox. Secondly, an algorithm of deciding ontology correspondence (such as equivalence, more general, less general, disjunction and overlapping) is designed, which is reasoned based on all kinds of concept relations. In this step, we restrict the semantic relation *rel* to be one of the relations form the set :{=,⊥,≤,≥,≌}.For example, rel{farmland, paddyfield}=≥means that *farmland* is more general than *paddyfield*; rel{tea garden, orchard}=≤means that *tea garden* is less general than *orchard*, rel{afforest land, slash}=≌means that *afforest land* is overlaid with *slash*. rel{bamboo forest, paddyfield}=⊥means that *bamboo forest* is disjoint from *paddyfield*. Finally in Eclipse environment, with the aid of Pellet reasoning machine, via Jena to call Pellet function to implement inconsistency check. The data of matching experiment based mainly on the fundamental geographic information data related to land use of China.

10G.3 | **USING ELECTION REGISTRATION DATA AS PROXY FOR MEASURING POPULATION MIGRATION IN SOUTH AFRICA** (#1216)

J. Maritz, J. Maritz
Senior researcher, Built Environment, CSIR, Pretoria, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\428_proceeding.*

Migration is an issue that remains critical for national- as well as regional policy agendas and government planning. Over time migration changes the demographic composition of towns, cities and regions which in turn requires adjustments to service- and infrastructure provision. The development of suitable policy responses requires reliable, comparable and timely information which in itself presents a problem as migration specific surveys at national scale does not occur frequently in South Africa. The most obvious previous sources of migration data was the national census (held every 10-years), as well as household- and labour surveys (*other surveys mostly extend to particular parts of South Africa*). Although socio-economic data has increased, it has not dealt well with migration. A recent research project conducted at the CSIR entitled the Integrated Planning Development and Modelling (IPDM) project explored the use of voter registration information as an alternative source from which migration proxy data can be extracted. Anonomised voter registration data was provided by the Independent Electoral Council of South Africa for several consecutive elections covering a 10-year period. The data, once spatialised (and related to voting districts), could then be processed to extract detail movements between subsequent election periods. The results were extremely valuable to identify mostly spatial migration trends over various time periods.   Analysis conducted during 2011/12 for a number of national government departments and institutions indicated a need for a more in-depth exploration of migration data particularly in understanding migration within the broader South Africa. The spatialised IEC proxy migration data has already proven to be extremely valuable (in the absence of other more frequent spatial data) for municipal /district planners to understand where migration and growth is taking place. This project activity proposed follow-up work be conducted to enable the IEC migration proxy data to be expanded to incorporate age and gender specific variables. At the national scale significant movements has also taken place as residents seek access to employment, and social services. The ex-homeland territories of South Africa still largely possess little opportunities for employment, whilst also lagging behind in public infrastructure and services. Since the end of apartheid there have been no limits to movement/relocation and it is speculated that a fair amount of migration from these areas to more developed towns, cities and metropolitan areas has occurred. The exact nature of this expected migration trend is not known – largely due to a lack of detailed or suitable migration statistics. The IEC migration proxy data does however allow for this analysis to be undertaken as it tracks voters between election periods. This paper applies a geospatial analysis to investigate the research question: "*What is the extent of spatial transition – specifically the movement to/from former homeland areas since 1999*?" Results obtained from this analysis are also compared with a number of other studies investigating migration. The spatial outputs provide new insights on migration trends during the last two decades since the end of apartheid.

10G.4 | **Mapping of the Landing Areas of the Soviet Lunar Rovers Lunokhod-1, -2** (#1090)

E. Gusakova[1], I. Karachevtseva[1], K. Shingareva[1], I. Nadezhdina[1], A. Zubarev[1], J. Oberst[1,2]

[1]Moscow State University of Geodesy and Cartography (MIIGAiK), MIIGAiK Extraterrestrial Laboratory (MExLab), Russia; [2]German Aerospace Center (DLR), Berlin, Germany

The Lunar Reconnaissance Orbiter data provide detailed mapping of the lunar surface. Using high-resolution images and modern GIS technology, we make comparisons with earlier data obtained after Soviet Lunokhods missions. **1.Introduction** The Lunokhods were a set of two Soviet robotic rovers which landed on the Moon more than 40 years ago. They were the first successful rover missions to another planetary body. The history of the Lunokhod missions came back into focus, when the LRO obtained high resolutions images (0.3-1.5 m/pixel). Using these data we mapped the landing site of Luna-17 (Lunokhod-1) and Luna-21 (Lunokhod-2) using GIS-tools. **2.Mapping of the Lunokhod Areas** Moon mapping is a rapidly developing activity for planetary cartographers. The main worksteps involve choosing the main cartographic data and mathematical basis, development of the cartographic symbols, and color scales, as described in this abstract. First, we orthorectified a number of LRO NAC images that covered the landing site areas, using the LDEM 1024 to MOON ME Coordinate System. In order to obtain a complete coverage of the Lunokhod-1 area (8 sq. km) one NAC image was sufficient, while for the large Lunokhod-2 area (172 sq. km) we had to use several LRO images. As a result we obtained a new coordinate-adjusted mosaic of the Lunokhod-2 area. Our next step was to digitize the traverses on the orthoimages *(Fig. 1)*. Full traverses lengths are in agreement with previous postmission published data (Barsukov et. al. 1978). Using selected DEMs (Lunokhod-1: DEM 0.5 m/pixel; Lunokhod-2: Kaguya DEM 7.5 m/pixel) we calculate various morphometric parameters, including topographic roughness and slopes, and created thematic maps of these parameters. Also based on DEM we developed hypsometric maps. We created a database *(Fig. 2)*, which contains crater coordinates, diameters, and depths. The crater data allow us to create maps of crater spatial density. **3.Morphologic Studies Based on a New Elevation Model** Our team has obtained a high resolution DEMs from LRO NAC stereo image pair covering the Lunokhods area (I. Haase, TU Berlin). The stereo image processing was done using methods and software as described in (Scholten et al.2012 and Zubarev et. al. (2012). The DEMs will allow us to carry out more detailed morphological analyses of craters (Basilevsky et al. 2012). It will contain a comparison of two craters data sets and allow to create morphological maps. **4.Conclusion** Data from the Lunokhod missions and new LRO information (Gusakova et al. 2012) can be used for mapping with high level of details and surface studies of landing sites for LUNA-GLOB and LUNA-RESOURCE. Our GIS analysis and the thematic maps allow us to generate a future electronic atlas of the Lunokhod landing areas.

5.Acknowledgements This work has been supported by a grants from the Ministry of Education and Science of the Russian Federation (№ 11.G34.31.0021 dd. 30/11/2010) and № 14.B37.21.1204 «Development of an integrated technology of determination the statistical characteristics of the relief of the planets and moons in the solar system based on DEM derived photogrammetric methods». Also, we wish to thank I. Haase for creating a LROC NAC DEM of the Lunokhod-2 final parking position.

References Barsukov V.L. et. al. (1978) Peredvijnaya laboratoriya na Lune Lunokhod-1, Vol. 2. *Nauka* (in Russian). Basilevsky A. et al. (2012) Identification and measurements of small impact craters in the Lunokhod 1 study area, Mare Imbrium. Abstract of 43-th LPSC Gusakova E. et al. (2012) Mapping and GIS-Analyses of the Lunokhod-1 Landing Site. Abstract of 43-th LPSC Gusakova E. et al. (2012) Cartography and Morphometric Analyses of the Lunokhod-2 Landing Site. Abstract of EPSC Zubarev A. E. et al. (2012), Features of creating DTM for Luna-Glob landing sites. (3M-S3), IKI Scholten et al. (2012), GLD100 – the near-global lunar 100 meter raster DTM from LROC WAC stereo image data, J. Geophys. Res. – Planets.

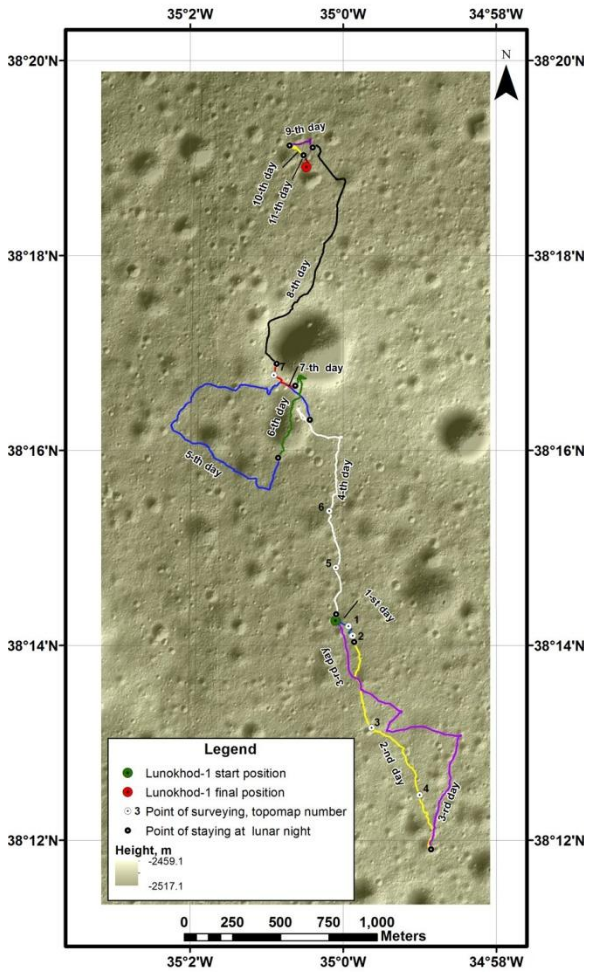


Figure 1.:
Base map of Lunokhod-1 traverse

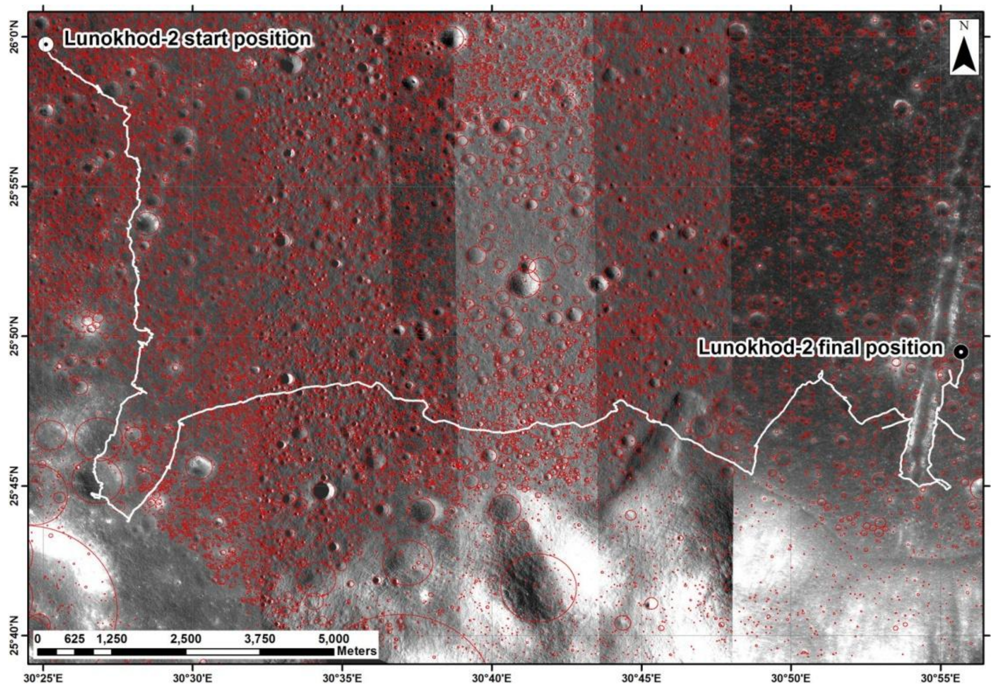


Figure 2. :
LRO NAC orthomosaic for the Lunokhod-2 area with crater database

Session S10-H

Business Meeting of the Commission on Cognetive Visualisation

Wednesday, 28 August, 2013

16:30 - 17:45

Session S10-I

Business Meeting of the Commission on Mapping from Remote Sensor Imagery

Wednesday, 28 August, 2013

16:30 - 17:45

PLENARY

Session KN-6

The Waldseemüller Map: A Present of Germany to the World

Thursday, 29 August, 2013

08:30 - 09:15

KN-6 | **"The Waldseemüller Map" - A Gift of Germany to the World** (#1392)

F. France

Library of Congress, Washington, D.C., United States

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 286

The Waldseemüller 1507 World Map was the first map, (printed or manuscript) to refer to America. It is sometimes referred to as "America's birth certificate" and was purchased by the Library of Congress in July 2001 from Germany. Johann Schöner (1477-1557), a Nuremberg astronomer-geographer had acquired an edition of the first printing, binding it into a volume with other maps. In 1901 Joseph Fisher, a Jesuit historian, who was conducting research in the library at Wolfegg Castle, Wurttenberg, Germany, discovered Schoner's book and the famous Waldseemuller Map. The copy at the Library of Congress is the only known survivor of the 1,000 copies of the map believed to have been printed. Due the extreme rarity of this precious map, the Library of Congress undertook two major initiatives to ensure its preservation. The exchange between the German Government and the Library of Congress required that the map always be on exhibit for anyone to view, and a large anoxic visual display encasement was designed to maintain a 20-30 year hermetic seal, protecting the document from environmental risks. Prior to encasement for display, the Library conducted hyperspectral imaging to capture extensive historical information for access by researchers and scholars.

ORAL

Session S11-A

Statistical Mapping

Thursday, 29 August, 2013

09:15 - 10:30

11A.1 | **Cadastral-based expert dasymetric system (CEDS) using census and parcel data** (#1190)

G. Strode, V. Mesev
Florida State University, Geography, Tallahassee, United States

A full-length version is available and can be opened here:

_extendedAbstract\315_proceeding.*

Population censuses are commonly aggregated and mapped as uniformly distributed areal census units. This causes a generalization of geographical patterns where occupied land is indistinguishable from unoccupied land. Many applications, including demographic profiling, calculation of appropriate populations requiring access to healthcare, and electoral districting can be measured more precisely if cartographic representations are more disaggregate. An example of disaggregate mapping is the dasymetric principle, which has been widely used to estimate the population of census tracts which are classified as occupied. These methods include simple areal weighting, centroid-based moving windows, land use interpolation from remote sensing and other more complex mathematical models. Each attempts to combine two or more data sets, redistribute population across known occupied land use, and some abide to the smoothing and mass-preserving principles pycnophylactic interpolation. However, many techniques are rigid by replicating choropleth maps in assuming uniformity across occupied space or by overly-reapportioning population and neglecting the underlying population distribution. Another limitation is that most dasymetric methods are implemented at single scales of census collection. The cadastral-based expert dasymetric system (CEDS) is a non areal weighting algorithm that interpolates census data with cadastral parcel data at multiple scales. In the US, the population census is reported at tract, block group and block level; and cadastral parcel data (sometimes referred to as taxlot data) contain information on land use type, number of residential units (*RU*), and number of square feet of living area (*RA*). The objective of CEDS is to estimate the population of a parcel. This is where: $POP_l = POP_c * U_l / U_c$ *POP*l = dasymetrically-derived cadastral parcel level estimated population POP_c = census population (at the tract, block group, or block level) U_l = the number of proxy units at the cadastral parcel level (*RU* or *RA*) U_c = the number of proxy units at the census level (*RU* or *RA* per tract, block group, or block level) The CEDS method calculates error rates for the number of residential units and square feet of living area. It then chooses the model that best fits each individual census polygon (across all three scales). The CEDS method has been tested on cadastral parcel data for the county of Hillsborough in the US city of Tampa in Florida. It has shown to perform well against many common methods of population estimation, and offers flexibility in terms of choice of predictive factor and scale of population information. Further testing is needed to explore the degrees of possible overestimating or underestimating, as well as applying spatial autocorrelation to identify erroneous clusters (especially at the urban-rural boundary). Various geo-visualization tools are also currently explored, including a hexagon tessellation which provides a more precise cartographic representation and the ability to perform multitemporal comparisons.

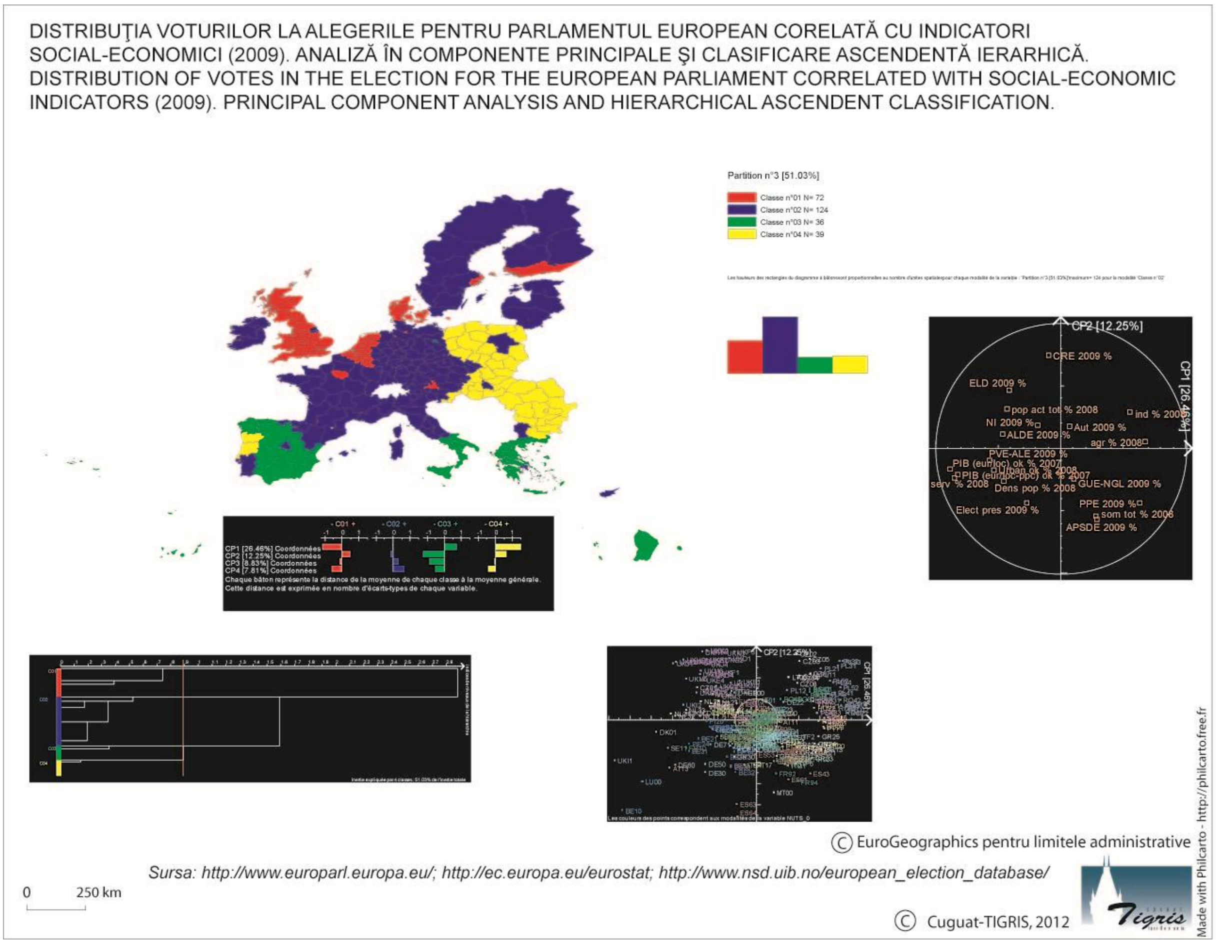
11A.2 | **Mapping the geographical electoral particularities. Case study: European Parliamentary elections (1979-2009) and National Legislative elections in Europe (1991-2010)** (#1247)

I. Boamfa, A. Munteanu
"Alexandru Ioan Cuza" University, Geography, Iasi, Romania

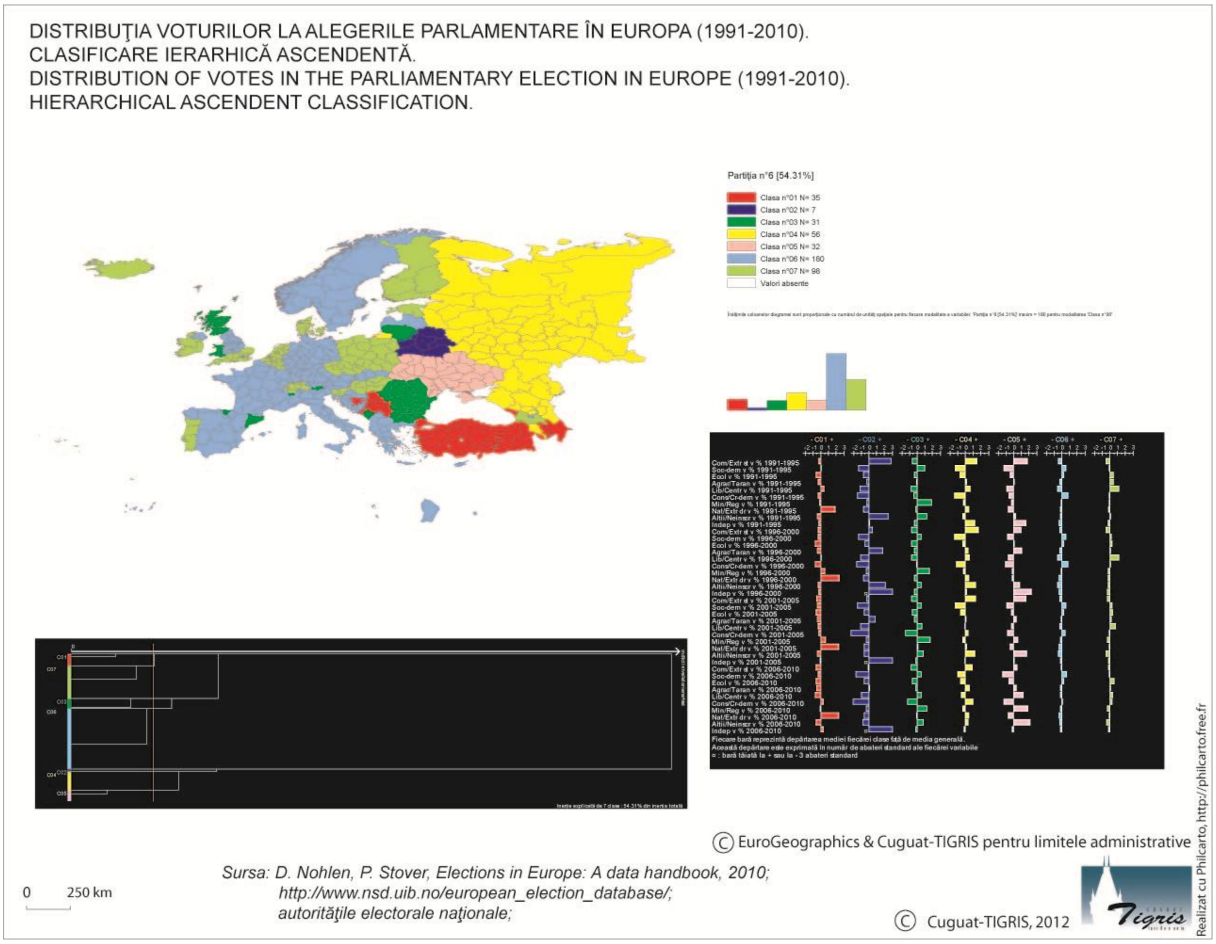
A full-length version is available and can be opened here:

_extendedAbstract\384_proceeding.*

This paper aims to highlight several mapping methods for the elections within European territory, whether for the European Parliament or national parliamentary polls. Generally, the spatial perspectives are given at NUTS 2 level or their equivalent for the countries that are not EU member states. The statistical databases used regarding the elections for the European Parliament were Eurostat's Annual Statistics Books for the years previous to 1989, the European Parliament's website for the following years and also the websites of the national election authorities. For the national parliamentary elections, the data sources were the national election authorities, the Social Science Data Services (NSD), Oslo, www.electoralgeography.com website and also the paper *Elections in Europe: A data handbook*, published by Nohlen and Stöver in 2010. The purpose of the study is to emphasize particularities of the European electoral geography for the national elections registered after the Fall of the Iron Curtain (1991-2010). The data for national parliamentary polls were processed for five-year election periods: 1991-1995, 1996-2000, 2001-2005 and 2006-2010. This method was used in order to analyze the regions of each European country in the same election cycle but also to offer a comparison between all election periods. The data were processed in Microsoft Excel and then used in different methods of mapping: graduated circles, thematic maps, hierarchical ascendant classification, principal component analysis and/or spatial distribution coefficients. Using several mapping methods allows observing the geographical features of the election process like the lower (gradually) turnouts in European Parliament and also in national general elections or the electors' diversification of political options (especially in the East part of the continent after the fall of the communist regime). The combination between principal component analysis and hierarchical ascendant classification emphasized another conclusion of the study related to the correlations existent between the indicated variables (low turnouts and variation of political choices) and different social, demographic and/or economic indicators like population density, share of urban population, GDP per capita in PPS, employment rate, professional structure of the population, unemployment rate, etc.).



Eur Parl 2009 ok:
Distribution of votes at the European Elections correlated with social-economic indicators (2009)



Pol options 1991-2010 ok:
Distribution of votes in the Parliamentary Elections in Europe (1991-2010)

11A.3 | **Dasymetric Mapping of Saskatchewan's (Canada) Population** (#585)

J. Siemer, A. Krahnen

University of Regina, Department of Geography, Canada

This presentation introduces the concept and techniques of the dasymetric method and its application to mapping population distribution and density of the Canadian Province of Saskatchewan. Today's society relies upon maps as an effective way of communicating spatial information. Maps are frequently used to display population distribution and density. Such maps are important for monitoring local and global population, but are also used in fields such as health studies and environmental justice, crime statistics, research on different social and racial groups, emergency planning and management, and accessibility to social services. Currently, the choropleth method is most commonly applied to map population density. A characteristic of choropleth maps is the abrupt change of displayed values at the enumeration unit boundaries. Thus, the application of the choropleth method is only appropriate for phenomena whose values change at these boundaries (*e.g.*, tax rates). Consequently, the choropleth method is inadequate for mapping phenomena whose real distribution is not reflected by the boundaries of administrative areas (*e.g.*, population density). Three the major problems of the choropleth method exist: first, there is a trend to use larger areal units for data collection and/or publication. This results in a simplification where both, unpopulated and populated areas are frequently combined in a single areal unit, producing underestimates of population density values. This leads to the second issue defined as generalization. When large enumeration areas are used, variations occurring within the choropleth boundaries cannot be shown and the true distribution of data values is lost. The third problem is known as the Modifiable Areal Unit Problem (MAUP) which refers to different results when one topic is mapped using different areal units. Research in thematic cartography has discussed the limitations and problems associated with choropleth mapping which was first applied in the early 19th century and quickly became one of the most popular cartographic mapping techiques. The dasymetric mapping technique is a less established thematic mapping technique for displaying statistical surfaces. Phenomena and variables that vary continuously over space are suitable to be displayed using this concept. The distribution of these phenomena such as population density is mostly independent from political or administrative boundaries. The dasymetric concept suggests that the distribution and density of population can be explained logically by using so-called ancillary data. By analyzing the relationship between ancillary data and population statistics, dasymetric maps are able to show distinct distributions, as well as peak values and local variations. Although there are numerous dasymetric mapping approaches, there is no standardized dasymetric method. Hence, a generally accepted valid relationship between ancillary data and statistical surfaces remains to be defined. Therefore the problem arises how to use statistical data (*e.g.,* census data), redistribute them to populated areas, and determine the population density of these areas. In this research the authors provide an overview of the most commonly applied dasymetric mapping techniques and their specific characteristics. These methods were evaluated for their applicability to mapping Saskatchewan's very uneven distribution of urban and rural population. Three methods (Binary Method, Intelligent Dasymetric Method and the Chinese Population Distribution Model) were selected and applied to a test area in Saskatchewan.

ORAL

Session S11-B

Usability 1

Thursday, 29 August, 2013

09:15 - 10:30

11B.1 | **Map design aspects, route complexity, or social background? Factors influencing user satisfaction with indoor navigation maps** (#905)

A. Lorenz[1], C. Thierbach[2], N. Baur[2], T. H. Kolbe[3]

[1]Technische Universität Berlin, Department for Geodesy and Geoinformation Science, Germany; [2]Technische Universität Berlin, Department of Sociology, Germany; [3]Technische Universität München, Institute for Geodesy, Geoinformatics, and Land Management, Germany

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 201-209

Indoor map design is an uncharted territory. Mostly, existing architectural floor plans are employed as visualization means, which do not fulfill cartographic requirements. In collaboration between geoinformation science and sociology, we develop and investigate cartographic methods for effective route guidance in indoor environments. Our evaluation's base are annual user studies during the "Long Night of Sciences" with more than 3,000 participants since 2009. In this article, we present our cartographic concept and show evaluation results, focusing on the discussion of different visualization forms varying in representational perspective and the integration of landmarks. Additionally, we compare the influence of map design aspects, route complexity, and demographic characteristics on the satisfaction of map readers.

11B.2 | **Moving Maps: The Relationship Between Mobile Maps and Scale** (#368)

R. Cammack

University of Nebraska Omaha, Geography and Geology, United States

With the widespread use of mobile mapping devices such a smartphones, tablets, laptops and navigational devices, the cartographic community must examine the relationship between the displayed map and the movement of the map itself. The research examines the fundamental nature of people and their rate of mobility. By considering a persons mobility rate, mobile maps can adjust to the human mobility rate and recreate the map experience that meets the prototypical map use. Map mobility is not a determinist characteristic to map use. Based on that understanding, map mobility considerations are based more on a probability approach. The most likely or best probability map use determines the beginning map display. This research explores previous work on determining initial map display and looks for new ways to collect and determine at the individual user level the preference for maps display based on the mobility of the map.

11B.3 | **Schematic Maps Based on User-generated Data Applied on Mobile Devices for Tourist Navigation Tasks** (#1396)

K. Pippig, D. Burghardt

Technische Universität Dresden, Institute of Cartography, Germany

A full-length version is available and can be opened here:

_extendedAbstract\15_proceeding.*

The ongoing progress in the field of mobile cartography opens up new perspectives for tourist-related applications and cartographic presentations. Mobile devices are nowadays well-equipped with multifaceted functionalities, which are used by different services, in particular location-based services. In addition, the development of web 2.0 causes a wide range of user-generated data: photo collections of Flickr and Panoramio, free encyclopaedias like Wikipedia, or free geodata like OpenStreetMap. These data can be made available on mobile map-based applications and likewise be used for touristic purposes on mobile devices; nevertheless, in most cases an adaptation of the content to specific thematic issues is rarely taken into consideration. Users are faced with a lack of an adequate selection of theme-relevant information. Moreover, basic cartographic principles are often not considered and maps are not designed for small displays of mobile devices. This paper addresses the issues of theme-adapted navigation and visualisation on mobile devices. We highlight the entire processing chain (in analogy with a visualisation pipeline) ending up in a mobile application of tourist navigation on user-generated data. Thereby, we focus on the extraction of user-generated data (1), the filtering of these data and their preparation for tourist navigation tasks (2), and the visualisation on mobile devices (3).

1. Within our approach, diverse sources of user-generated data are used and combined to extract tourist-relevant information. Via Flickr and Panoramio, relevant places and frequent sightseeing tours are mined from geo-referenced photos and photo collections, respectively. Explicit information in terms of tags and photo statistics (e.g. number of views) is analysed as well as implicit information arising, for example, from spatial-temporal behaviour of users. Furthermore, Wikipedia is used and provides, on the one hand, geo-referenced articles and, on the other hand, articles of domain-specific vocabulary. Thus, important information about places by geo-referenced articles is implicitly gained and this information is semantically enriched with other non geo-referenced articles. Thereby, a semantic similarity determination is applied.
2. The data filtering is carried out for tourist navigation tasks in general and for an individual theme route planning in particular. Theme-related routes can be computed based on a thematic continuum which is derived from photo densities of Flickr and Panoramio, and a ranking of semantic similarities of Wikipedia articles. By applying individual theme routes, user-requirements can be met as the user can self-define the theme and, thus, the route.
3. The focus of visualisation techniques on mobile devices is set on schematised map presentations. Schematic map presentations are a suitable way to display reduced information amount without losing the purpose of navigation. As shown in user studies, schematic maps are useful in way-finding, for example within urban areas, and as equally effective as topographic maps for specific tasks. On this basis, different schematic presentations in different scales are developed. Amongst others, an egocentric, time-distorted representation of hiking paths is designed taking into account previous filtered information on time requirements from user-generated data. Likewise, representations of hiking paths in terms of a transportation network plan are designed as well.

An own user study will be carried out on the usability of these schematic map presentations for hiking purposes. The results will also be presented on the ICC 2013.

11B.4 | **Introducing Usability Heuristics for Mobile Map Applications** (#1175)

L. Kuparinen[1], J. Silvennoinen[2], H. Isomäki[2]

[1]*University of Jyväskylä, Department of Computer Science and Information Systems, Finland;*
[2]*University of Jyväskylä, Department of Mathematical Information Technology, Finland*

A full-length version is available and can be opened here:

_extendedAbstract\424_proceeding.*

Currently the usability problems concerning mobile map applications are not taken properly into account. The problem is that the existing usability heuristics are not suitable for evaluating specific problems that occur in the mobile map applications. For instance, in the area of geovisualization, following research themes concerning usability have been pointed out by Slocum et al. (2001): geospatial virtual environments, dynamic representations including maps, metaphors in user interface design, and individual and group differences.   Typically, in the application development projects there are not enough resources to obtain the usability testing or other user-centered design methods, even though those methods would enhance the usability of the final application. The deficient solution is to use the usability heuristics, which offer a discount usability engineering method for situations where there is no time for more complete usability investments. It has been stated that the domain-specific usability heuristics are more suitable for evaluating the usability of special applications than the widely used generic heuristics. Although domain-specific usability heuristics have been introduced for many fields there are no suitable heuristics for mobile map applications.   In this paper, a set of heuristics for evaluating the usability of mobile map applications is introduced. We have developed the heuristics by first exploring the present generic heuristics and testing the suitability of them for usability evaluation of an existing mobile map application. We noticed the deficiencies of the present heuristics keeping an eye on the development of the new domain-specific heuristics. By reporting the deficiencies and unsuitable items of the present heuristics and collecting design guidelines from the existing literature of designing mobile map applications, we formed the components of the usability heuristics for mobile map applications. Finally, the new heuristics for mobile map applications were tested by usability experts who evaluated the usability of a mobile map application with both the new and the old heuristic sets. The amount and types of the found problems with both, generic and the domain-specific heuristics for mobile map applications were compared to each other.   Because mobile maps consist of various special visual symbols and it is essential the user understands the meaning of them, a special attention is paid on the visual design of user interface of map applications in the new heuristics. Other aspects that are covered with the heuristics are: clear information about the user's location, unambiguous route guidance, map scalability, adaptability of visible information depending on the device's screen size, up-to-date maps, application customizability to support user's personal interest (e.g. POIs), connections to the social media keeping privacy in mind, and use of shortcuts to save important locations.   The hypothesis is that with the new set of usability heuristics for mobile map applications more usability problems are found than with the generic usability heuristics. The hypothesis will be tested and the results reported in the final paper.   Slocum, Terry A., Connie Blok, Bin Jiang, Alexandra Koussoulakou, Daniel R. Montello, Sven Fuhrmann, and Nicholas R. Hedley. 2001. "Cognitive and Usability Issues in Geovisualization." *Cartography and Geographic Information Science* 28 (1): 61–75.

ORAL

Session S11-C

Generalisation of Networks 2

Thursday, 29 August, 2013

09:15 - 10:30

11C.1 | **A practical experience on road network generalisation for production device** (#201)

J. Renard[1], S. Rousic[2]

[1]*IGN France, COGIT Laboratory, Saint Mandé cedex, France;* [2]*CETE Méditerranée, DCEDI/AGIL, Aix-en-Provence cedex 03, France*

A full-length version is available and can be opened here:

_extendedAbstract\81_proceeding.*

Background and objectives Cartographic generalisation aims at adapting the content of geographic data depending on their scale, to ensure the legibility of a map while preserving its main characteristics. In case of a whole road network, reducing the scale of a map implies many generalisation operators to make the network sensible and readable at the final scale, among them road structures detection and collapsing, and road selection. CETE Méditerranée maintains a road network database named RGC (High Circulation Roads) at a high level of detail. They need to derive this database at a lower scale – for national coverage – through a whole generalisation process. To solve this issue, CETE has collaborated with COGIT Laboratory to use their road network generalisation processes, which could therby be tested and improved through a real issue in a context of production device. **Approach** A whole process has been tested to generalise RGC road network, through different stages. The first stage focuses on roundabouts detection and collapsing. Detection is based on compactness of topological faces of the network, then on small triangular faces for branching crossroads. Collapsing finally consists in reconnecting the external roads of the roundabout while deleting the internal roads. The second stage deals with dual carriageways detection and collapsing. Detection of dual carriageways separators is based on elongation and compactness of topological faces, depending on their convexity. Collapsing consists in constructing a skeleton of these separators through a triangulation and replacing the dual carriageways by a single road based on this skeleton. Slip roads are then reconnected. The third stage concerns road selection, to keep only major and significant roads. It is based on road strokes construction and shortest paths computation in the whole network, to determine which roads are probably useful compared to others. It is sensible to note that the original data is already widely selected, so only a few roads should be deleted at this stage. **Results** The first experiments have been carried out with the existing algorithms, which only takes into account the geometry and the topology of the road network. The results were not good enough to be integrated in a production workflow. Nevertheless, results were significantly improved by taking into account the semantic structures of the data, allowing for instance to treat roads one by one through their names and numbers. The dependence to the data schema to perform a good generalisation is an interesting issue to be considered, and probably the most sensible contribution of this work. In terms of effectiveness, 95% of the roundabouts are detected and correctly collapsed. Almost 100% of the dual carriageways are correctly detected, the errors remaining being due to a lack of precision in the data. Collapsing dual carriageways gives satisfying results, with possible improvements in properly reconnecting the extremities of generalised roads, and overall in generalising interchanges as global structures. Road selection through shortest path computation seems to be sensible, but the tests have not been carried out as far as possible. **Conclusion and future work** Processes and operators that have been tested seem to be strong enough to support a production device, but still need to be improved to be able to perform a perfect result on 100% of the road network, especially for dual carriageways collapsing which is not totally satisfying. Anyway, the most important conclusion of this work is probably that road network generalisation algorithms based on data geometry need to be adapted to the data structure, including semantics, to be really powerful and relevant. This observation should lead us to question how to conduct generalisation research. **References** Touya G. (2010), *A Road Network Selection Process Based on Data Enrichment and Structure Detection*, Transactions in GIS, Volume 14 Number 5, 595-614

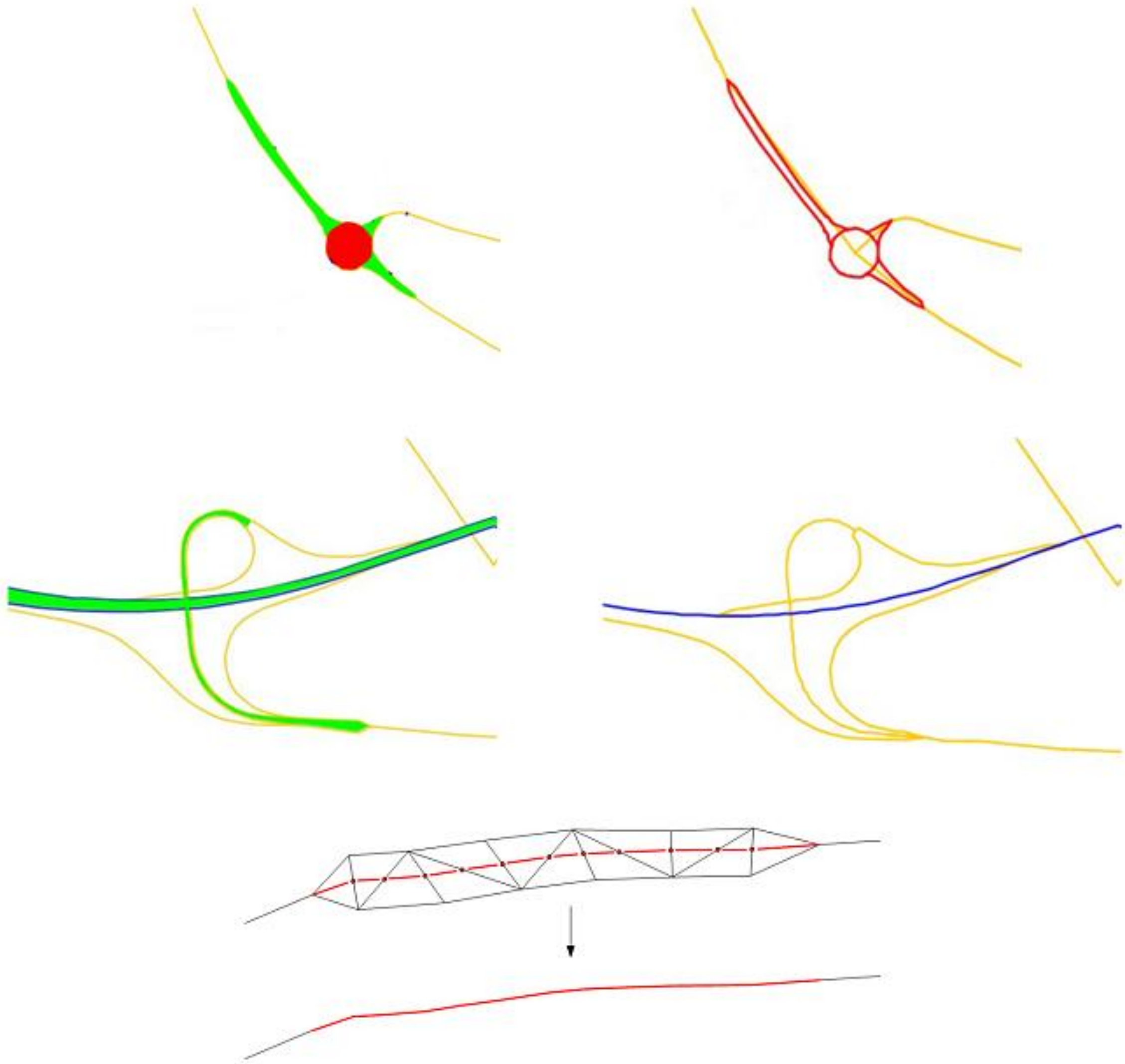


Figure 1:
Examples of road structures detection and collapsing

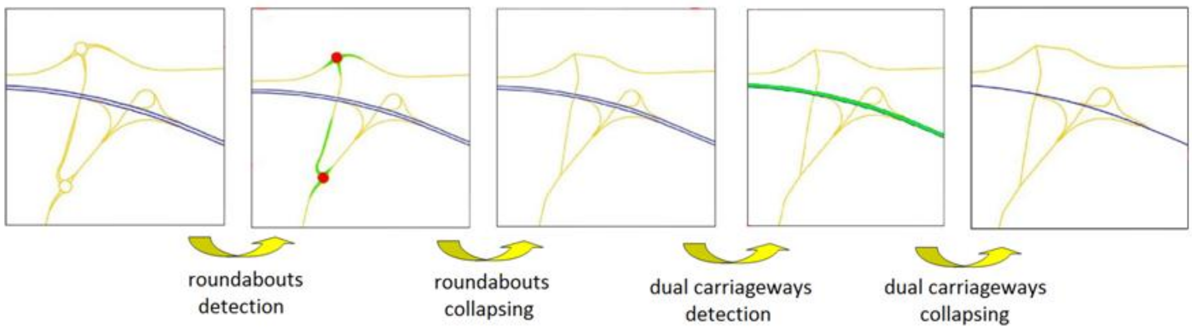


Figure 2:
Overview of different stages of the whole process

11C.2 | **Automatic Enrichment of Stream Networks with Primary Paths for Use in the United States National Atlas** (#584)

B. Buttenfield[1], L. V. Stanislawski[2], C. Anderson-Tarver[1], M. J. Gleason[1]

[1]University of Colorado, Geography, Boulder, United States; [2]United States Geological Survey, Center for Excellence in Geospatial Information Science, Rolla, United States

A full-length version is available and can be opened here:

_extendedAbstract\238_proceeding.*

Hydrography comprises a commonly included vector layer in topographic base mapping. It is highly sensitive to scale change. The National Hydrography Dataset (NHD) represents natural and human-made surface water features for the United States. Two versions are distributed by USGS for use at 1:24,000 (24K) and 1:100,000 (100K). The NHD reprsents surface water including natural and human-made hydrographic features. USGS is undertaking a multi-year project to generalize 24K NHD for mapping scales of 1:1million (1M) and smaller, for base and thematic mapping. The 24K data does not include a specific feature class or attribute that identifies primary stream paths through the flow network. These are cartographically important at larger scales, to establish connectivity among water polygons and flowlines. At smaller mapping scales, a generalized primary path may substitute for the entire network. The goal is to generate an automatic workflow and assess the degree to which the set of primary paths generated from 24K data reflect 1M content and geometry.   Primary paths cannot be derived from raster DEMs for this project, as the channels and reach codes must match 24K NHD flowlines to link features in the two databases; thus primary paths must be delineated directly on the vector data. Stream order is one metric commonly utilized to delineate primary paths through hydrography (Merwade et al 2005). The vast geographic footprint and irregular update cycle make comprehensive attribution of stream order difficult in the 24K data. Automatic delineation of primary paths calls for database enrichment. Neun et al (2008) argue for enrichment as a labor-intensive yet mandatory processing step for generalizing vector databases. In landscapes where terrain is flat, or where flowlines approach coastal waters, stream networks may become complex, forming braids or deltas. The database enrichment must accommodate areas of complex channels and prioritize flowlines within them.   This paper presents a process of enrichment and generalization for automatic demarcation of primary paths through a complex stream network, in support of data production for the U.S. National Atlas. The work extends previous database enrichment for stream centerlines (Stanislawski et al 2007; Anderson-Tarver et al 2011; 2012). The use case involves 36 hydrographic subbasins spanning a 140,000 km2 region in the central United States. The subbasins vary in stream channel density and physiography (terrain and precipitation). Data will be enriched, ladder pruned to 100K and then to 1M, and then simplified. Resulting channels will be conflated with existing National Map channels to assess the generalization by comparing total stream length, average segment lengths, and amount of displacement, and establishing the extent to which these comparisons deviate across various landscape types.   **References** Anderson_Tarver, C. Gleason, M., Buttenfield, B.P., and Stanislawski, L.V. (2012) Automated Centerline Delineation to Enrich the National Hydrography Dataset. Proceedings GIScience 2012 Columbus, Ohio: Springer LNCS 748: 15-28 Anderson-Tarver, C. and Buttenfield, B.P. Stanislawski, L.V. and Koontz, J. 2011 Automated Delineation of Stream Centerlines for the USGS National Hydrography Dataset. Proceedings 25th International Cartographic Congress Paris France,   Vol 1: 409-423 Merwade, V.M., Maidment, D.R., Hodges, B.R. 2005 Geospatial Representation of River Channels. Journal of Hydrologic Engineering 10(3): 243-251 Neun, M., Burghardt, D., Weibel, R. 2008 Web Service Approaches for Providing Enriched Data Structures to Generalisation Operators. International Journal of Geographical Information Science 22(2): 133-165 Stanislawski, L.V., Finn, M., Starbuck, M., Usery, E.L., Turley, P. 2006 Estimation of Accumulated Upstream Drainage Values in Braided Streams Using Augmented Directed Graphs. Proceedings AutoCarto 2006, Vancouver, Washington

11C.3 | **A Novel Approach of Selecting Arterial Road Network for Route Planning Purpose** (#627)

H. Fan[1], H. Gong[2], Q. Fu[3]

[1]University of Heidelberg, Chair of GIScience, Germany; [2]Kotei Navigation Co.Ldt, Wuhan, China, China; [3]Tongji University, College of Surveying and GeoInformatics, Shanghai, China

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 119-138

The most of existing algorithms for road network selection are proposed for the visualization purpose. Hence, the connectivity of road network for route planning has rarely been considered in the previous works. In this paper, we propose a novel method of road selection, whereby decisive paths that distinguish the suboptimal route from the optimal one can be identified and added to the high-layer network which is formed mainly by the connectivity of the crucial cities. This benefits the improvement of vertical partitioning and finally the construction of a high-layer road network that allows the optimal route planning. A case study in Bavaria State, Germany, reveals the feasibility of the proposed approach.

11C.4 | **DETERMINING WEIGHTS OF PARAMETERS IN GENERALISATION OF RIVER NETWORK** (#1295)

A. Sen, T. Gokgoz

Yildiz Technical University, Geomatic Engineering, Istanbul, Turkey

A full-length version is available and can be opened here:

_extendedAbstract\333_proceeding.*

Map generalization operations concerned with the abstraction of the database come under the heading of “model generalization”, whilst the set of operations concerned with the optimal visualization of the selected data are grouped under “cartographic generalization”. Selection and elimination operation has primary importance in accordance with the key role such as reducing the data volume as a filtering and the term is often used interchangeably with the model generalization and database abstraction. Töpfer’s law is the only quantitative rule in the selection of the features, and the formula yields the number of symbols to be displayed, but it does not reveal which of the symbols should be chosen. The generalization of river network has to answer these questions: How many branches to be selected? Which channel is important? The Töpfer's law has answered the first question. But second question is not easy to answer. If the whole context of river network is not considered with geometric, topologic and semantic parameters, the abstraction will dramatically destroy the original structure. It may be useful to compare different datasets at different resolutions to determine the geometric, topologic and semantic parameters and priorities for the selection result. In this study, we used National Hydrography Dataset (NHD) which is a vector geospatial data layer of the National Map, being developed by the United States Geological Survey (USGS). Two different subbasins at 1:24,000-scale (24K) and 1:100,000-scale (100K) were chosen that represent different drainage patterns on which exist on hilly and flat terrains defined by drainage basin morphometric parameters. These two different subbasins: Pomme De Terre shows dendritic pattern and Santa Fe shows recurved trellis. In order to provide connectivity of network and hydrographic meaning, with reference to USGS Draft Standards for 100K NHD, the geometric parameters which are length and sinuosity; topologic parameters which are centrality measures, degree, closeness and betweenness, and the semantic parameters which are Horton based stream level, river type (intermittent and perennial) and lake intersection were used at 24K. We determined weights of parameters by calculating chi-square statistics and phi-coefficient. In order to calculate the weight of each parameter in terms of its contribution to the overall goal of selection, the correlations between a parameter and selection result assigned binary integers (0: eliminated; 1:selected) at target 100K were compared by chi-square test and phi coefficients. If there is a relation, the calculated chi-square statistic is significant and H_0 hypothesis, there is no relation, is rejected and the phi coefficient provides the strength of relation. The geometric and topologic parameters are in interval scale. However, semantic parameters and the selection results are in nominal scale. In order to evaluate in same scale, the length variable is categorized into two classes according to 100K NHD standards. If it is greater than or equal to 1.6 km, then it is assigned 1, else 0. The other interval scaled parameters are categorized by standard deviation. Finally, each numerical weight is calculated by normalization dividing each correlation with the sum of correlations. The determined weights of parameters are given in the following Table.

Parameter	**Pomme de Terre**	**Santa Fe**
Length	0.29	0.21
Sinuosity	0.13	0.09
Betweenness	0.20	0.20
Closeness	0.02	0.07
Degree	0.18	0.18
Stream Level	0.11	0.15
Type	0.04	0.03
Lake Intersection	0.03	0.07

ORAL

Session S11-D

Historical Cartographers and Their Work

Thursday, 29 August, 2013

09:15 - 10:30

11D.1 | **J.G. Lehmann´s system of slope hachures - an investigation on the quality of relief representation at the beginning of the 19th Century** (#672)

W. G. Koch

Dresden University of Technology, Institute for Cartography, Germany

A full-length version is available and can be opened here:

_extendedAbstract\265_proceeding.*

The occasion for focussing afresh on German Topographer and Cartographer Johann Georg Lehmann and his work was the 200th anniversary of his death on 6 September 2011. As is known, at the end of the 19th Century, Lehmann created a mathematically well-founded slope hachure system, which undoubtedly had a *paradigmatic effect* on the theory of the cartographic relief representation. The Lehmann system was included in all relevant textbooks, handbooks and dictionaries of cartography over the last 200 years. Before being published by G.A. Fischer, his work "Art of Topographic Drawing" was translated into French on the orders of Napoleon, then into English with the permission of the Duke of York. The depiction of relief in large- and medium-scale topographic maps was dominated throughout the 19th century by the more-or-less strictly applied Lehmann system. It was increasingly displaced by the combination of contour lines and shading only after the First World War. Further investigations showed, that Lehmann was active not only in topography and cartography, but also in a complex geo-scientific environment. Lehmann, however, developed primarily a scientific and mathematical justification of the system of slope hachures. By limiting the scale to the range between 0° and 45° and using steps of 5 degrees, readability was significantly improved compared to earlier representations. Since the hachures are also slope lines (plan projections of profile sections) between the contour lines (not shown), the slope of the terrain and the (projection of) the direction of fall are readable at any point in the map. The absolute heights have to be represented by additional data points. The hachures of adjacent rows are slightly offset from each other to better illustrate sloping zones. Lehmann was providing an optimal solution in relation to the typical relief conditions in central Germany (valleys cutting through plateau and hilly landscapes). At that time his new method was considered to be ideal for the military function of topographic maps and the technical options for reproducing maps (Papay, 2002). The new method was also associated with a form of standardisation. Advantages and disadvantages are clearly visible on visual observation and cartometric evaluation of Lehmann's original maps. The cartometric analysis was performed on six test areas near the city of Dresden. Here, in addition to the Saxon maps included (first) French map sheets with Lehmann hachures. These historical maps (situation 1813) are known only since 2010. These four related map sheets of the area around Dresden with a 1:30,000 scale were published in Paris in 1849. A comparison of the maps with the contents of the Saxonian mile sheets shows that these formed the basis for the French maps. Strikingly, however, a transformation of the hachures (parallel and cross-hatched) of the mile sheets into Lehmann slope hachures occurred. The reworking must be acknowledged as a cartographic masterpiece (Brunner, 2011). This review was been confirmed by means of cartometric studies and after comparison of hachuring and natural landforms on six other test areas. In many cases it became clear that the French depiction of the relief and inclines was done with remarkable precision. In addition, it was found that the depiction is really carried out exactly according the theory of Lehmann. It must be remembered that the new hatchuring is done in a much smaller scale – so in addition it was to solve a generalization task.

11D.2 | **Covert Mapping the Ottoman Empire: the Career of Francis Maunsell**

(#92)

P. Collier

Peter Collier, Portsmouth, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\14_proceeding.*

British military mapping in the Ottoman Empire started in the 1840s when Britain intervened to support the Empire in the conflict with Mehmet Ali, Pasha of Egypt. Further mapping was carried out during the Russo-Turkish War of 1877, when British surveyors under Colonel Home surveyed the approaches to Constantinople partly in anticipation of a need for the British to intervene militarily in support of the Ottoman Empire. Following the war, Home argued that Britain should instigate a mapping programme in the Ottoman Empire in anticipation of the need to intervene in any future conflicts between the Ottomans and the Russians. The British Treasury refused funding for the mapping, but the presence of British officers under Charles Wilson involved in reforming the Ottoman Gendarmerie, gave them the opportunity to commence covert mapping. A leading figure in subsequent covert mapping activities was Francis Maunsell, who used the cover of his role as a Military Attaché, or as an archaeologist to survey and map large parts of Eastern Anatolia. Based on his covert activities, in 1893 Maunsell produced a "Military Report on Eastern Turkey in Asia" which provided the geographical information needed by any force wishing to deploy in the area. Subsequently, Maunsell was able to draw on his own work, and that of the former military advisors to compile a 1:250,000 map of “Eastern Turkey in Asia” (IDWO 1522). These maps were unusual in being compiled in anticipation of a future need to intervene in support of the Ottomans against a Russian incursion through the Caucasus, whereas most previous British mapping was prepared in the face of an imminent threat. He was later employed in carrying out a survey of the railway between Haifa and the Hijaz Railway. This paper will discuss the work of Maunsell, and the maps he produced in the context of the political tensions of the time.

11D.3 | **Prague Atlas of João Teixeira Albernaz – Commented Comparasion maps from Guanabara Bay** (#315)

P. Menezes

Federal University of Rio de Janeiro, Geography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\234_proceeding.*

In 1994, with the cooperation of the Army Geographical Service of Czech Republic, it was possible to present by the first time, a manuscript of 17th century discovered in the Nostitz Library, in Prague, Czech Republic. There was intention of publishing a facsimile edition of this manuscript, having it been copied in microfilm for development of researches. Unfortunately it was happened the robbery of the document, in the National Museum of Prague, and until today it was not found. The work is anonymous, it was compared with samples of old Portuguese cartography, and finally deduced it authorship to the Portuguese cartographer João Teixeira Albernaz I. The manuscript, as an Atlas, is not a direct copy of any other one document published by Albernaz I, but it is an independent work. The dating of the document takes to the years of 1628 and 1640, due to some analyzed characteristics presented in several maps. This paper aims to present the Prague Atlas, its structure and main documents, as well as the researches accomplished on the documentation, which characterized the dating and authorship of the Atlas. In a second moment it will be presented a comparative study among the map of "*Demostraçaõ of Rio de Janeiro*", belonging to the Atlas, with other maps developed by Albernaz, such as: Carta do Rio de Janeiro, 1626; Carta do Rio de Janeiro, 1627; Descrição do Porto do Rio de Janeiro, 1630; Capitania do Rio de Janeiro, 1631 and Carta do Rio de Janeiro, 1640. The comparative analysis was developed through the graphic description, attributed geographical names, analysis of characteristic signs of João Teixeira Albernaz, as well as, identifying the map presented in the Prague Atlas as being of his authorship. In this way this work intends to increase some information more on this prominent Portuguese cartographer's work.

11D.4 | **Ptolemy’s World Map and Eratosthenes's Circumference of the Earth**

(#1460)

I. Tupikova

TU-Dresden, Lohrmann Observatory, Germany

A full-length version is available and can be opened here:

_extendedAbstract\442_proceeding.*

The relationship between the determination of the circumference of the Earth and the geographical mapping performed by Ptolemy in his *Geography* is discussed. It is shown that a simple transformation of the Ptolemaic coordinates to the (bigger) circumference of the Earth measured by Eratosthenes drastically improves the positions of the locations given in Ptolemy's catalogue. As a consequence, by comparing the recalculated positions of the identified localities with their actual positions, the very high precision of Eratosthenes' result for the circumference of the Earth is confirmed.

ORAL

Session S11-E

Rock Depiction and Relief Representation

Thursday, 29 August, 2013

09:15 - 10:30

11E.1 | **Solid Landscape Models in the 21st Century – A Balanced Approach**

(#1404)

J. Welter

Dresden University of Technology, Institute for Cartography, Germany

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 300

Cartography in general, and building solid landscape models in particular, requires an interdisciplinary set of skills in order to be done well. Traditional handcrafted construction methods provide quality results, but are extremely labor-intensive and therefore costly. Modern methods using DTMs and CNC milling are fast and accurate, but the finished models are visually less than optimal. Solutions are proposed using DTMs and CNC milling to create landscape models in which the initial shaping is done mechanically and the fine details are carved by hand. This 'balanced approach' to landscape modeling combines the time- and cost-advantages of modern digital technology with the quality of traditional handcrafted techniques resulting in highly accurate landscape models which still retain the artistic 'feel' of the human touch.

11E.2 | **Towards automating Swiss style rock depiction** (#1085)

R. Geisthövel

ETH Zürich, Institute of Cartography and Geoinformation, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\391_proceeding.*

The Swiss style of cartographic rock depiction produces monochrome line renderings incorporating shaded relief and aerial perspective effects for enhanced legibility of topography. Their creation and maintenance is an involved hand-craft requiring drawing skills and expertise in terrain morphology. Thus, automatic methods in support of the rendering process are desirable. Observing a cartographer manually rendering rock depictions reveals, that the actual drawing of lines and hachures is preceded by the implicit construction of an abstract, generalized terrain model. In consequence, automatic rock depiction is as much about terrain modelling as it is about hachure rendering. Algorithmic tools for creating Swiss style rock depictions based on raster elevation data will be presented, that build generalized terrain representations from the grid elevations applicable as a reference frame for guiding the placement and stylization of the hachures. Two modelling approaches will be explored, one using contour lines, with the other one using three-dimensional Voronoi cells as basic building blocks. The first method starts out from vector contour lines thinned by a constrained Douglas-Peucker point elimination, the constraints resulting from mutual line adjacency and proximity to ridge and valley cells obtained from the original raster data. From the resulting point set of all contour line vertices, a Delaunay triangulation is generated and a subset thereof designated as the set of skeletal lines. Taken together, contour and skeletal lines allow for the construction of a three-dimensional attributed vector representation of the terrain, that is suitable for the further processing steps of relief shading, i. e. partitioning the terrain into graded areas of light and shade, and the placement and modulation of rock hachures. The complementary Voronoi cell approach builds a terrain model by iteratively chopping off half-planes from a cube enclosing the grid elevations and subdividing at concavities, thus creating a collection of convex three-dimensional Voronoi cells. These lend themselves to the creation of rough, sketchy overviews of the major illumination conditions at small scales, as well as to modelling the distinctive triangular shapes of rock faces. Having thus constructed a terrain model, relief shading is applied by defining a major light direction and locally varying it to enhance contrast in areas of low light incidence. Gray-values are applied according to statistical distributions extracted from existing manually shaded relief maps. The whole procedure's output is a two-dimensional orthographic rendering of rock hachures, distributed along the edges and faces of the vector terrain model and possibly warped in the direction of an imaginary viewer in areas of steep slopes to be able to convey more detail. The wobbliness and density of individual hachure lines is derived from statistical distributions, again sampled from existing maps such as the Swiss national map.

11E.3 | **Digital Rock Drawing on Czech Topographic Maps: Present and Future Development** (#576)

J. Lysák, M. Traurig[2]

[1]*Charles University in Prague, Department of Applied Geoinformatics and Cartography, Praha, Czech Republic;* [2]*Czech Office for Surveying, Mapping and Cadastre, Land Surveying Office, Praha, Czech Republic*

A full-length version is available and can be opened here:

_extendedAbstract\142_proceeding.*

Methods for digital cliff drawing on large-scale Czech topographic maps produced by the Czech Office for Surveying, Mapping and Cadastre (Czech national mapping agency) are introduced and research on their future development is presented. The Czech Republic has hardly any high mountain peaks; the most common type of rock terrains are sandstone landscapes and outcrops on sides of valleys carved by bigger rivers. First, a brief historical overview and details of contemporary digital processing are described. It is based on a digital topographic database, where the rocky areas are represented as polygons, acquired from orthophotos, field work or early maps. During cartographic processing, these polygons are filled with slope-oriented lines resembling stylized hachures. Although they might not reach the clarity and beauty of the hand-drawn swiss-style rock portrayal, its production is by far not so time-consuming and can be done automatically to some extent. This method is currently used in digitally processed large-scale maps covering the whole area of the republic with more than 40,000 objects. Advantages, limitations and drawbacks of this approach are summarized. Recently, a new project of mapping hypsography of the Czech Republic using airborne laser scanning is in progress. Resulting products of the project - very detailed and accurate DTMs - contain more information than ever before, and so show a strong potential to improve cartographic representation of rocky terrains. To really utilise it, following questions have to be considerate: how to represent such detailed information about rocks in a digital topographic database and how to derive enhanced cartographic representation of rocks. Another big issue is, to what extent this can be done automatically. Suggested database representation is based on digitized upper and lower edges as well as on other structure lines, with an emphasis on generalisation and keeping essential characteristic of rocky terrain. This serves as the input for further cartographic processing, which is partially based on ideas from the late 1960s, used in topographical maps of sandstone areas in Saxony. Selected aspects of this cartographical processing are described, with focus on avoiding schematisation so often visible in contemporary representation. Designed algorithms for extraction of some features as well as for cartographic processing are mentioned briefly. Finally, experimental results from a sandstone landscape of National Park České Švýcarsko (Czech Switzerland) are presented.

ORAL

Session S11-F

Cartographic Education 1

Thursday, 29 August, 2013

09:15 - 10:30

11F.1 | **Intelligent Solutions Sustaining Urban Economies – Master Classes casestudy** (#787)

A. Ciolkosz-Styk[1], E. Goodyer[2], A. Wells[3], S. Dibnah[4], C. Edwards[2], S. Anand[5], M. Jackson[5], D. Convers[6], M. Baranowski[1], P. Kwiatkowski[1], J. Bouffier[7], G. Chirici[8], B. Lasserre[8], M. Corvino[9], F. Spallone[10], T. Raventos[3], M. Gruziel[1], H. - K. Saari[6], A. Groom[11]

[1]Institute of Geodesy and Cartography, -, Warszawa, Poland; [2]De Montfort University, Leicester, Great Britain; [3]University of Leicester, -, Great Britain; [4]Leicester City Council, Great Britain; [5]University of Nottingham, Great Britain; [6]Aerospace Valley, Toulouse, France; [7]Centre d'etudes Techniques de l'equipement du Sud Ouest, Bordeaux, France; [8]Universita Degli Studi del Molise, Campobasso, Italy; [9]E-GEOS SPA, Matera, Italy; [10]Sviluppo Italia Molise, Campobasso, Italy; [11]Infoterra Limited, Leicester, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\261_proceeding.*

THE ISSUE is a project within the Regions of Knowledge scheme funded through the European Commission's Seventh Framework Programme. THE ISSUE focuses on traffic, health and the environment to achieve intelligent solutions for sustaining urban economies by bringing together innovative research-driven clusters to coordinate European research and technology development in six areas. These comprise ITS; transport impacts on urban mobility; transport greening; intermodal regional transport; safety and security of citizens; and associated economic, health and environmental impacts. THE ISSUE project particularly addresses the use of space technologies from satellite remote sensing and navigation, as well as GIS and computer intelligence technologies in transport-related sectors. This paper specifically looks into the planned Master Classes program. THE ISSUE project comprises research clusters from the East Midlands Region in the UK, the Midi-Pyrenees and Aquitaine Regions in France, the Molise Region in Italy and the Mazovia Region in Poland. Each region has set up a three-way partnership between regional authorities, academic partners, and industry contributors working to draw together the industry and academic strengths in the regions and connect the research with the needs of managing traffic, transport, and air quality that the regional bodies are responsible for. The three-year project is supporting scientists, engineers and development agencies from the different regions to work together, using the latest space and information technologies, to develop more effective methods of easing road congestion and improving the urban environment. As part of THE ISSUE project "Master Class" knowledge exchange programmes will be developed using material from the earlier review of applicable technology and expertise within the THE ISSUE consortium. Two variants will be developed, one focussing on senior management and policy/strategy makers and the other with a focus on technical awareness and implementation. The "Master Classes" will be trailed and delivered through workshops for core partners and associates. The case studies, which will be part of the Master Classes, will present information on how cartography, GPS&GIS database applications, navigation and remote sensing are used in urban transport, health and air quality related data. The project is bringing together scientists, engineers, development agencies and bodies responsible for managing traffic, transport and air quality in four European regional clusters using advanced space and information technologies, to develop the most effective methods of easing urban congestion and improving the impact of transport on the local economy, urban environment, climate change and the health of citizens. These Master Classes materials will contribute for the exchange of knowledge and expertise in sustainable traffic solutions between academic, business and public sector partners within and across the five European regions.

11F.2 | **3D Cartographic Modeling in Educational Process** (#302)

T. Bandrova, S. Tzvyatkova

University of Architecture, Civil Engineering and Geodesy, Photogrammetry and Cartography, Sofia, Bulgaria

A full-length version is available and can be opened here:

_extendedAbstract\39_proceeding.*

The report considers 3D Cartographic modeling presented in Students' projects. They were created and developed in Laboratory of Cartography, University of Architecture, Civil Engineering and Geodesy, Sofia. Most of projects start to be realized in the last semester of Master degree of education and finish by diploma theses. The Laboratory is supplied by different software: CAD, GIS, image processing, map design and 3D modules of the most world famous software companies and the necessary hardware. The students are educated and informed about different technologies for 3D map making and they used the most suitable one for their purposes, needs and applications. The topics are mostly connected to 3D visualization of cartographic products. For example, some of topics are: Designing of 3D Map with interactive Internet application, 3D city mapping for Google Earth, 3D mapping for architectural applications. The last project is based on precise geodetic measurements and accurate modeling of the environment and the result gives possibility to architects to understand the territory better before new buildings modeling. The applied technologies contain several steps from data collection to final visualization of the cartographic product. The data capturing is connected also to geodesy skills of students. Very often the existing cadastral or topographic maps should be updated by geodetic measurement. This fact gives possibility for students to measure the 3rd coordinate of the mapped objects. Special decision in different areas of 3D modeling is found in every project: visualizing small objects as monuments with complicated shapes; situation of 3D model in Google Earth environment, choosing of suitable symbol system, including 2D symbols. The realization of such topics is not difficult if we have enough good and expensive techniques, hardware and software. Very often we need to find cheap and easy decision being part of diploma theses. Several decisions are discussed in the paper. Different technologies for 3D map creation are developed and presented in the paper. All of them give easy and cheap way for 3D map making as well as they are applied for different needs and users. The idea is to find way for 3D data capturing and processing and after that the steps for cartographic applications to be separated according user applications. Three of used technologies are presented and discussed. Symbol system, scale, generalization, object classification, virtual camera, lights, photorealistic texturing are discussed and defined in the context of 3D cartography. Most of these terminologies came from computer graphics and 3D techniques but their cartographic application gave new tasks to cartographers: they should be used for map creation, analysis and visualization but as well described in cartographic science. In this context, symbol system creation is explained and a technology for symbol system design is proposed. To have results of user understanding of presented information, questionnaires are prepared. Using the negative results from the questionnaire, the created 3D models or symbols were rebuilt and changed for better user understanding. Conclusions for future work and development of 3D cartography are presented.

3D map for architecture:
Students should find practical application of their 3D map. This model is used in Faculty of architecture for situation of new designed buildings

11F.3 | **Analyses of Visualization Methods of the Earthquake Catalog Mapping for Educational Purposes** (#898)

A. Pődör

University of West Hungary Faculty of Geoinformatics, Department of Geoinformation Sciences, Székesfehérvár, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\404_proceeding.*

11F.4 | **Perspectives on Developing Critical Human GI Capacity in a Developing Country Context** (#1403)

F. O. Akinyemi
Kigali Institute of Science and Technology, Faculty of Architecture and Environmental Design, Rwanda

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 451-460

The geospatial industry is experiencing unprecedented growth despite the global financial maelstrom. Consequently, the demand for manpower skilled in geographic information science (GISc) and technologies is great and this holds true both in developed and developing countries. Projections globally is that of a shortfall in the supply of geospatially skilled manpower. There is therefore the urgent need to develop a critical mass of geospatial specialists. In a developing country context as Rwanda, the awareness is high of the use of geographic information (GI) for economic development. Currently, every ministry is seeking to produce location based data and information in their respective domains. This is exemplified by the fact that GIS positions were recently created in the ministries. With increasing demand for GI personnel in both public and private sectors, there is need to develop GI human capacity. This paper describes strategies currently being used in geospatial manpower development in Rwanda. It reviews the state of available programs vis-a-vis the areas of need with the aim of highlighting gaps in existing curriculum. In addition to the regular or traditional model of course delivery, other options for training and educating geospatial personnel are discussed and recommendations made based on lessons learnt.

ORAL

Session S11-G

Planetary

Thursday, 29 August, 2013

09:15 - 10:30

11G.1 | **Interactive Visualization of Planet Movements for Highschool Education**

(#684)

S. Wondrak, L. Hurni

ETH Zürich, Institute of Cartography and Geoinformation, Switzerland

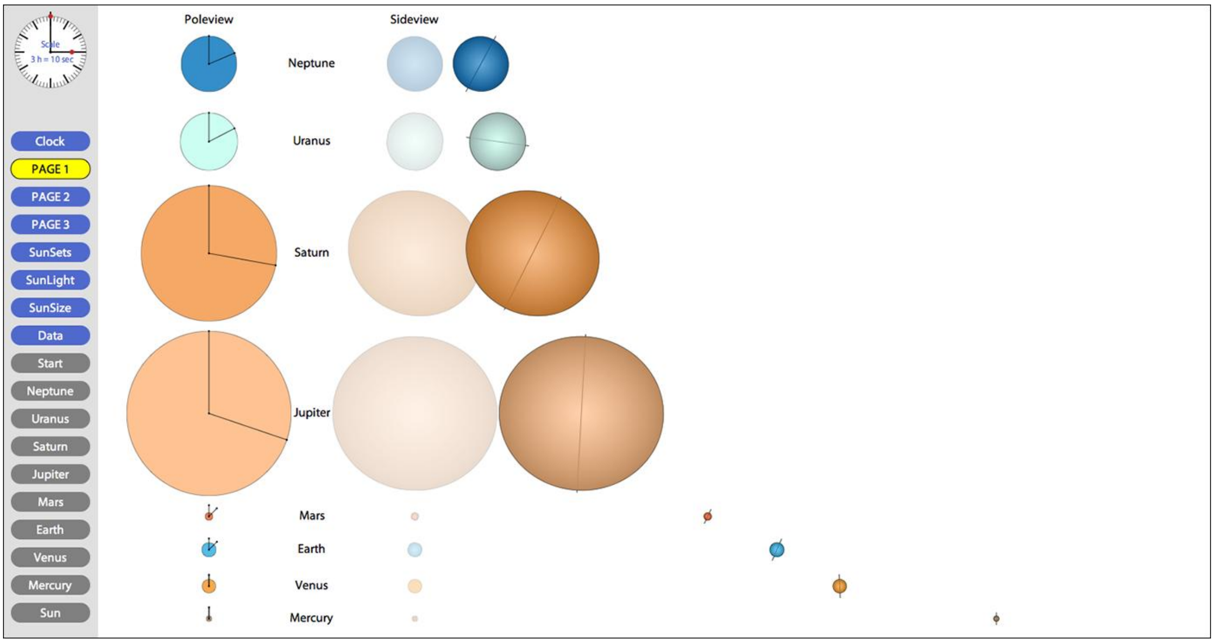
A full-length version is available and can be opened here:

_extendedAbstract\273_proceeding.*

The proposed paper investigates the capabilities of 2-dimensional vector graphics for the visualization of physical and orbital characteristics of the planets in our solar system. The final aim is the development of an appropriate illustrative model for the Swiss World Atlas Interactive, the web version of the Swiss World School Atlas. Today we have already very detailed data about the planets in our solar system. Despite of having such precise data we often cannot comprehend their real dimensions. We have for instance only a rather vague idea about the distance between Neptune and the Sun or about the movements of the planets in space. How can we improve our imagination of the real dimensions of the physical processes in our solar system, and also about the space beyond, the Milky Way, and at last the whole Universe? Today there are different techniques to provide realistic and sustainable images of our solar system:

- Virtual 3-dimensional and interactive applications usually show a model of the whole solar system, wherein the user can navigate with commonly known navigation tools. Restrictions exist only with respect to the resolution of the projected images and to the size of the computer screen. The depictions are very detailed and almost similar to a natural view. But, in most cases, a dynamically generated scale number provides the only information about the size of the currently visible objects.
- In the real world we can see and experience the distances in our solar system during a walk on a planet trail. Planet trails show us a true to scale model of our solar system. In Switzerland 16 planet trails are established today. At a scale of for instance 1:1 billion, an average visitor needs about one and a half hour to walk from the sun to Pluto.
- In printed atlases we often see 2-dimensional depictions, which show size comparisons of the planets and the sun. Another well-known model type is an overview of the whole solar system, where either the orbits of the planets or the distances between the planets and the sun are shown true to scale. The planets appear always extremely enlarged, otherwise they would not be visible.

All mentioned techniques have specific benefits, but also drawbacks. However, a main principle is always the reduction of the presented data down to the essential information, like it is also done in the process of map editing. With the capabilities of the markup language Scalable Vector Graphics (SVG) for instance we can enhance 2d vector graphics by animations. Almost every motion in 2-dimensional space can be visualized in an easily observable way. Physical and orbital planet characteristics like equatorial and polar radius, axial tilt, or rotational and orbital speed can be shown in one composite animation. Beside the generalized planet depictions, relations between each planet and the solar system become visible. We see for instance the distance each planet covers in space during one revolution around its axis. The relation of that distance to its size gives us a realistic impression of its movement in space. After such direct comparisons, it is also important to get an idea of the extent of the solar system. Therefore we have to scale down the solar system to the size of our computer screen. For detailed views of the planets and moons in such a mini model, the user needs predefined levels and positions for zooming and panning straight to the object of interest. An animation generates the impression of a virtual flight. But, even the model of the Neptune system with its currently 13 moons fits on a computer screen only with adjusted values for orbital distances, object sizes and orbital periods. We cannot see all moons with the same scale and correct orbital distances. We need a few variations of the same model generated by altering the mentioned adjustable parameters. Hence the realistic impression evolves due to a combination of different views in our mind.



Planet Movements:
Comparison of Size, Rotational and Orbital Speed of all planets

11G.2 | **"Blind Mouse" on Mars and Moon – a Map Game for Disseminating Planetary Topographic Knowledge** (#288)

M. Gede[1], H. Hargitai[2], E. Simonné-Dombóvári[3]

[1]*Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary;* [2]*Eötvös Loránd University, Cosmic Materials Space Research Group, Budapest, Hungary;* [3]*Vienna University of Technology, Research Group Cartography, Department of Geoinformation and Cartography, Austria*

A full-length version is available and can be opened here:

_extendedAbstract\288_abstract.*

11G.3 | **A New Mapping Method for the Moon With the Chang'E-1 Data** (#1456)

L. Mu, C. Li, J. Liu, X. Ren, X. Zou

National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China

A full-length version is available and can be opened here:

_extendedAbstract\419_proceeding.*

On October 24, 2007, the first lunar probe—Chang'E-1 was successfully launched into the space. A new era for China to explore the mysteries of the universe is coming. Chinese scientists and cartographic experts have produced lunar map series using the Chang'E-1. This map series is based on a new mapping method, which is satisfied with paper mapping, globe making and electric map releasing. How to map the new planet (including the Moon) with high efficiency is main problem for the planetary cartographic experts. In this paper, a new mapping method for the Moon will be introduced based on the spatial database.

ORAL

Session S11-H

Geodaten heute und morgen

Thursday, 29 August, 2013

09:15 - 10:30

11H.2 | **Kartografie im Zeitalter der Apps** (#1465)

M. Forster

ESRI Schweiz, Zürich, Switzerland

Im Vortrag „Kartografie im Zeitalter der Apps“ werden verschiedene Aspekte der sich ändernden Anforderungen an die Kartographie angesprochen und Anhand von Praxisbeispielen thematisiert. Ausgehend von den sich rasant ändernden technologischen Rahmenbedingungen wird einerseits auf die heutigen Anforderungen der Kartennutzer eingegangen. Andererseits wird die Situation und die Herausforderung an die Kartenhersteller angesprochen. Esri Schweiz hat in den vergangenen Jahren zahlreiche Projekte in diesen Zusammenhang realisiert. Anhand ausgewählter Beispiele werden die thematisierten Aspekte erläutert und mögliche Umsetzungen demonstriert.

11H.3 | **Generalisierung sehr großer Datenbestände mittels Partitionierung**

(#1466)

M. Sester

Leibniz Universität Hannover, Institut für Kartographie und Geoinformatik, Germany

Am Institut für Kartographie und Geoinformatik wird seit vielen Jahren im Bereich der kartographischen Generalisierung geforscht. In diesem Zusammenhang wurden auch Softwareprodukte entwickelt, die von verschiedenen Institutionen eingesetzt werden. Es sind dies Programme zur Vereinfachung und Aggregation von Gebäudegrundrissen (CHANGE), zur Darstellung von Gebäuden in kleineren Maßstäben durch Typifizierung (TYPIFY) und zur kartographischen Verdrängung (PUSH). Das Programm PUSH bietet eine ganzheitliche Verdrängung von Punkten, Linien und Flächen auf Basis ihrer Verdrängungseigenschaften (insbesondere erforderliche Verdrängungsbreite und Mindestabstand). Dies wird durch eine Optimierung auf Basis der Methode der kleinsten Quadrate erreicht. Dies erfordert die Lösung eines linearen Gleichungssystems. Der Aufwand hierfür hängt von der Anzahl der unbekannten Punktkoordinaten ab, d.h. von der Anzahl der Objekte. Durch Nutzung von Sparse-Technologien können auf einem Rechner mit 4GByte Hauptspeicher Gebiete einer Größe von ca. 15x15km (bzw. ca. 360.000 Unbekannte, was einer Anzahl von 180.000 Punkten entspricht) problemlos bearbeitet werden (Rechenzeit ca. 3 Minuten). Somit können beispielsweise ganze TK25-Kartenblätter ganzheitlich verdrängt werden. Zielt man jedoch auf größere Bearbeitungsgebiete – etwa ganze Bundesländer/Länder ab, so kann dies nicht in einem Arbeitsschritt geschehen, sondern das Gebiet muss unterteilt werden. Eine einfache Art der Partitionierung ist eine Einteilung in Kacheln. Die Generalisierungsoperationen sind allerdings i.d.R. nicht lokal begrenzt, sondern Nachbarobjekte beeinflussen einander – speziell an den Kachelrändern. Dies würde dazu führen, dass die einzeln verdrängten Kacheln beim anschließenden Zusammenfügen Versätze aufweisen würden. Daher wird nicht nur der eigentliche Kachelinhalt verdrängt, sondern die Kachel wird künstlich vergrößert, um somit den räumlichen Kontext der Verdrängungsobjekte mit einzubeziehen. Die Größe des erforderlichen Kachelrandes hängt von dem Verdrängungspotential der beteiligten Objekte ab. Wählt man die Breite des Randbereiches groß genug, steht bei der Generalisierung genug räumlicher Kontext für Objekte im Innenbereich zu Verfügung, so dass korrekte Ergebnisse berechnet werden. In verschiedenen Untersuchungen wurde ermittelt, dass ein Rand von 1,5 km sinnvoll ist – in diesem Randbereich klingen die Verdrängungseffekte der Objekte im Zentralbereich genügend ab. Aufgrund der Untersuchungen kann hochgerechnet werden, dass die Fläche Niedersachsens in 17h komplett automatisch verdrängt werden kann – eine zusätzliche Beschleunigung ergibt sich, wenn die Verarbeitung auf mehrere Rechner verteilt wird. Dieses Konzept der Pufferung kann auch angewendet werden, um einzelne Datenelemente lokal fortzuführen, ohne den gesamten Datensatz neu generalisieren zu müssen. Dies bedeutet, dass um ein neu eingefügtes Objekt wird ein genügend großer Puffer gebildet, darin wird die Verdrängung durchgeführt und anschließend wird das Ergebnis in die alte Situation wieder eingefügt.

11H.4 | **Urbanes WebMapping** (#1467)

M. Möller

Beuth Hochschule für Technik Berlin, Institut für Kartographie und Geoinformatik, Germany

Insbesondere in kleinräumig strukturierten, detaillierten, urbanen Anwendungen werden oftmals Geoinformationen mit hoher räumlicher Auflösung und entsprechend einem großen Anwendungsmaßstab eingesetzt, bspw. zur Information der Einwohner. Für eine Nutzer-angepasste Geovisualisierung werden ausgefeilte Webmapping Anwendungen entwickelt. Die moderne Kartographie zeichnet sich auch dadurch aus, dass mit ihrer Hilfe vernetzte Geodaten so aufbereitet dargestellt werden, dass der Nutzer einerseits die Geoinformationen für seine individuellen Bedürfnisse passend zugeschnitten entnehmen kann, aber zusätzlich -und das ist wirklich neu in dieser Form der Kartenvisualisierung- auch mit dem Karteninhalt direkt interagieren kann. Dafür sind Internet-gestützte Webmapping Plattformen als Frontend im Browser notwendig, also Nutzerschnittstellen, in denen über Geobrowser ein vielschichtiges Kartenmaterial zur kartographischen Visualisierung und interaktiven Erfahrung angeboten wird. Geobrowser wie etwa Openlayers können dafür über Javascript basierte Application Programming Interfaces (APIs) so erweitert und an die Nutzeransprüche angepasst werden, dass selbst ausgefallene, komplexe Kartenanwendungen zu realisieren sind. Im Projekt "HistoMap Berlin" werden in Kooperation mit dem Landesarchiv Berlin die alten Kartenbestände der Stadt in einem aufwändigen Portal kartographisch so dargestellt, dass sie in Schichten chronologisch vom Nutzer betrachtet werden können. So ist es möglich, dass für vergangene Objekte der heutige Zustand rekonstruiert werden kann. Der Einsturz der Eislaufhalle in Bad Reichenhall im Januar 2006 hat dazu geführt, dass nun alle öffentlichen Gebäude bezüglich Ihrer aktuellen Auflast beobachtet werden müssen. Diese Auflasten aus Schnee und Eis sollen auf einer Kartenbasis so dargestellt werden, dass der Nutzer auf einen Blick die aktuelle Auflast mit Hilfe eines Ampelfarbsystems visuell erkennen und die Gefahr beurteilen kann. Genau diese Schnittstelle wurde im Projekt "BE-SAFE" entwickelt, ebenfalls auf Basis von Openlayers und mit einer komplexen Struktur an OGC-Diensten (Open Geospatial Consortium), die im Hintergrund laufen. Hier kommen neben aktuellen Wetterdaten der meteorologischen Stationen auch die Messwerte von Schneewaagen im System zusammen, werden in Echtzeit analysiert und auf einer Kartenbasis und parallel dazu tabellarisch Gebäude-genau dargestellt.

ORAL

Session S11-I

Mixed Session

Thursday, 29 August, 2013

09:15 - 10:30

11I.1 | **A New Algorithm for Extracting Drainage Networks from Gridded DEMs**

(#862)

T. Wang

Singapore-ETH Centre, Future Cities Laboratory, Singapore

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 335-353

Drainage networks are important abstract features in terrain modeling and play functional roles in hydrological, geomorphologic and biological analyzing models. Watershed indices based on drainage networks are crucial in flood predicting models. Huge efforts have been made on automatic extraction of drainage networks. However, there are no effective methods to extract threshold-insensitive and noise-free drainage networks from gridded elevation data. This paper proposes an algorithm to extract complete and reasonable drainage networks from gridded digital elevation models (DEMs) by integrating global and local methodologies. First, the flow routing algorithm is employed to derive primary drainage segments, which includes depression removal, flow direction computation and threshold value setting. Threshold values are set based on experts' experience and terrain types. The value heavily influences lengths of individual drainage segments and geometric forms of extracted drainage networks and watersheds, which the results are sensitive to threshold values and can introduce uncertainties to further analysis. In order to incorporate the missing drainage segments filtered out by threshold values, the second step utilizes a moving-kernel method to flag morphometrically characteristic points, which are then integrated into the initial result by downward and upward connecting processes based flow direction information produced in the first step. Both above two steps introduce congested drainage segments at the downstream area, which are taken as noises for constructing geometrically clear and topologically consistent drainage networks. In the third step, noisy drainage segments and parallel drainage segments are classified into different types and handled based on inductive analysis and rule-based treatment. The topological consistency of drainage networks are maintained in every step. The final results include single-pixel-width drainage networks and correspondent watershed sub-divisions. Two datasets covering different geomorphometric areas are used to test our new algorithm. The Strahler ordering scheme, length and structure of extracted drainage networks are analyzed. The quantitative analysis demonstrates that extracted drainage networks based on new algorithm are insensitive to threshold values. Visual inspection of overlaid maps of new results and contour lines shows that drainage segments pass through every curve bend.

11I.2 | **A NEW SPATIAL FRAMEWORK FOR DIGITAL EARTH: SPHERE SHELL SPACE 3D GRID** (#387)

G. Wan, X. Cao, F. Li, K. Li

Information Engineering University, Institute of Geospatial Information, Zhengzhou, China

A full-length version is available and can be opened here:

_extendedAbstract\138_proceeding.*

The range of human spatial activities has been promoted to various levels of earth space that from underground, land, sea, air to space. And spatial observation scope has been enlarged to every sphere shell of earth systems, and spatial exploration ability be enhanced. More and more scientific research, military and economic activities have shown their characteristics of global three-dimensional distribution, spanning temporal and spatial scales, interdisciplinary. As a result, it is essential to construct the global uniform space framework and to integrate various earth sphere shells' information. Therefore, the construction of sphere shell space 3D grid and the establishment of uniform space framework of land, sea, air and space becomes an important problem. Although Discrete Global Grid provides a means of rasterizing the earth surface, and then has been considered as the basic data model for digital globes. Discrete Global Grid is only confined to the surface, because it can not reach to the inside and outside of the earth surface. The Sphere Shell Space 3D Grid (SSSG) proposed here sets up a new spatial reference framework for the whole earth 3D space for Digital Earth. It is able to represent spatial objects distributed from underground, land, sea, air to space within a uniform framework, and also uniformly organize various kinds of spatial information in each earth sphere shells. The followings are what we have done in this study: 1. The comprehensive review of current achievements has been taken firstly, and these problems in existing space grid models have been pointed out. Then, the sphere shell space 3D grid (SSSG) is the new direction of geographic space grid has been brought forward, which is following the development of geographic space grid from plan grid to solid grid, from spherical surface to sphere interior. 2. The Sphere Shell Space 3D Grid (SSSG) is putted forward for the first time. The basic conceptions that Sphere Shell Space and Sphere Shell Space Grid are proposed, and then their connotations and theoretical characteristics have been discussed in details. The basic idea of subdivision of SSSG is that, the earth spherical surface is set as starting surface; the whole earth has been divided into several homocentric datum sphere shells along the radial direction, and then the grid subdivision of each datum sphere shell has been taken place. 3. The extended-Octree (e-Octree) subdivision model of SSSG is proposed. The design idea and three subdivision mechanisms including regular subdivision, degraded subdivision and adaptive subdivision are presented first. The mathematical form of partition curve, partition surface and partition voxel are given out. And then the equal area property of sphere shell surface grid generated by the partition curve has been proved using differential geometry. The e-Octree grid coding model is proposed according to three subdivision mechanisms, and also the algorithm of conversion between grid code and geographic coordinate. Experiments have shown that e-Octree subdivision and code model has improved the agile ability while holding coherence. This is favorable for spatial entity representation and spatial information organization. 4. At last, the prototype system of SSSG is realized. And then it has been used to implement global terrain visualization, space orbit objects representation. These typical applications experiments show that SSSG is a new 3D spatial reference model for digital earth and a new methodology for global change researches and earth system science. Furthermore, it can not only be used for representation, but also be used for dynamic simulation and spatial index.

11I.3 | **Living on Fumes: What “small data” interviews can tell us about Location-based Services and Big Data’s increasing role in what we know and where we are.** (#278)

J. Thatcher
Clark University, Geography, Worcester, United States

A full-length version is available and can be opened here:

_extendedAbstract\82_proceeding.*

Amidst the clamor for Big Data research, location-based services (LBS) have come to play an increasingly prominent role as both object and tool of research due to their generation of spatial data. The addition of *where* to data that already provides who is doing what, when, and with whom has caused some authors to go so far as to proclaim the “end of theory”, envisioning a world in which the rapid aggregation and analysis of large data sets obviates the need for social explanation (Anderson 2008). Forgotten in this dream of a purely descriptive world without need for explication is the proscriptive nature of the processes of data creation within location-based services. These overtly optimistic views ignore that the very acts which create large data sets are always necessarily encouraged, mediated, and limited by and through the technologies used to enter, record, and store said information. Through qualitative interviews with LBS designers and developers – so-called “small data” – this paper introduces the concept of data fumes. Data fumes refer to location-based services and mobile applications that, rather than creating their own cartographic and spatial data sets, rely upon those collected or created by other, more widely used, applications. For example, the start-up *Local Mind* (http://localmind.com) uses place and check-in data from *FourSquare* (http://foursquare.com). *FourSquare*, in turn, relies upon *MapBox*’s cartographic representation (http://mapbox.com) of *OpenStreetMap*’s data (http://openstreetmap.org). See attached image for a side-by-side comparison of *Local Mind* and *FourSquare*. Through detailed ethnographic interviews, the complex web of interacting technologies is untangled and traced revealing that, rather than attempting to encourage new user behaviors, LBS developers actively seek to capitalize upon behaviors and data sets that have been designed, tested, and created by others. Data fumes reveal LBS and Big Data advocates frequent proclamations of individualization and customization to be a myth: Building from the long tradition of critical cartography and research into the epistemic limits embedded within map design, this paper demonstrates that even as ever more specialized LBS appear, the power of design is placed into a shrinking number of designers and developers. After defining and demonstrating the role of data fumes, the paper examines one potential outcome of their use. Drawing from interviews, published patents, and soon-to-be-released applications, the presentation shows that “location” has become disassociated from physical location and commoditized, as movement patterns through cities are increasingly bid for, bought, and sold with location-based services. While LBS promise ever greater customization for end-users and ever more accurate description of society for those who analyze the resulting data, they are, in reality, granting a very small number of designers the ability to influence both where an end-user goes and how they get there. As applications increasingly rely upon the design decisions of other applications, both the limits of cartographic design and the resulting data that can be gathered are placed into the hands of an extremely small group of programmers whose decisions promulgate throughout the mobile application ecosystem. **Works Cited** Anderson, C. (2008). The End of Theory: The Data Deluge Makes the Scientific Method Obsolete. *Wired*. < http://www.wired.com/science/discoveries/magazine/16-07/pb_theory>

Data Fumes:
Side by side comparison of Local Mind and Four Square

11I.4 | **Mapping sea ice coverage from Canadian RADARSAT images** (#845)

J. Li[1,2]

[1]Xiamen University, Computer Science, Canada; [2]University of Waterloo, Geography and Environmental Management, Canada

Sea ice covers between 11% and 15% of the Earth's surface at the polar regions. It is important to map sea ice dynamics because its extent and duration has an effect on the global climate and present a hazard to shipping, in particular in Canada's north waters. Since the polar regions are dark during more than half the year and are often cloud covered, synthetic aperture radar (SAR) onboard Canada's RADARSAT-1/-2 and upcoming RADRASAT Constellation Mission have been proved the most useful sea-ice mapping sensors from space. At the Canadian Ice Service (CIS), Environment Canada, the operational interpretation of SAR sea-ice images relies on a human operator to manually delineate homogeneous areas. The sea-ice charts, as the final product, label each identified region with an egg code, which indicates sea-ice information (e.g., the type, concentration and floe size). This visual interpretation of SAR sea-ice images, although capable of incorporating knowledge and experiences, is very demanding due to the vast amount of daily sea-ice observations. Hence automatic software tools thatare able to both accurately and time-efficiently detect types and extends of sea-ice coverage ar urgently needed. This paper presents three recent developments of automatic approached to SAR sea-ice detection from RADARSAT images at the joint China-Canada Centre of Excellence for Remote Sensing and Spatial Informatics (C³ERSSI). These three approaches are based on (1) the enhanced total variation optimization, (2) the patch-based Principal Component Analysis (PCA), and (3) the improved bilateral filtering, respectively. In general, denoising SAR images was applied first followed by simple or optimized K-means clustering in all these three approaches. The first approach has two phases - the total variation optimization phase followed by the finite mixture model classification phase. The second approach has three steps - the log-transformation, patch-based principal component analysis, and K-means clustering. In the third approach, an improved bilateral filtering was implemented first followed by optimized k-means clustering with intelligent initial centroid selection. Those there approached have been tested on both synthetic images and RADARSAT-1/2 images. The obtained results were compared with other well-established approaches. With the advantage of less processing time, the visual inspection and quantitative analysis of the detection results confirm the superiority of these new approaches over other existing methods.

Session S11-J

Business Meeting of the Commission on Data Quality

Thursday, 29 August, 2013

09:15 - 10:30

ORAL

Session S12-A

Geoanalytics in Urban Management

Thursday, 29 August, 2013

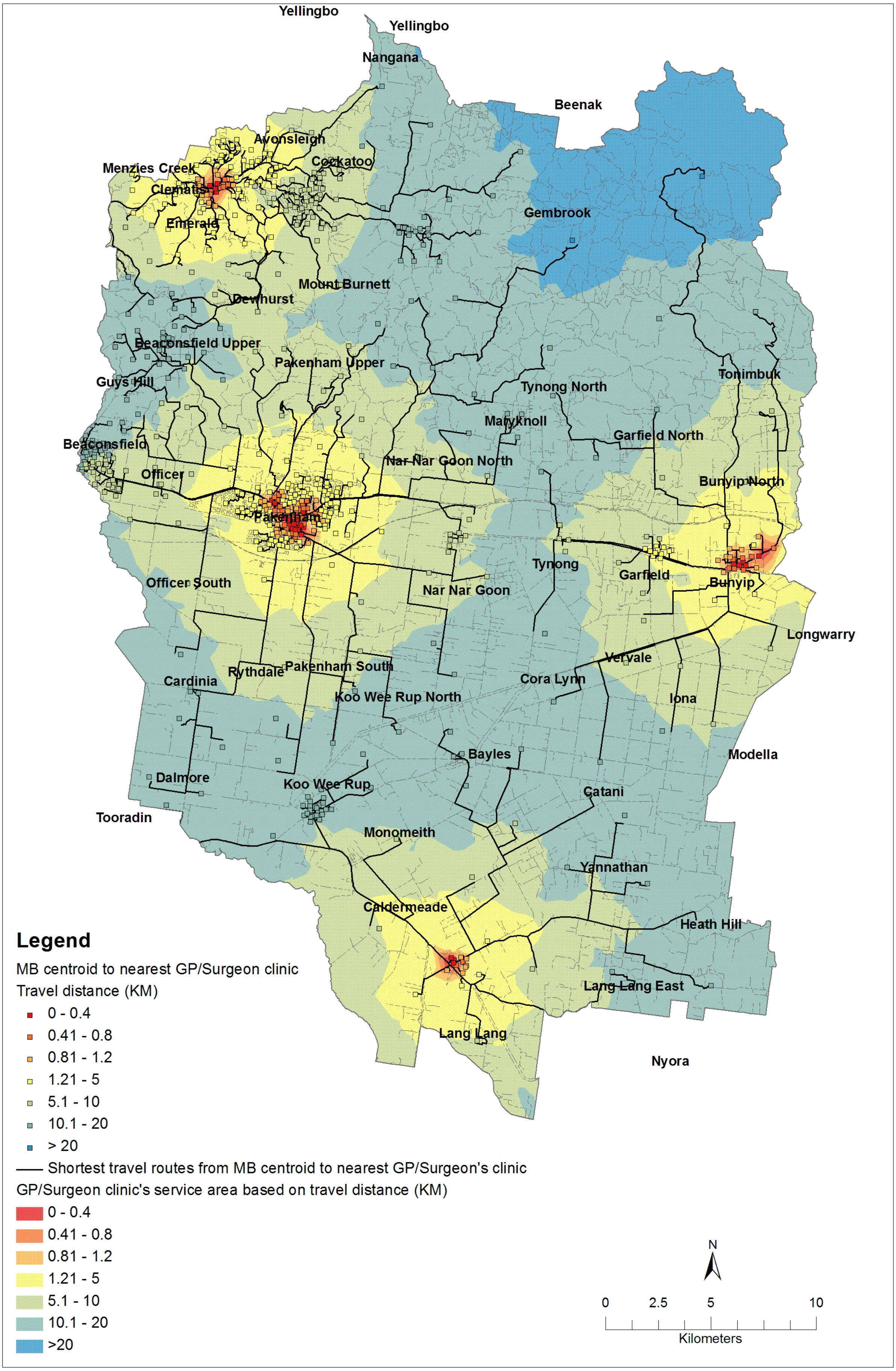
11:00 - 12:15

12A.1 | **A GID-BASED INVESTIGATION OF SPATIAL ACCESSIBILITY TO HEALTH CARE FACILITIES WITHIN AN URBAN FRINGE AREA OF MELBOURNE, AUSTRALIA.** (#439)

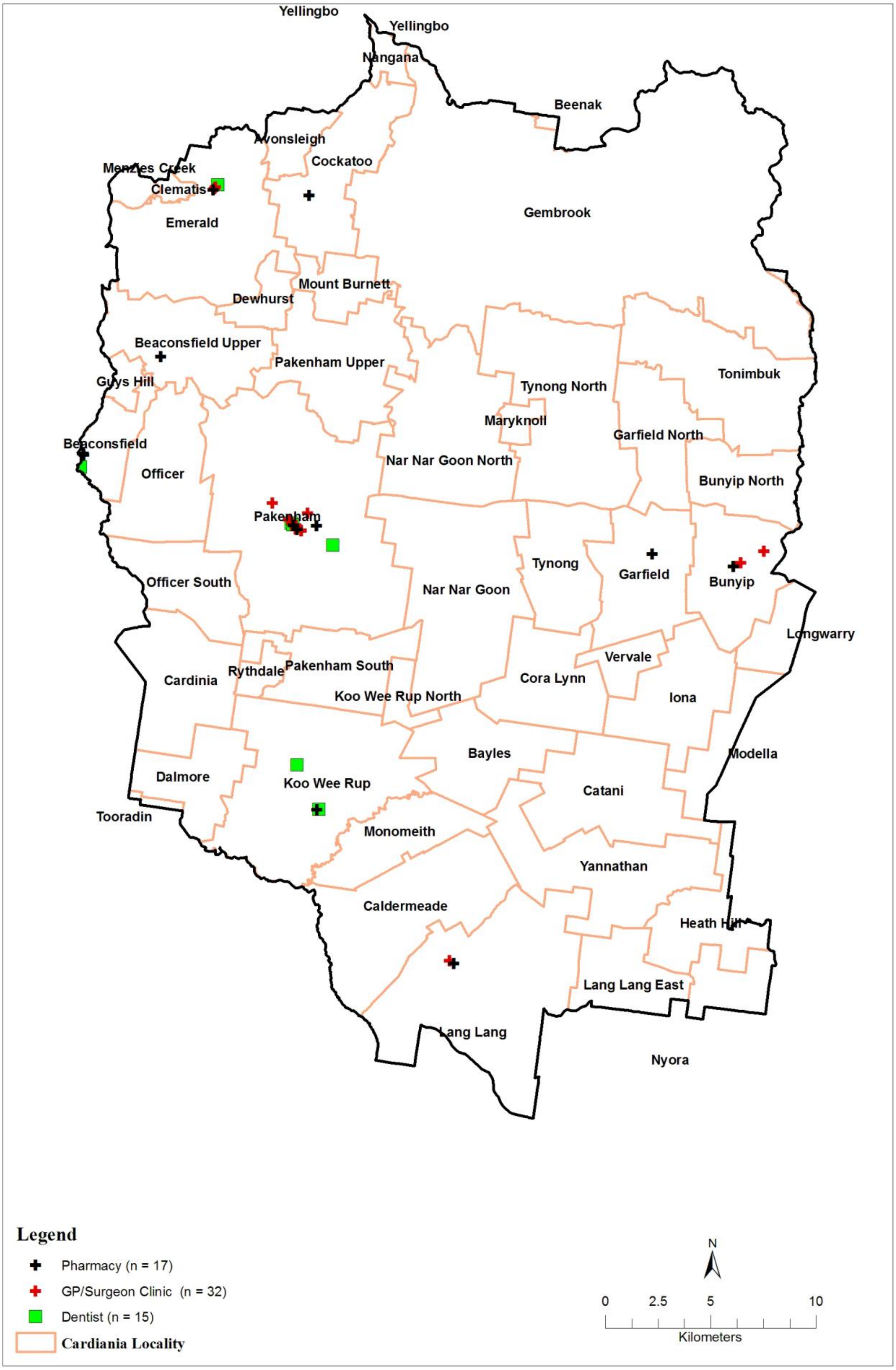
G. - J. Liu[1], A. Salahuddin[1], B. Engels[2]

[1]RMIT University, School of Mathematical and Geospatial Sciences, Melbourne, Australia; [2]RMIT University, School of Global, Urban and Social Studies, Melbourne, Australia

Adequate and equitable access to health care facilities by local communities in urban areas is an important issue of human service provision to both public policy makers and urban planners. Equitable and easy access to health care facilities is often considered one of the main objectives of many health care systems. Due to spatial variations in population distribution, transportation infrastructure as well as distribution of health care facilities, there exists spatial variation in accessibility to the health care facilities and locations where accessibility to health care facilities is poor. This study focuses on local communities residing in an urban fringe area in Melbourne, Australia, uses high spatial resolution data sets and GIS-based spatial analysis and spatial statistical measures like car based shortest travel distance, shortest travel time, and service areas, and seeks to uncover spatial variation in accessibility to health care facilities at fine spatial resolution (e.g. at the Mesh Block level) using fine resolution population distribution, gravity based accessibly index, and local spatial statistical measures, and identify disadvantaged locations / local communities in the study area by means of spatial overlay (union) analyses. The study area has a relative lower facility to population ratio: 1:3,310 for pharmacy, 1:1,758 for GP/Surgeons clinic and 1:3,751 for dental clinic. Only 9 out of the 49 localities within the study area have one or a few of the selected three types of health care facilities, the rest 40 localities do not have any such health care facilities, but many of those localities are also not well connected with public transport services. According to ABS 2006 census, many non-working populations, including young mother with dependent children and senior citizens, especially the unemployed females in the study area, have a very poor accessibly to health care facilities because they are left behind by their working family members without a car. This study revealed that local residents have to drive over 3km (3228.6m) or 4 minutes for a pharmacy, drive about 6km for a GP/Surgeon's clinic, or a dental clinic, and in average they have to drive for about 5km to visit their respective nearest health care facilities. There are 27.5 % (over 12,000 persons), 20.3% (about 10,000 persons), and 12.9% (about 6,000 persons) of the population reside within a tolerable walking distance of 1.2km from the nearest pharmacies, GP/Surgeons clinics and dental clinic respectively, and majority of the population have to drive or use public transportation to reach their nearest health care facilities. In average there are about 23% of the total population are located within 15min of walking distance to nearest health care facilities, and over 75% of the total population are located beyond tolerable walking distance to nearest health care facilities. In the Shire, significant proportions of residents in dependent population (35%), low income dwellings (27%), and dwellings with less than 2 cars (27%) resided in locations with poor spatial accessibility to health care facilities. Based upon spatial clustering and overlay analyses, there are about 5.5% of the total population or over 2500 persons are identified with the univariate LISA analysis living in disadvantaged locations with poor spatial accessibility to health care facilities.



General Practitioners:
Travel distance and service area



Healthcare facilities:
Spatial distribution

12A.2 | **GPS-based Crowd Sourced Intelligent Traffic Information Hub** (#1043)

R. Zhu

Gyözö Gidófalvi, Urban Planning and Environment, Stockholm, Sweden

A full-length version is available and can be opened here:

_extendedAbstract\330_proceeding.*

12A.3 | **Including a social perspective into urban planning using visualisations based on self-organising maps** (#224)

H. - J. Stark[1], S. Bleisch[2], T. Klöti[3]

[1]University of Applied Sciences and Arts Northwestern Switzerland, Institute of Geomatics, Muttenz, Switzerland; [2]University of Melbourne, Department of Infrastructure Engineering, Victoria, Australia; [3]University of Applied Sciences and Arts Northwestern Switzerland, Institute for Social Planning and Urban Development, Basel, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\176_proceeding.*

The technical process of urban planning in Switzerland is normally defined through aspects such as, maximum building heights, gross floor space, type of use or connection to public transport. Such a guiding framework ensures a controlled development of town and city districts. To create liveable and social sustainable environments it is imperative to additionally include a social perspective in the planning process. However, as relevant social information often consists of a myriad of factors and combinations of those, such multidimensional information is difficult to consider or to routinely integrate into the planning process. Consequently, this article presents and evaluates how considering social factors through the use of self-organising maps (SOM) and suitable visualisations of the results can support a more integrative planning process.   To enable a routine integration of multidimensional social information into the planning process the data needs to be presented in an understandable format. Further this presentation needs to be created as automated as possible. The biggest challenge to automation is the collection, combination and suitable structuring of the social data itself. The relevant social variables come from various sources, include quantitative as well as qualitative dataand are often structured in geographic units that are either too coarse or to fine, the latter being of concern for privacy protection reasons. Suitable units in terms of social meaningfulness and size seem to be areas bordered by major and/or minor roads. Thus, the data has been organised to fit into those units.   Self-organising maps allow summarising and visualising multidimensional data on a two-dimensional layout. The SOM algorithm groups similar data sets (more similar in all attribute dimensions) closer together than more dissimilar data sets. While this grouping allows simpler visualisations there is still the option to visualise and explore each attribute dimension by itself, as the details in the data are retained. The resulting information from the SOM is interactively connected to the geographical unit of street blocks in 2D maps but also in a 3D planning and visualisation tool already used by planners. This tight integration allows the planners to explore the different social factors and include this information in the planning process in addition to the technical planning framework they have to adhere to.   The process of data preparation, SOM calculation and 2D and 3D visualisation of the results has been tested with a dataset from the commune Langenthal in Switzerland where currently urban planning processes are underway. In a case study the results have been made available to the urban planners and their use of it has been evaluated. The outcomes suggest a few improvements of the data preparation and presentation. Generally, the created displays are well usable and allow the consideration and integration of social factors into the planning process. Crucial to the success is training the planners and thus their understanding of the created displays.

12A.4 | **Accessibility to Public High Schools and School Performance in Metropolitan Baton Rouge, Louisiana 1990-2010** (#250)

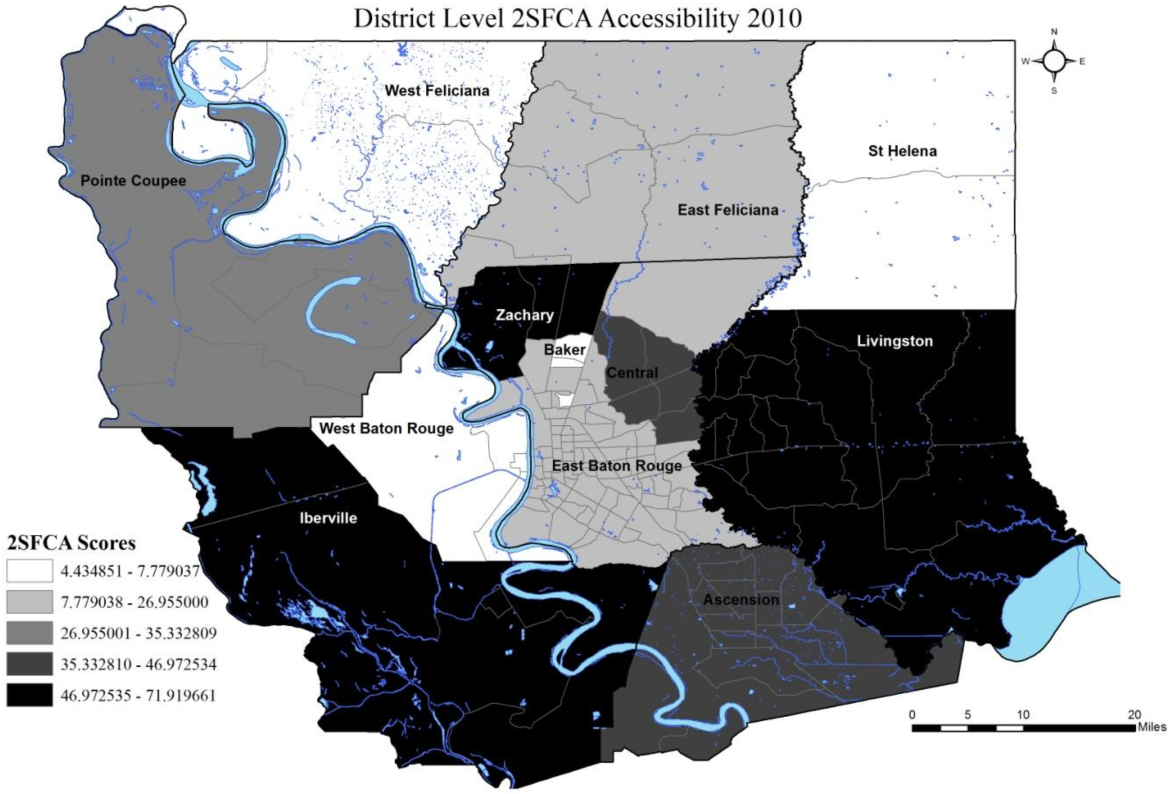
S. Williams

Louisiana State University, Geography and Anthropology, Baton Rouge, United States

A full-length version is available and can be opened here:

_extendedAbstract\368_proceeding.*

Education policies developed to initiate improvements to public school systems across Louisiana often result in a continuation or intensification of salient accessibility challenges. The public high school and its students have been particularly susceptible to these actions which have been sustained for decades within the state despite the increasing awareness of individual and community hardships connected to high school level inadequacies. Beyond isolated district studies or aggregate state reports, limited focus has been placed on student accessibility to public high schools or on responses of students and communities to processes which alter their access to area high schools. This study advances the role GIS in historical geography and education research by implementing the Two-Step Floating Catchment Area (2SFCA) method to link historical phenomena with contemporary accessibility conditions for social groups within the Baton Rouge Metropolitan Statistical Area (BRMSA). This work implements the 2SFCA method and two derivatives to gauge the transitions of high school accessibility from 1990 to 2010 and challenge heuristic approaches which demote the influence of geography in policymaking which effects high school accessibility. A regression analysis revealed a moderately strong positive association between spatial accessibility determined the 2SFCA and school accountability scores established by the Louisiana Department of Education with 2010 data. Additionally, this examination found urban areas have experienced the lowest levels of accessibility and correspondingly low accountability scores, which in most cases have only continued through time when compared to nonurban high schools. Together these analyses support the potential attraction of suburban high schools within the BRMSA. The conclusion of a series of common factor analyses implemented to complement accessibility measurements further support the attraction argument and the overall link between access, accountability, race, and geography as a potential offshoot of the White flight phenomenon was captured in the 2010 implementation.



District Accessibility:
District level accessibility within the BRMSA of Louisiana

ORAL

Session S12-B

The Rhetoric of Maps

Thursday, 29 August, 2013

11:00 - 12:15

12B.1 | **Why Maps Are Silent When Texts Can Speak. Detecting Media Differences through Conceptual Modelling** (#1022)

Ø. Eide

University of Oslo, Unit for Digital Documentation, Blindern, Norway

A full-length version is available and can be opened here:

_extendedAbstract\31_proceeding.*

12B.2 | **Four Rhetorical Styles of Persuasive Geocommunication: An Initial Taxonomy** (#581)

I. Muehlenhaus

University of Wisconsin - La Crosse, Geography and Earth Science, United States

A full-length version is available and can be opened here:

_extendedAbstract\355_proceeding.*

Maps are tools for geocommunication that make specific arguments about the state of a spatial environment (Brodersen, 2008). As is true with any form of communication, different methods, or rhetorical styles, of geocommunication can be employed to persuade an audience to view an argument from a particular perspective in a given context (Muehlenhaus, 2012). This paper uses the results from a quantitative content analysis (QCA) conducted on a dataset of 251 persuasive maps (produced in Western countries post-1800) to demonstrate that rhetorical styles exist and are statistically identifiable. Persuasive geocommunications have four distinct rhetorical styles that have been consistently embraced by cartoraphers over the past 200 years. QCA is increasingly being used to study and compare the composition of large map samples and to test for change in map design over time (Edsall, 2007; Kessler & Slocum, 2010; Muehlenhaus, 2010, 2011a). In the QCA underlying this research, each of the 251 persuasive maps was coded based on 192 data model, graphic design, and layout variables using binary, Likert scales, and count measurements. The variables were then statistically tested to see whether any significant relationships existed among them (e.g., lack of a data source with inappropriate projection). This dataset has previously been used to test whether the design of persuasive maps has changed dramatically since the advent of modern thematic cartography around 1800; the analysis showed that the techniques used to create the persuasive maps in this sample have not changed significantly (Muehlenhaus, 2011b). This paper uses the same dataset to go a step further in the analysis. Using the 16 most significantly correlated variables in the persuasive map dataset, a two-step cluster analysis was run on all of the maps in the sample. Four clusters emerged (with no outliers) based on the composition of the maps. These four clusters, or categories, differ dramatically in cartographic style. It is argued that these four categories can best be thought of as rhetorical styles for persuasive geocommunication. These unique styles differ from one another in the following realms: data models, symbology and representation, and graphic design and layout. The styles have been given the following names based on their characteristics: authoritative, sensationalist, propagandist, and understated. This paper outlines the methodology behind these four styles discovery, reviews in detail the characteristics of and design differences among these four styles, and provides information on how to identify when these rhetorical styles are being used. It is also argued that these four rhetorical styles may not be unique to persuasive maps and that more QCA research might be done on other types of geocommunication as well. Brodersen, L. (2008). *Geo-communication and information design*. (Translator: Nick Wrigley) Denmark: Forlaget Tankegang. http://www.geokommunikation.dk/english.htm Edsall, R. (2007). Iconic maps in American political discourse. *Cartographica*, *42*(4), 335–347. Kessler, F., & Slocum, T. A. (2010). Analysis of thematic maps published in two geographical journals in the Twentieth Century. *Annals of the AAG, 101*(2). Muehlenhaus, I. (2010). Lost in visualization: using quantitative content analysis to identify, measure, and categorize political cartographic manipulations. *Geography*. University of Minnesota. Muehlenhaus, I. (2011a). Another Goode method: how to use quantitative content analysis to study change in thematic map design. *Cartographic Perspectives*, (69), 7–29. Muehlenhaus, I. (2011b). Genealogy that counts: using content analysis to explore the evolution of persuasive cartography. *Cartographica*, *46*(1), 28–40. Muehlenhaus, I. (2012). If looks could kill: the impact of rhetorical style on persuasive geocommunication. *The Cartographic Journal*, doi:10.1179/1743277412Y.0000000032

12B.3 | **Ontology of place-names and orientation in their development and evolution on maps** (#1369)

<u>Y. Ferland</u>, Y. Ferland

Université Laval, Sciences géomatiques, Québec, Canada

Two empirical arguments are rarely invoked about so-called exonyms, *i.e.* a place-name pronounced, spelled, written, and used in other languages that the one spoken in that place (a term that suffers a weak, odd, suspicious, and contradictory definition). They are the ontology of the spatial-object's root-name (not to confound with its etymology), and the orientation in its linguistic, spatial, and cultural evolution through centuries. In geography and cartography contexts, **ontology** refers to types of real features whose general characteristics and properties can be explicitly and universally represented and recognizable in most actual places or spaces as substantial "entities" or features, quite distinctly from others (*e.g.*, what makes an "island" and makes sense of this generic referent). An effective interest to theoretical approaches of toponymy aspects in cartography (for paper maps, gazetteers, digital databases, map and satellite imagery services, mobile devices, etc.) comes to consider the value and comprehension for proper usage of exonyms in immediate and multilingual situations. The role of exonyms effectively exists: a place bears many names that originated together then evolved and remains correct among various groups of languages nowadays. Despite being different than the official toponym at that place, many exonyms are ancient, justified rather than random, stable since long time, still convenient, and probably anterior to the actual corresponding endonyms as used by present day inhabitants. Note that newly created endonyms are not under consideration here. Thus, how different or "distant" in both linguistic and geographical senses are an official endonym and main branches of actual foreign exonyms? To look at that, one can trace the geographical **orientation** of the transmission, or diffusion, of a toponym from a language spoken in the surrounding of the named place long time ago, from places to places toward farther countries, due to cultural or political influences or commercial exchanges. For both arguments, it is not just a question of mere etymology. A same root-word or generic term denotes the deep meaning of the spatial object, be it physical like a river (e.g. **dona*), circumstantial like a stronghold (e.g. **burg*) or a spring for bath (e.g. **ag*), or cultural like a settlement (e.g. **colon*), whatever the phonetic variations. It appeared clearly (at least partly) in different linguistic families or cultural lineages as the specific term of assimilable features distributed through many countries (e.g. the **Alp* mountains). For instance, that is the case for the river Danube, from the Latin *Danubius*; in most Western languages, its metathetic (*i.e.*, by inversion of vowels in successive syllables) varieties in Central and Eastern Europe looking closer to the Sanskrit root *dānu*, and the name of many other main rivers like Dvina, Donets and Don (in England). The evolution of place names appears oriented through slightly different directions and trajectories, from the same starting place although the representation, significance, and spatial extension and limits to display on the maps may differ from both the originally and the present named place. Many endonyms have been stabilized in their present form quite recently, due to frequent steps in its evolution in naming that place, as spoken by local inhabitants or elites. That contrasts with perennial exonyms for that same place, which remains stable in languages of foreign countries since centuries, because they were adopted correctly by foreigners at a certain moment of the local evolution and have not changed thereafter. Exonyms rarely come out of the blue to fall on the map!

ORAL

Session S12-C

NSDI 2

Thursday, 29 August, 2013

11:00 - 12:15

12C.1 | **Dutch NMCA launches Open Data** (#497)

N. Bakker[1], H. van der Vegt[1], B. Bruns[2]

[1]*Cadastre, Land Registry and Mapping Agency, Strategy and Policy, Apeldoorn, Netherlands;*
[2]*Cadastre, Land Registry and Mapping Agency, Geo-information, Apeldoorn, Netherlands*

A full-length version is available and can be opened here:

_extendedAbstract\123_proceeding.*

Dutch NMCA launches Open data This paper describes the effects of launching open data in the Netherlands. Not only the Dutch Mapping and Cadastre Agency serves its topographical database but also many organisations make their geographical data available to stimulate the development of innovative applications for society. Since January 2012 the Dutch Key Register Topography (BRT) is available as open data. In the Netherlands, the Open data paradigm has been stimulated by INSPIRE and the open data policy of the European Community, based on the Digital Agenda of Europe and the Public Sector Information (PSI) directive. Not only the Key Register Topography, which contains the digital topographical maps of the scale range 1:10,000 (TOP10NL) to 1:1.000.000 are available, but also other datasets are freely available in the Netherlands, like the Key Register Buildings and Addresses. The data can be downloaded as raster or vector files and is also published as reference map in web portals. One of the goals of the Digital Agenda of Europe and the PSI directive is to stimulate small and medium enterprises to build commercial applications based on open data and further stimulating economical growth. In the meanwhile also other governmental organisations deliver open data, like road information and satellite images. Linking data of different sources together can bring brand new applications for society, e.g. satellite data are used for monitoring agriculture. The BRT data has been downloaded many times and it is now available via different web services. As reference map it is served by the web portal PDOK (Public Data On the Map), an initiative of different governmental organisations serving the reference data of its contributors. Other users can add their own data for special applications. The data can also be obtained via Openstreetmap and ArcGISonline. The last one has put the TOP10NL as a geographical basis for the Dutch territory. Current research looks at the effects of the open data for small and medium enterprises. This paper will focus on the use of the open data and the benefits for society.

12C.2 | **A Contextual ICA Stakeholder Model Approach for the Namibian Spatial Data Infrastructure (NamSDI)** (#883)

K. M. Sinvula[1], S. Coetzee[1], A. K. Cooper[1,2], W. Owusu-Banahene[1], V. Rautenbach[1], E. Nangolo[3], M. Hipondoka[4]

[1]Centre for Geoinformation Science, Department of Geography, University of Pretoria, South Africa; [2]CSIR, Built Environment, Pretoria, Namibia; [3]Independent Research, Windhoek, Namibia; [4]University of Namibia, Department of Geography, History & Environmental Studies, Windhoek, Namibia

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 381-394

In 2011, the Namibian parliament presented and promulgated the Namibian Spatial Data Infrastructure (NamSDI) with the aim of promoting the sharing and improved access and use of geospatial data and services across Namibia. Notable SDI models, developed from the enterprise, information and computational viewpoints of the Reference Model for Open Distributed Processing (RM-ODP), comprise direct and indirect roles of stakeholders and special cases of each general role in an SDI. Hence, the International Cartographic Association (ICA) model was used to identify the stakeholders in and around NamSDI, which is still at the infancy stage of development. The application of a high-level ICA model proved to be relevant and useful in discriminating and categorizing NamSDI stakeholders according to their roles and vested interests. Some stakeholders, such as official government mapping agencies, assume multiple roles, while others, such as database administrators, are not yet active. In the absence of baseline data and given the infancy status of NamSDI, attributes such as skills, capacity of producers and service providers, were not considered. Modelling NamSDI stakeholders in the context of ICA's stakeholder model contributed significantly to a better understanding of NamSDI stakeholder types and subtypes and pointed out gaps that may hinder its successful and effective implementation.

12C.3 | **Methodology of creating the new generation of official topographic maps in Poland** (#1140)

R. Olszewski[1], J. Zieliński[2], A. Pillich-Kolipińska[1], A. Fiedukowicz[1], A. Glazewski[1], P. Kowalski[1]
[1]*Warsaw University of Technology, Cartography, Warszawa, Poland;* [2]*Head Office of Geodesy and Cartography, Warszawa, Poland*

A full-length version is available and can be opened here:

_extendedAbstract\248_proceeding.*

Poland's role on the international stage and the position of the Polish economy in the international market, especially in the European Union, is increasingly dependent on the level of access to information, including the spatial information. Providing access to spatial information contained in a structure of topographic objects database (BDOT) and developing a new generation of topographic maps in scales: 1:10 000, 1:25 000, 1:50 000, 1:100 000, 1: 250 000, 1: 500 000 and 1: 1 000 000, was the key activity in the past few years in Poland. In accordance with the Act of 17th May 1989 – the Geodetic and Cartographic Law, (Journal of Laws, 2010.193.1287), one of the fundamental tasks of the Polish Service of Geodesy and Cartography is publishing the official maps and creating national topographic maps. The Surveyor General of Poland establishes, maintains and provides the standard cartographic studies – topographic maps in scales of: 1:25 000, 1:50 000, 1:100 000, while the marshals of voivodeships in consultation with the Surveyor General of Poland establish, maintain and make available standard cartographic studies - topographic maps in the scale of 1:10 000. Based on Art. §19.1 point 9 of the Geodetic and Cartographic Law, in the Regulation of 2011 the Minister responsible for public administration described the scope of information collected in the topographic objects database and general geographic objects database, the organization, procedures and technical standards for creating, updating and sharing these databases, as well as creating of topographic maps. Topographic maps of new generation are created on the basis of relevant datasets stored in the National Geodetic and Cartographic Resource databases in the form of six basic graphic layers: *1.* Drawing of situation consisting of selected database elements: - *topographic objects* whose LoD and resolution allows creating standard cartographic studies in scales of 1: 10 000 - 1: 100 000; - *the state register of basic geodetic, gravimetric and magnetic networks;* 2. Drawing of elevation in the form of contour map with shading for selected areas of the country, created on the basis of *digital terrain model*; *3.* Lines of administrative borders on the basis of *the state register of unit area boundaries and territorial divisions of the country;* 4. Geographical names, placed on the basis of *the state register of geographical names.* 5. Cartographic shortcuts. 6. Map frames with emblem and margins. For cartographic visualizations, the newly developed database of standardized symbols for standard studies is used. It was published in the form of seven annexes to the Regulation, which includes over 600 symbols with new color schemes, and a new design of typefaces (fonts) for geographical names and other descriptions on the maps. The purpose of building the Polish topographic objects database along with the database management system is to acquire a full nationwide coverage and consistent current information about the topographic objects and their attributes. By the end of 2013, thanks to the funding of 85% refund from the EU budget, Poland will have one of the newest, most technologically advanced databases of topographic objects in Europe, which will be also used to create topographic maps of new generation for the entire country. An important element of a new generation of maps will also be shaded relief, developed on the basis of DEM of high accuracy.

ORAL

Session S12-D

3D Cartography

Thursday, 29 August, 2013

11:00 - 12:15

12D.1 | **From 2D to 3D Modeling – A case study of Walloon region-Belgium** (#932)

R. Hajji
Hassan II Institute of Agronomy and Veterinary Sciences, Rabat, Morocco

A full-length version is available and can be opened here:

_extendedAbstract\286_proceeding.*

12D.2 | **3D maps – scale, accuracy, level of details** (#671)

T. Bandrova, S. Bonchev, S. Tzvyatkova

University of Architecture, Civil Engineering and Geodesy, Photogrammetry and Cartography, Sofia, Bulgaria

A full-length version is available and can be opened here:

_extendedAbstract\76_proceeding.*

Nowadays the three-dimensional (3D) maps are very popular and essential part of the cartography. Day after day the cyber 3D worlds become more realistic, more detailed, more accessible to more people and useful for more purposes. 3D maps undoubtedly offer very good way for perfect visualisation of geographical data, but can we know, how much these data are correct? In the traditional 2D cartography the elements such as scale and accuracy are much clearer than 3D cartography. We have clear definition about the scale of 2D map and we can calculate the accuracy of the map on this base. Cartographical theory still does not clearly define the same topics about 3D maps. What does it mean large-scale 3D map and what does it mean small-scale 3D map. The purpose of this paper is to describe, analyze and define the meaning of the terms scale, accuracy and level of details in 3D cartography and to provoke a discussion about that. Creating of a map required data collecting: existing maps, photogrammetric or geodetic measurements to get data about the position of the geographical objects. 3D maps required also terrain elevation data and data about the height of the objects. There are different ways to collect data and nowadays the technical evolution offer getting data with high level of accuracy. The data can influence the scale, accuracy and level of details and also it depends what is the final purpose of 3D map. All these elements are connected together. The scale of 2D maps is also clear defined. But in 3D maps there are horizontal scale and vertical scale. They could be different. When we use 2D map to create 3D map the scale of 2D map influence the scale of 3D map and also the accuracy. In this paper we will try to define what does it mean the scale in 3D cartography compared with 2D cartography. It is very difficult to define the accuracy of 3D Maps on clear way like mathematical definitions of accuracy of 2D topographic maps. We can also divide the accuracy of 3D maps on two types: horizontal and vertical. Very often they are different and it is not clear which accuracy is higher. Everything depends on data sources accuracy. Usually cadastral, topographical or other 2D map is used as a base for 3D map creation. This 2D map has already its own accuracy. If this map is not in digital form the accuracy could be go down after data processing. Some experimental details about scale and accuracy of 3D map is represented in the paper. Levels of detail (LoD) is a term which is mostly discussed in 3D CityGML. Many scientists use these 5 LoD without counting user needs. The cartographical visualisation, principles and user needs allow us to use not all of LoD defined here. Discussion continues also about LoD for 3D mountain maps where a relief presentation is one of the most important. As well as LoD in symbols' creation is discussed. The mapmaker could decide how many LoD of visualisation of a cartographical symbol could be defined. This is also privilege of the author of 3D map. Very often this is defined according user needs or special topic of the map. A Questionnaire is made about the above discussed three topics: scale, accuracy and LoD. Participants in the questionnaire are professionals (cartographers, geodesists, geographers, computer graphics scientists) and also students who are not familiar with 3D modeling. The results helped us to make definitions and discuss the problems in every one of pointed topics. Discussions are opened in cartographical society and authors hope to find right directions to determine clear definitions and explanations about so new fields in cartography came from computer graphics technology. Several examples of 3D cartographic modeling are shown in the paper. All of them are accompanied by explanations of scale, accuracy and LoD.

3D map of mountain resort:

The 3D map is made on the base of different kind of sources

12D.3 | **Z-axis Based Visualisation of Map Elements – Cartographic Experiences with 3D Monitors Using Lenticular Foil Technology** (#1425)

K. Bröhmer[1], C. Knust[2], M. Buchroithner[2], F. Dickmann[3]

[1]*Main author, Institute of Geography, Bochum, Germany;* [2]*correspondence author, Institute for Catography, Dresden, Germany;* [3]*correspondence author, Insitute of Geography, Bochum, Germany*

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 211

The current advent of autostereoscopic monitors and TV screens using lenticular foil technology proves the increasing desire to visualise movies, pictures, graphics or even maps in true 3D. These techniques could expand the cartographic 'tool box' drastically, implying that 3D is no longer limited to the well-known representation of landform characteristics. Major map design aspects of multi-image models have been analysed and evaluated regarding their use in thematic cartography. For map design using lenticular foil technology empirical findings are necessary to position layers adequately along the z-axis of a 3D depiction. Hovering layers may generate additional information values, which seem to be able to compensate the shortcomings in two-dimensional maps. Several parameters or dimensions of cartographic contents can be displayed simultaneously. True-3D display techniques must be implemented in a differentiated manner to achieve positive impacts on cartographic communication. However, lenticular foil technique opens perspectives for more diverse products in thematic cartography.

12D.4 | **Techniques used for optimizing 3D geovisualization of Terezín Memorial** (#1088)

K. Jedlička[1], V. Cada[1], R. Fiala[1], P. Hájek[1], K. Janečka[1], J. Jež ek[1], J. Roubínek[2], J. Strejcová[1], M. Vichrová[1]

[1]*University of West Bohemia, Faculty of Applied Scienes, department of Mathematics, Geomatic section, Plzeň, Czech Republic;* [2]*Terezin Memorial, Terezín, Czech Republic*

A full-length version is available and can be opened here:

_extendedAbstract\281_proceeding.*

In memory of events happened in Terezín during World War II, the newly created Czechoslovak government, opened the Terezín Memorial in 1947. The key mission of the Memorial is to commemorate the victims of the Nazi political and racial persecution during the occupation of the Czech lands in WW II, to promote museum, research and educational activities, and look after the memorial sites connected with the suffering and death of dozens of thousands of victims of violence. The largeness of Terezin Memorial and its interior complexity doesn't allow visitors to orient here without previous reading and studying. Moreover the sources that are available there is hard to understand. Therefore the project “Landscape of memory. Dresden and Terezín as places of memories on Shoah” aims to accentuate Terezín urban area for its history and Terezín Memorial for its depth of knowledge. The result of the project will be virtually presented landscape capturing the memories of the cross-border Czech-Saxony region in times of Third Reich. For this purpose the technologies serving for geographical description of historical contents, 3D visualization, data description and publication will be used, combined and further developed. Looking at the concept of the virtual model of Terezín Memorial, the model consists of two main parts: the geometric 3D model which depicts the place and the lexical base of data which describes the history of Terezín, mainly during the WW II. Taking a closer look, the heterogeneous nature of existing both analogue and digital documents about the history leads to use a content management system (CMS). CMS is used, together with a relational database, for the lexical data. Each document in CMS has its unique identifier, identifier of a place to which is referred to and two dates referring to a time period. The spatial part of the Terezín model consists of detailed models of all historically valuable buildings and constructions. These models are complemented with less detailed models of the rest of buildings and constructions in the Terezín town. Both lexical and spatial part of the virtual model is filled up with large amount of data. Therefore it is crucial to build such a method of (both lexical and spatial) data selection, which is fast and serve relevant information to the user. Whereas well known one dimensional data indexes can be used for lexical data, situation is a bit more complex in 3D, where common geographic (two dimensional) data indexes cannot be used. In 3D, size of bounding box (BB) of each potentially portrayed object is calculated, based on the observer position, its view direction and the distance from the object. When the size of BB of each object is calculated, different level of detail (LOD) of each object can be displayed. Different LODs are used also in two dimensional maps, where they are used for creation of a scale dependent map, but there is again principal difference between 2D and 3D. While in 2D always just one LOD at a time is portrayed in the map, objects closer to the observer are displayed in higher detail then farther ones in 3D. It leads to a situation, where objects are displayed in different LODs in one 3D scene. This issue poses a major challenge to a creation of a multi-scale 3D model, because different LODs have to share major shape (at least footprints and heights). In summary, the paper shortly introduces history of Terezín as important reminder of events happened there during the WW II. Consequently it describes a motivation of the project and then presents and explains the concept used for model creation from the cartographic point of view. The result of the project is an interactive information system displaying 3D models of Terezin Memorial containing the multimedia historical content. Authors were supported by the project “Landscape of memory. Dresden and Terezín as places of memories on Shoah“, reg. n. 100110544.

ORAL

Session S12-E

Cartographic Education 2

Thursday, 29 August, 2013

11:00 - 12:15

12E.1 | **Issues in Cartographic Education: How and How Many?** (#700)

D. Fairbairn

Newcastle University, School of Civil Engineering & Geosciences, Newcastle upon Tyne, Great Britain

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 461-470

This paper addresses two related issues in contemporary cartographic education: how we should teach and train the increasingly broad range of subject matter which characterises the discipline of cartography today (i.e. what is the scope of cartographic education); and how many should be taught to be cartographers (i.e. what is the scale of cartographic education). A personal interpretation is attempted of these two issues and it is concluded that a well-researched 'Body of Knowledge' can assist in determining the scope of education; and that significantly more effort needs to be directed towards manpower planning in and for the cartographic industry to ensure a meaningful focus for such educational provision.

12E.2 | **Cartography in higher education: changes in the last decades** (#814)

L. Zentai, B. Kovács
Eötvös University, Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\196_proceeding.*

12E.3 | **University 'Mapping' Education in Australia – a Confusing Exposure?**

(#48)

P. Corcoran[1,2], D. Bruce[1,2]

[1]University of South Australia, School of Natural and Built Environments, Adelaide, Australia;
[2]University of South Australia, Barbara Hardy Institute, Adelaide, Australia

A full-length version is available and can be opened here:

_extendedAbstract\445_proceeding.*

12E.4 | **First resume of the new international Master of Science in Cartography**

(#553)

S. Peters[1], L. Meng[1], J. Krisp[1], G. Gartner[2], F. Ortag[2], M. Buchroithner[3], D. Burghardt[3], N. Prechtel[3]

[1]Technical University Munich, Cartography LfK, 81371, Germany; [2]Technical University of Vienna, Department of Geodesy and Geoinformation, Research Group of Cartography (FK), Wien, Austria; [3]Technical University Dresden, Institute of Cartography (IfK), Germany

A full-length version is available and can be opened here:

_extendedAbstract\553_abstract.*

ORAL

Session S12-F

Disaster Management

Thursday, 29 August, 2013

11:00 - 12:15

12F.1 | **Geospatial Data Collection/Use in Disaster Response: A United States Nationwide Survey of State Agencies** (#1104)

M. E. Hodgson[1], S. E. Battersby[1], B. A. Davis[2], S. Liu[1], L. Sulewski[1]

[1]*University of South Carolina, Geography, Columbia, United States;* [2]*Department of Homeland Security, Science and Technology Directorate, Washington, United States*

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 407-420

In the United States presidential disaster declarations are typically issued after major disaster events to provide assistance (in the form of monies, staff, geospatial data, etc.) to states when the disaster overwhelms the resources of the state. Geospatial support is one of the forms of assistance and a frequent publicity item used by Federal agencies in demonstrating their relevance. During the disaster the state is ‘in charge’ of the disaster response while the Federal government provides assistance. Are the geospatial data (including remotely sensed imagery of all types) needs met by the states (based on their experience)? What are the expectations of the states for Federal help in geospatial data? Are states embracing newer paradigms for collecting/exploiting geospatial data, such as volunteered geographic information or crowd-sourced data/information? In the winter of 2011-2012 a nationwide survey of the geospatial data, methods, and problems in all fifty United States emergency management offices (EMOs) was conducted. Responses to the key questions on geospatial data priorities, remotely sensed imagery, timeliness, expectations, staffing, and emerging technologies are presented in this article. This nationwide survey of state EMOs provides a unique view of the EMO director’s view of geospatial methods during emergency response/recovery.

12F.2 | **Thematic Mapping for Disaster Management at Local and Regional Level** (#487)

S. Tsvyatkova

University of Architecture, Civil Engineering and Geodesy, Department of Photogrammetry and Cartography, Sofia, Bulgaria

A full-length version is available and can be opened here:

_extendedAbstract\220_proceeding.*

In the last ten years 85% of the Bulgarian municipalities were frequently and highly affected by natural and man-made disasters. According to the Bulgarian Disaster Management Act disaster management should be planned at local, regional and national level. Each Municipal Disaster Management plan should include two main sections: “Geographic characteristics of the municipality” and “Measures for disaster prevention or mitigation of the effects of disasters”. A main component of both sections of the local plan should be a graphical part that depicts the characteristics and peculiarities of each municipality. Decision making and cooperation between two or more neighboring municipalities in crisis situation are still rendered difficult because of lack of harmonized data and detailed and accurate maps of the regions. The paper examines the necessity of: using a common geographical reference system, standardizing the object classification, standardizing the level of detail, unifying the cartographic visualization. Thus, the maps included in the plans would be usable by both local and regional authorities and would facilitate significantly the cooperative disaster management strategy. The paper presents a series of maps of the Municipality of Troyan, Lovech Region, intended to support disaster management activities. The maps are designed in accordance with a methodology for drawing up local disaster management plans. The paper proposes associative map symbols for cartographic visualization that aim to support decision making in case of emergency and to improve the whole process of crisis management at local and regional level.

12F.3 | **Socio-Environmental Vulnerability and Geotechnologies as Contributions for Risks Cartography** (#595)

M. I. Freitas

Unesp - IGCE, Planejamento Territorial e Geoprocessamento, 13506-900, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\198_proceeding.*

The **s**tudies of vulnerability, hazards and risks are priorities in the intergovernmental agenda of countries all over the World, especially those participating in the UNITED NATIONS action called INTERNATIONAL STRATEGY FOR DISASTER REDUCTION (UN-ISDR). The World Conference on Disaster Reduction, which took place in 2005 in Kobe, Hyogo – Japan, defined the Hyogo Framework for Action (2005 – 2015), a 10-year plan to make the World safer from natural hazards, which was adopted by 168 Member States of the United Nations. The geotechnologies and mapping procedures are the basis of spatial representation of phenomena associated with risks, both technological and natural. The main aim of this paper is to perform a review of the methodological procedures for the modelling of socio-environmental vulnerability using geotechnologies and present case studies in selected areas in Brazil and Portugal. We intent to contextualize the world literature about vulnerability and risks, highlighting different concepts, methodologies and technical procedures concerning Cartography, Geographic Information System (GIS) and Statistics, trying to understand the international tendencies in this area and future research perspectives, emphasizing studies with application in Brazil and Portugal. The study areas were selected in developed regions in the State of São Paulo – Brazil and in the Central Region of Portugal using as reference counties with similarities in location (continuous territorial range) and landscape (from the coastal plain to the first interior reliefs) and physical and diversified social and economic status. The study of vulnerability is based on GIS and Statistics, using factor analysis and principal component analysis for aggregation of statistical socioeconomic and environmental variables derived from census. The statistical program SPSS R. 18 and the GIS ArcGIS 9.3 were adopted to produce the vulnerability analysis and mapping. The results were presented in the format of vulnerability tables and maps. The main factors with high vulnerability in counties of State of São Paulo – Brazil were related to the population concentration in urban areas such as high birth, crime and poverty and also rural exodus and some precarious condition of accommodation in the cities. In Central Region of Portugal vulnerability factors associated with economic contraction appeared, confirming that the country is facing **the** consequences of low birth rate and aging population. In addition, variables related to the aging of urban buildings and to forest fires were detected, which are recurring events in the country. The model showed results consistent with the reality of most counties studied and will be improved in the way of a standardization of the analysis between the two countries, hoping to contribute with planners and public administrators in the studied regions and in other similar situations regarding the vulnerability and risks.

12F.4 | **Focus on Rescue and Emergency Services in Sweden** (#185)

P. Wasström

Lantmäteriet - The Swedish mapping, cadastral and land registration authority, International Services Department, Gävle, Sweden

A full-length version is available and can be opened here:

_extendedAbstract\144_proceeding.*

Lantmäteriet - The Swedish mapping, cadastral and land registration authority - started in November 2009 a user group for actors in rescue and emergency services. The purpose with this user group is to increase the knowledge of the users, their activities and procedures, and current and future needs of geodata. Another purpose is to provide information about Lantmäteriet's geodata (content, quality, structure) among the users. Twice a year Lantmäteriet gathers the representatives for a dialogue, with national focus, to exchange knowledge and experience. This means that Lantmäteriet increase its own and other actors' insight on access needs and demands. In this way Lantmäteriet get knowledge of what actions Lantmäteriet, actors and the market have to take to give the users better and actual geodata. Use of both cadastral and geographic information is very important for hazard management and for the emergency services. The ready availability of current and reliable maps and cadastral information is of vital importance for these services. Common goals in the user group are to increase the understanding about the demands and supply of geodata i.e. cadastral (land) and geographic information. To create a platform for continuous dialogue about common problems and development needs for the national supply of geodata for the emergency operations. In the end the most important thing is that the rescue and emergency services must on the quickest and easiest way "find the correct place“.

ORAL

Session S12-G

Mixed Session

Thursday, 29 August, 2013

11:00 - 12:15

12G.1 | **The Design and Mapmaking of "ShenZhen and Hong Kong Atlas"** (#153)

Z. He[1], A. Hu[2], J. Miao[3], Z. Cai[1]

[1]Wuhan University, School of Resource and Environmental Science, China; [2]Second Highway Consultant Co. Ltd of Ministry Of Communication of China, Surveying and Mapping Company, Wuhan, China; [3]Wuhan Geotechnical Engineering and Surveying Institute, Cartographic Center, China

A full-length version is available and can be opened here:

_extendedAbstract\105_proceeding.*

In this paper, we discuss the design and mapmaking of "ShenZhen and Hong Kong Atlas" (hereinafter referred to as the Atlas)) under total digital environment. The Atlas is that makes Shenzhen City and Hong Kong two regions as one cartographic region for the first time. The Atlas involves a wide range of sciences and contains a large quantity of information, and as being a comprehensive information library construction project. The Atlas has authoritative information, innovative designs and the latest data. The compilation and publication of the Atlas may provide map readers with comprehensive, detailed, high quality and convenient information guidance, and contribute to the cultural exchanges, social and economic development of Shenzhen and Hong Kong. This paper researches the design principles and unique feature of the Atlas based on the analysis of the development status and trends of contemporary atlas. Because the basic cartographic information sources between Shenzhen and Hong Kong are different, the basic cartographic information of the Atlas needs to connect and coordinate in the map design and mapmaking to make the two regions as a whole graphics area. This paper discusses the Atlas for the principles and methods of arrangement and composition of design, format and layout design, framing and scale design, color design, symbol design, annotation design, map index design and so on with atlas design and production theory. Hill-shading method was used to represent the relief trend of Shenzhen and Hong Kong. The Atlas classifies and grades of various kinds of geographic features such as residential areas, roads, water system, titles, village names in the uniform standards, and take social and cultural differences of the two regions into account in symbol design and annotation translation, etc. It makes atlas form an organic-related and mutually complementary map system, so as to show the characteristics of the integration of Shenzhen and Hong Kong. The paper discusses the digital mapmaking process of the Atlas, and describes the digital cartographic process of the atlas in detail, including computer mapmaking methods of the map data layers design, roads, water system, landscapes, residential areas, boundaries, vegetation and map index with examples. Hill-shading was done based on digital vector contour line. It establishes a new map generalization concept in the production of the regional map. Compared with traditional atlases, it is focused on the expression of the authenticity of the geographical factors and pay attention to the harmonization and coordination in the selection and generalization degree of the content. According to the differences between two data sources, take a different degree in selection and generalization for Shenzhen and Hong Kong. Map content of Shenzhen tends to detailed and authentic direction, while map content of Hong Kong is simplified based on the original, so the balance of the information of the two regions was ensured.

12G.2 | **New production environment for the National Topographic Database 1:25.000 (BTN25). Intelligence for geographic databases** (#1346)

J. García García[1], A. de Las Cuevas Suárez[2], A. Marin[2], V. Martin[2], F. Sanchez-Garcia[2], J. González-Matesanz[3]

[1]Head of Basic and Derivated Cartography Area, National Geographic Institute, madrid, Spain; [2]Basic and Derivated Cartography Area, National Geographic Institute, Madrid, Spain; [3]Assistant Deputy Director of Geodesy and Cartography, National Geographic Institute, Madrid, Spain

A full-length version is available and can be opened here:

_extendedAbstract\415_proceeding.*

INTRODUCTION This paper aims to show the technological change that happened in the cartographic production workflows of IGN-E during last years. Particularly it puts special emphasis on how the semantic rules introduced through this change are safeguarding the logic consistency and quality in the cartographic products obtained. In the first decade of 2000 a geographic information product was defined, the National Topographic Database 1:25000 (BTN25). This new product was created by means of a transitional technology consisting of a geographic database stored in Oracle Spatial, and it was implemented by a customizing CAD environment and also by some own applications related to management and data control. Since May 2010, we are focusing our efforts on getting a safe production environment, specifically watching the consistency and quality in our products. For this result we have introduced the semantic rules, which establish a set of permissions and restrictions by means of topological relationships that “must or can” be accomplished by the geographic features. **PRODUCTION ENVIRONMENT DEFINITION** We have designed our environment by setting the six following goals: 1. - The information will be updated via satellite files (mdb) which are exported from the central database (ORACLE). The updated file and the original one are compared through a matching process, introducing changes at the case (new definitions, deletions or modifications). This management is performed by the importing tool towards the central database allowing a view of the data base related to a certain date and it can also detect changes in the database between any two dates, regardless of the sequence of updating information process. This is a great advantage for updating derived products. 2. – The environment allows performing data processing and information updating to occur simultaneously, resolving conflicts in order to re-import the updated information. 3. - An information capture environment has been created in order to check the consistency of the information before recording it. It has been faced by introducing semantic rules that verify the fulfillment of the conditions defined in the data dictionary. 4. - There are several custom settings supporting the following data sources: photogrammetric data and orthophoto plus DEM or DSM depending of what you are recording. 5. – There is a custom control environment in the post-processing stage, which performs the following checks: 5.1 Geometric: Semi-automatic corrections of duplicate lines, loops, kickbacks, overshoots, undershoots and other geometric anomalies. 5.2 Topological: It verifies both continuity within a production unit and continuity between different production units. 5.3 Format and domain: It detects violations of formatting rules and domain rules applied to attribute values. Also, it verifies if the combination of the attribute values of one instance of a feature type is allowed. 5.4 Elevation control: It detects inconsistencies between the height of captured element and the elevation model. 5.5 Semantic: It applies semantic rules in the post-process stage in order to observe inconsistencies in the captured data. 5.6. Support system for visual control: checking the completeness, the shape and position of the geometries and the proper classification and allocation of names by a visual inspection is performed, comparing the information with reference sources, elevation models and orthophotos. 6. – And finally, there is an error management system, which tracked the errors found in the reviewing process. Once an error is detected, changes its state until it is resolved, thus ensuring traceability in this process. **CONCLUSIONS** In short, we have created a new production environment, characterized by its safety, speed, high usability and by adding an extra value to BTN25 information.

12G.3 | **A Construction Theory of Thematic Map Taking A Carto-Linguistic Perspective** (#479)

Z. Fei[1], Q. Du[2], W. Cong[1], L. Jianjun[1]
[1]National Geomatics Center of China, Beijing, China; [2]Wuhan University, China

A full-length version is available and can be opened here:

_extendedAbstract\479_abstract.*

12G.4 | **GIS-mapping of Phobos based on new results of image processing of Mars Express data** (#1075)

I. Karachevtseva[1], S. Afanasyeva[1], K. Shingareva[1], I. Nadezhdina[1], A. Zubarev[1], N. Kozlova[1], L. Shishkina[1], E. Gusakova[1], M. Baskakova[1], C. Lorenz[2]

[1]State University of Geodesy and Cartography (MIIGAiK), Extraterrestrial Laboratory (MExLAb), Moscow, Russia; [2]Vernadsky institute of geochemistry and analytical chemistry, Laboratory of Meteoritics, Moscow, Russia

Using remote sensing data have been received from Mars Express (MEX) spacecraft as well as results of processing of these data we created maps of Phobos based on geographic information system (GIS). Data are presented on sphere and 3-axial ellipsoid. **1. Introduction** Based on the MEX data a new control point network of Phobos has been created at MIIGAiK Extraterrestrial Laboratory (MexLab). It allowed us to update shape parameters of Phobos: 13.24 km, 11.49 km, 9.48 km (Zubarev et al. 2012). From the control network solution a new DTM and a orthomosaic of Phobos have been derived on sphere. The new products allow us to create up-to-date Phobos maps and provide geomorphology analysis. **2. Input data** Using the new control point network, a DTM with breaklines has been produced with accuracy of 10-70 m/px. The DTM was used to create a new orthomosaic with resolution 20 m/pixel. 136 SRC (MEX) and 13 Viking Orbiter images were involved in mosaicking. The new orthomosaic enables particular mapping of Phobos' surface (Nadezhdina et al. 2012).. The most detailed parts of the DTM (Fig. 1) provide an opportunity for deeper morphological analysis **3. Mapping of Phobos** Based on the new orthomosaic of Phobos the update of global crater catalog (Karachevtseva et al. 2012) has been developed. In total, about 5500 craters were digitized. The catalog contains diameters and depths of craters as well as the ratio of depth/diameter (for craters with diameter more than 300 m). Using this information we calculate size-frequency distribution and spatial density of craters. Using the global DTM morphological characteristics of surface (slopes, roughness) have been derived and presented in thematic maps. In addition results of mapping represent on 3-axial ellipsoid. **4. Geomorphological map of Phobos** Using the geomorphological scheme of Phobos' surface has been created morphological analysis of high resolution MEX images. The scheme comprises the distribution of impact ejecta deposits and locations of down slope regolith movement sites as well as the up-to-date conception about the possible temporal relationships of different groove families. Seventeen regions of different surface structure and its possible stratigraphic positions were also shown on the scheme. We have created a geomorphological map of Phobos using these data (Fig. 2). **5.Conclusion** During our work different data have been combined and used to create the thematic maps and statistical analysis of crater distribution of Phobos. The maps of Phobos and results of the geomorphology study will be published at the Geoportal of MexLab (Karachevtseva et al. 2012). **6.Acknowledgements** This work has been supported by a grant from the Ministry of Education and Science of the Russian Federation (Agreement # 11.G34.31.0021 dd. 30/11/2010) and grant #14.B37.21.1303 “Development of planetary data Geoportal to provide access to results of planets and satellites the Solar system research” and partly supported by a grant #11-05-91323 Geodesy, cartography, and research of the Martian satellites Phobos and Deimos. **References:** A. E. Zubarev, I. E. Nadezhdina, A. A. Konopikhin (2012) Problems of remote sensing data processing for modelling of small bodies of the Solar system. Actual problems in remote sensing of the Earth from space, IKI RAS. Vol.9, #4, pp. 277-285 I. Nadezhdina, A. Zubarev, V. Patraty, L. Shishkina, O. Zharov, A. Zharov and J. Oberst (2012) Phobos Control Point Network and Librations. Abstract of EPSC Karachevtseva I.et al.(2012) Global Phobos Geodatabase and GIS Analyses, Abstract of 43 LPSC I. Karachevtseva, E. Matveev, E. Cherepanova (2012) Razrabotka maketa rossiiskogo segmenta hranilischa planetnyh dannyh na osnove GIS-tehnologii (in Russian). Abstract of Actual problems in remote sensing of the Earth from space. Moscow, IKI RAS Conference, 12-16 November

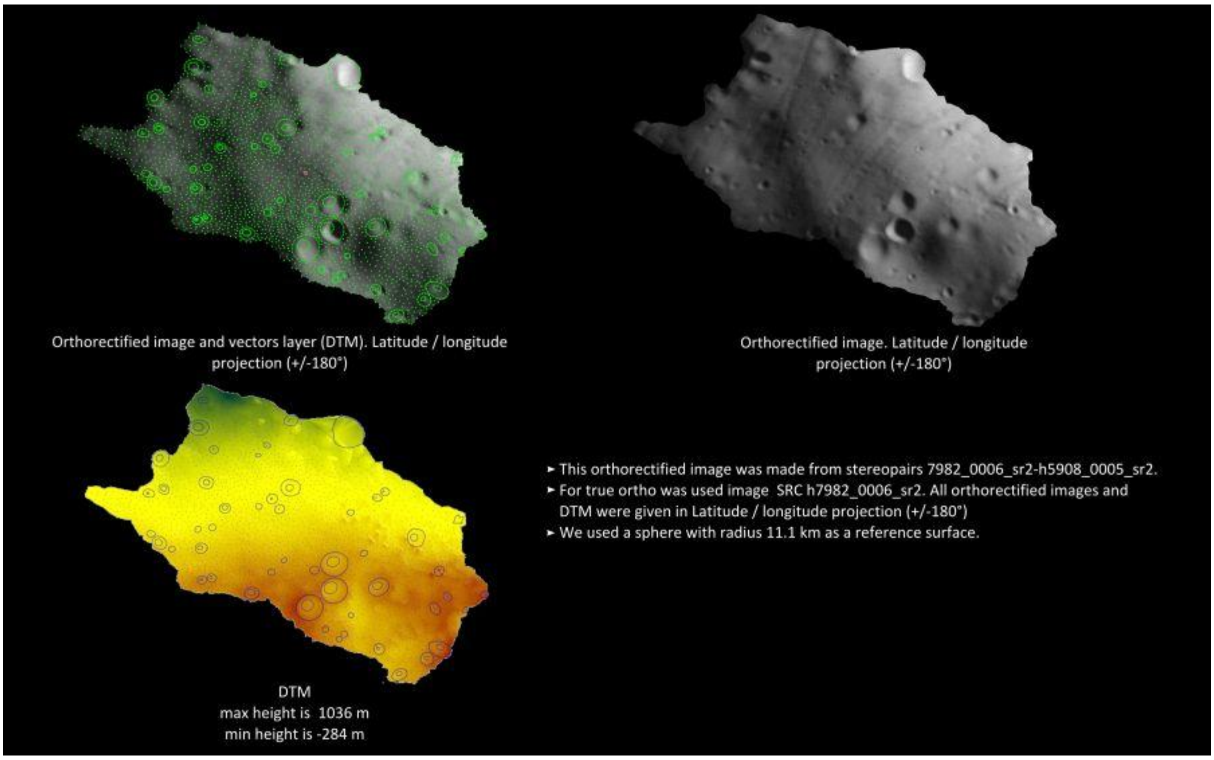


Fig.1. :
Local DTM and orthoimages of Phobos (resolution12.28 m/px)

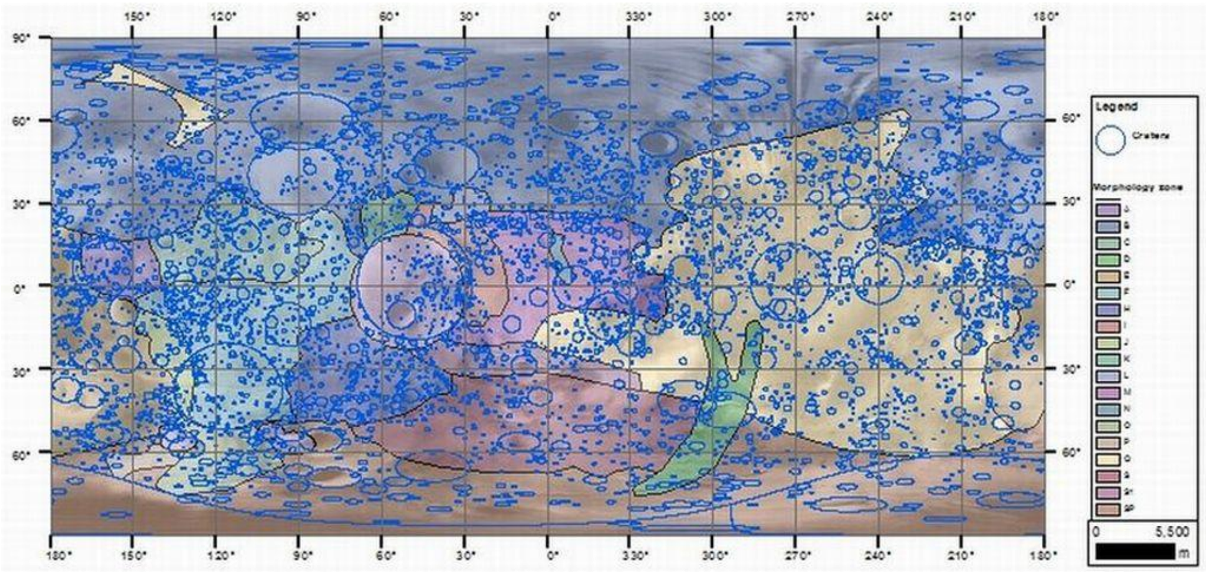


Fig.2.:
Global distribution of craters on morphological zone

ORAL

Session S12-H

Aus der Arbeit der DGfK-Kommissionen

Thursday, 29 August, 2013

11:00 - 12:15

12H.1 | **Urheberrecht und Open Government Data - passt das zusammen?** (#1472)

D. Diez[1,2]

[1]Kommission Recht und Geodaten, Deutsche Gesellschaft für Kartographie, Germany; [2]Landesamt für Geoinformation und Landentwicklung Baden-Württemberg, Stuttgart, Germany

Unter Open Data wird die Handlungsmaxime verstanden, dass Daten, die vom öffentlichen Sektor erhoben bzw. zusammengetragen werden und nicht offensichtlichen Einschränkungen – beispielsweise aufgrund von Datenschutz- oder Sicherheitsaspekten – unterliegen, offen verfügbar gemacht werden. Open Data ist jedoch weder ein gesetzlicher Begriff noch wird er einheitlich interpretiert. Somit bleibt offen, in welchem Verhältnis dieser Begriff zum Urheberrecht steht. Daten aus der öffentlichen Verwaltung wie z. B. Vermessungsergebnisse werden regelmäßig nach zwingenden fachlichen Regeln erstellt, die keinen Raum für persönliche geistige Schöpfungen lassen. Sammlungen solcher Daten können allerdings als Datenbank i. S. d. § 87a UrhG geschützt sein. Dies ist der Fall, wenn die Datensammlung systematisch oder methodisch angeordnet ist und die Daten einzeln zugänglich sind. Außerdem muss die Beschaffung, Überprüfung oder Darstellung der Daten eine nach Art oder Umfang wesentliche Investition erfordern. Analoge topografische Karten sind außerdem seit langem als urheberrechtsfähige Darstellungen wissenschaftlicher Art anerkannt (§ 2 Abs. 1 Nr. 7 UrhG). Das Urheberrechtsgesetz berücksichtigt öffentliche Interessen an einem freien und ungehinderten Zugang aller Bürgerinnen und Bürger zu Daten aus der öffentlichen Verwaltung in § 5 UrhG. Nach § 5 Abs. 1 genießen Gesetze, Verordnungen, amtliche Erlasse und Bekanntmachungen sowie Entscheidungen und amtlich verfasste Leitsätze zu Entscheidungen keinen urheberrechtlichen Schutz. Nach § 5 Abs. 2 gilt das gleiche für andere amtliche Werke, die im amtlichen Interesse zur allgemeinen Kenntnisnahme veröffentlicht worden sind, mit der Einschränkung, dass die Bestimmungen über Änderungsverbot und Quellenangabe entsprechend anzuwenden sind. Ein amtliches Interesse an einer allgemeinen Kenntnisnahme von Geodaten liegt zweifelsfrei dann vor, wenn eine Norm des öffentlichen Rechts den urheberrechtlichen Schutz von Geodaten begrenzt oder ausschließt. Der Bund ist mit der am 16.11.2012 in Kraft getretenen Neufassung des GeoZG über die Anforderungen der INSPIRE-Richtlinie hinausgegangen und hat einen großen Schritt in Richtung Open Government Data unternommen. Nach § 11 Abs. 2 GeoZG sind Geodaten und Metadaten über Geodatendienste für die kommerzielle und nicht kommerzielle Nutzung geldleistungsfrei zur Verfügung zu stellen, soweit durch besondere Rechtsvorschrift nichts anderes bestimmt ist oder vertragliche oder gesetzliche Rechte Dritter dem nicht entgegenstehen. Nach § 11 Abs. 3 GeoZG werden die Einzelheiten zur Nutzung von Geodaten und Geodatendiensten in einer Rechtsverordnung nach § 14 GeoZG geregelt. Diese Rechtsverordnung wurde am 19.03.2013 erlassen (Verordnung zur Festlegung der Nutzungsbestimmungen für die Bereitstellung von Geodaten des Bundes - GeoNutzV). Danach müssen die Nutzer den Geodaten, Metadaten und Geodatendiensten beigegebene Quellenvermerke erkennbar einbinden und Veränderungen, Bearbeitungen, neue Gestaltungen und sonstige Abwandlungen mit einem Veränderungshinweis versehen. Wenn eine öffentlich-rechtliche Vorschrift eine geldleistungsfreie Nutzung von Geodaten durch jedermann zulässt und die Nutzungsbedingungen festlegt, geht diese Vorschrift gegenüber dem Schutz nach dem Urheberrechtsgesetz vor.

12H.2 | **Die Stadt in 3D - Modellierung und Präsentation** (#1473)

I. Jaquemotte[1,2]

[1]Kommission 3D-Stadtmodelle, Deutsche Gesellschaft für Kartographie, Germany; [2]Jade Hochschule, Oldenburg, Germany

Das Interesse an virtuellen 3D-Stadtmodellen ist in den letzten Jahren stetig gewachsen. Insbesondere in der kommunalen Verwaltung wird das Potential von virtuellen 3D-Stadtmodellen zunehmend erkannt. Während in vielen großen Städten der Innenstadtbereich zunächst für touristische Anwendungen bzw. zu Repräsentationszwecken modelliert wurde, werden heute zunehmend auch kommunale Anwendungen identifiziert, die ein 3D-Stadtmodell zwingend verlangen. Dabei sind die Anforderungen an Detailgrad und visuelle Aufbereitung sehr unterschiedlich. So erfordert die Bestimmung des Solarpotentials detaillierte und verlässliche Dachformen, wohingegen die graphische Ausgestaltung von Fassaden eine untergeordnete Rolle spielt. Im Rahmen von Planungsverfahren dagegen muss die Umgebung deutlich wiedererkennbar sein, daher wird hier eine realitätsnahe Ausgestaltung des städtischen Raumes einschließlich der Darstellung von Vegetation und Straßenmöbeln gefordert. Dies gilt insbesondere in Projekten von öffentlichem Interesse, an denen die Bürger/innen beteiligt werden sollen. Aktuell wurde und wird eine Vielzahl leistungsfähiger Methoden und Softwaresysteme entwickelt, die eine weitgehend automatisierte Erfassung und Modellierung von 3D-Stadtmodellen auf der Basis unterschiedlicher Datenquellen erlaubt. In Zukunft sollen lt. Beschluss der Arbeitsgemeinschaft der Vermessungsverwaltungen der Länder der BRD (AdV) 3D-Gebäudemodelle in den Detailstufen LoD1 und LoD2 auch als Geobasisdaten durch die amtliche dt. Vermessung bereitgestellt werden. Und auch für eine graphisch hochwertige Visualisierung stehen leistungsfähige Programme mit unterschiedlichen Zielsetzungen zur Verfügung. Somit sind inzwischen gute Voraussetzungen für einen breiten Einsatz von 3D-Stadtmodellen geschaffen. In dem Vortrag werden Ergebnisse und Erfahrungen aus studentischen Projekten und Abschlussarbeiten der Jade Hochschule im Umfeld der 3D-Stadtmodellierung vorgestellt. Dabei wird zunächst auf die Erfassung und Fortführung mit ausgewählten Softwareprodukten eingegangen, wobei neben dem graphischen Ergebnis auch die erreichte Höhengenauigkeit und die Zuverlässigkeit der Dachformerkennung angesprochen werden. Die unterschiedlichen Anforderungen verschiedener Fachdisziplinen an ein 3D-Stadtmodell werden analysiert und der jeweils erforderliche Erfassungsaufwand anhand von Beispielen erläutert. Daneben sollen verschiedene Varianten der Ausgabe eines 3D-Stadtmodells vorgestellt werden. Ein Fokus liegt dabei auf der graphischen Aufbereitung von Informationen, wobei gute Lesbarkeit und Verständlichkeit im Vordergrund stehen. Dies gilt insbesondere für die Visualisierung solcher räumlichen Informationen wie Lärm oder Luftverschmutzung. Zuletzt werden moderne Techniken aus der Computergrafik vorgestellt, die den Einsatz von 3D-Stadtmodellen unterstützen, wie z.B. die stereoskopische 3D-Darstellung, der Einsatz eines Multi Touch Table oder die Erweiterung der Realität (Augmented Reality).

12H.3 | **Kartographie und Geoinformation für das Management von Desastern**

(#1474)

H. Kremers

Kommission Risiken, Katastrophen, Sicherheit, Deutsche Gesellschaft für Kartographie, Germany

Im gesamten Zyklus des Managements von Gefahrenlagen (von der Ersthilfe bis zur den Planungen und Maßnahmen zur Katastrophenvorsorge) haben Kartographie und Geoinformation eine zentrale Rolle bezüglich aller raumbezogenen Aussagen. Die RKS-Kommission der DGfK hat sich die Aufgabe gestellt, nicht nur innerhalb der Kartographie eine Plattform für den Erfahrungsaustausch zu bieten, sondern auch zusammen mit den vielen interdisziplinären Akteuren eine Intensivierung und Optimierung des Einsatzes von Kartographie und Geoinformation bei den unterschiedlichen Aufgabenstellungen zu fördern. Besondere Herausforderungen an die Methoden und Techniken der Kartographie bereitet die typische hochdynamische Situationsentwicklung im Falle von Desastern. Dabei sind die Anforderungen vieler Akteursgruppen, insbesondere der Entscheidungsträger und der Öffentlichkeit, zu berücksichtigen. Kartographie und Geoinformation bieten die erforderlichen synergetischen Analysemöglichkeiten der verfügbaren Daten (je nach Auswertungsbedarf u.a. Daten von Umwelt, Sozio-Demographie, Wirtschaft und Gewerbe, Gesundheit, amtlicher Statistik etc.). National und international wächst die Überzeugung, dass eine durchgreifende Standardisierung von Informationen und Informationsflüssen im Desaster Management erforderlich ist. Die dabei auftretende Vielfalt der zu einer schnellen Auswertung, Analyse und Kommunikation für Entscheidungsträger erforderlichen Fachdaten überschreitet organisatorisch den bisherigen Rahmen von INSPIRE deutlich. Die Kartographie leistet damit verstärkt Beiträge zum Bevölkerungsschutz und zur Bewältigung bzw. zu Vorsorge anderen humanitären Ausnahmesituationen.

12H.4 | **Karten versus Globen – Entfernungen auf ebenen und sphärischen Displays** (#1475)

F. Hruby[1,2]
[1]Kommission Kartenkuratoren, Deutsche Gesellschaft für Kartographie, Germany; [2]University of Guadalajara, Department of Geography and Regional Planning, Mexico

Wir sind gewohnt zu wissen, dass die Erde annähernd rund ist. Ebenso sind wir gewohnt, die annähernd runde Erde als vollkommen flache Erdkarte zu sehen. Möglichkeiten, die Erde in Form von Erdkarten darzustellen gibt es viele - mathematisch gesprochen sogar unendlich viele. Diesen vielen Möglichkeiten sind jedoch zwei unvermeidbare Nachteile gemeinsam: Erdkarten sind niemals frei von Verzerrungen und unterliegen immer der Bedingung, die kontinuierliche Erdoberfläche entsprechend der jeweiligen Kartenränder zu unterbrechen. Es können daher in keiner Erdkarte Entfernungen, Flächen und Winkel mit gleicher Genauigkeit dargestellt und gemessen werden. Dieser Nachteil gibt in der Kartographie und Geographie seit Jahrzehnten Anlass für Diskussionen um die Frage, welche die geeignetste Kartenprojektion sei, die Erde als Erdkarte darzustellen. Bei solchen Diskussionen wird jedoch meist eine wesentliche Alternative zur Erdkarte ausgeschlossen, nämlich die Repräsentation der Erde auf einem Globus. Welches die Vorteile einer Darstellung der Erde auf einem Globus gegenüber einer Karte sind bzw. sein könnten, ist die zentrale Thematik dieses Vortrags. Ausgehend von dieser Problematik soll zunächst einerseits versucht werden, den aktuellen Stand technologischer Entwicklungen im Bereich digitaler Globen und sphärischer Displays unter dem begrifflichen Konzept des "Hyperglobus" zusammenzufassen. Andererseits soll an einem Fallbeispiel gezeigt werden, wie der Hyperglobus nicht nur der Visualisierung globaler Datenbestände dienen kann, sondern zugleich auch eine Untersuchungsplattform bietet, mit welcher die Vor- und Nachteile von Globen vs. Karten empirisch geprüft und neu bewertet werden können. Die konkrete Frage dieses Fallbeispiels lautet: Wie werden Distanzen auf Globen und Karten, das heißt auf sphärischen und ebenen Displays gelernt, gespeichert und abgerufen?

Session S12-I

Business Meeting of the Commission on Ubiquitous Mapping

Thursday, 29 August, 2013

11:00 - 12:15

POSTER

Session P3

Poster Session

Thursday, 29 August, 2013

12:15 - 12:45

P3.1 | **The Spanish Provincial Maps: A new way of mapping from geospatial databases** (#1286)

L. Sanz Bueno[1,2]

[1]National Geografical Institute, Subdirectorate for Geodesy and Cartography, Madrid, Spain; [2]National Geografical Institute, Subdirectorate for Geodesy and Cartography, Madrid, Spain

Throughout history, the provincial map series of Spain has evolved to achieve formats and designs with greater functionality with the objective to fulfill the user's needs. At the same time, the means of production have also been changing to make the users required information in the shortest time, with the least number of resources involved in the process and thereby, improving efficiency in the production process. The subject of this paper is to introduce the new Spanish Provincial Map at 1/200.000 scale (MP200), that is obtained from the National Cartographic Database (BCN200), a multipurpose database. On one hand, this new production provides an own analysis from a geographical information database and, on other hand, the quality of cartographical production is more quickly and easier. The idea has been to maximize the automatic map production from geospatial databases taking advantage of the possibilities offered by new technology tools and, therefore, establish more efficient flow production. The MP200 comes from the need to provide cartography between the National Topographic Map, at 1:25000 and 1:50,000 scale, and "Map of the Iberian Peninsula, Balearic and Canary Islands" at 1/1.250.000 scale. The territorial division of Spain into provinces, is a good way to think of an intermediate mapping. It provides a suitable format for the mapping editing and the scale supplies cartographic information useful for the user. The tradicional way of national map production system has been settled by sheets through 'Computer Aided Design' (CAD) programs. These programs have been used in all the processes of mapping formation and were very versatile at the time but now, that it is pretended produce maps from geodatabases, using them is not the best option. Technological changes and the use of geospatial databases as storage media of geographic information are motivating a change in the production process. At first it was considered using the modules of geodatabase managers in the whole cartographic production process. But these modules work connected to the database which causes cartographic editing were too slow. Due to this situation, the solution adopted was the next one: The Geographic Information Systems Managers (SGIG) are used for treating and debugging geographic information, and they solve in an efficient way the control of the information. With the updated and controlled information, to perform an efficient cartographic editing, it is carried out through a vector editing software which works with attributes. The fact of working with attributes during all the working process allows to establish a link between the map that will be printed and geodatabase storage, fitting perfectly to the needs of this new production system. Having said that, the working process exposed in this articleis considered has two milestones: - The first one is to get a cartographic geodatabase , BCN200, which will serve to produce MP200. - And the second one is layout the final map that will be printed. The proposed process considers two products and two different work environments: -BCN200 inside a database environment as a storage medium, and -MP200 implemented inside a vector editing environment as the final representation map that will be printed. Both products must be connected and it is possible through the fact of working with attributes. So that all changes that occur in the geodatabase or map are considered in both environments. With this new production process cartographic editing work is minimized and the map update process is automated as much as possible. Intrinsically the manual tasks are considerably reduced and thus errors due to subjective interpretations of operators.

P3.2 | **Applying cartography to semi-automated map creation** (#1155)

C. Wesson

Ordnance Survey, Cartographic Design & Development, SOUTHAMPTON, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\259_proceeding.*

As a national mapping agency recognised for its excellence in cartography, embracing the world of Geographic Information System (GIS)-created mapping has been something of a challenge for Ordnance Survey. This poster aims to showcase what cartographic styling can be achieved within a modern day GIS package, to give an outline of what tools were used and to have a brief look at how a set of generic rules can achieve respectable results across a national product with somewhat varied terrain and topography. Our Multi-Resolution Data Programme (MRDP) combined with cartographic ability coming into GIS has allowed us to produce new products almost straight from data. This has a massive gain in terms of data currency and if automation is set up right with the correct quality checks in place then their can also be time and cost efficiency gains. Using examples such as OS VectorMap® Local and OS VectorMap® District, the poster will demonstrate how Ordnance Survey's Cartographic Design and Development team have been able to style relatively detailed, national-coverage map products in a GIS. For many years, styling within a GIS environment was very limited when compared to graphics packages such as Adobe's Creative Suite. Whilst still not ideal for map creation, the advantage of being able to read in geographically referenced data straight from a database, apply some 'on the fly' data filtering, apply styles including colours, line weights and labelling, apply selective masking and automate export to produce a national map series makes the appeal outweigh its weaknesses for some map products. Recent introductions to GIS software such as cartographic representations, some basic visual effects, better symbol support, improved multi-level styling capabilities, better user interfaces and enhanced export options make it more desirable to the cartographer. In the United Kingdom, we have quite a variety of topography for a relatively small island nation. The remote, barren and rural mountain landscapes of the Scottish Highlands pose far different cartographic challenges to the crowded urban mass of London; our capital city and the largest urban zone in the European Union. We also have areas such as the Midlands with a dense meeting of communication themes such as roads and railways and as a group of islands, a large proportion of the country can be considered coastal. In automated map creation this variation makes some aspects of cartography very difficult. Even with filtering and categorising of the content data, one cannot keep subcategorising to cater for every different scenario. At some point a feature type on the map will have to be styled using the method of 'one rule fits all'. For label placement especially this is something of a skill in recognising or calculating the best compromise. Traditionally a cartographer would label based upon a set of rules but would have the opportunity to consider other factors such as competing labels, other features on the map, and so on in order to find the 'best space' for a label. For our semi-automated products this has been calculated automatically using a set of GIS rules worked out by our Cartographic Design and Development team. The results of this work are the release of the OS VectorMap® Local and OS VectorMap® District product portfolios. The cartography of both the raster versions of these products and the stylesheets for the vector versions were completely produced using ESRI ArcMap 10 and have allowed us to create a national set of maps with a cartographic style that is automatically applied to the data at the push of a button.

P3.3 | **A Geospatial Reference Framework for Student Training Survey Camps**

(#1280)

S. Sepehr, D. Fraser, E. Stefanakis

University of New Brunswick, Geodesy and Geomatics Engineering, Fredericton, Canada

A full-length version is available and can be opened here:

_extendedAbstract\312_proceeding.*

This paper addresses the procedure to build a geospatial reference framework for storing, managing and analysing the survey camp data, collected annually by Geodesy and Geomatics Engineering (GGE) students at the University of New Brunswick. The feature coding and modeling issues of survey camp data will be discussed first, along with the generation of a base map using past survey camp data. The base map will be reflecting the geospatial reference framework characteristics regarding the data modeling requirement. GIS approaches have been employed to conduct the encoding and analytical processes over the existing survey camp data. ESRI ArcGIS has been utilized, to implement spatial and non-spatial data analysis functions, over the campus CAD maps to provide an initial base map. The base map generation procedure will be defined as the first stage towards the development of the geospatial reference framework. The establishment of a uniform data model will be pursued. Semi-automated technical GIS approaches, known as GIS Analysis Modeling, will be developed next to facilitate the update and maintenance of the geodatabase. The geospatial framework will constitute a potential repository for modeling and management of past and future measurements collected in GGE Survey Camps. In order to make the framework accessible to students and anyone who might need to use or study the survey camps data, a web map service (WMS) will be developed over the base map. WMS provides the ability to publish the framework specifications and characteristics to the users over the web. The service will be developed and designed using ArcGIS Javascripts API. Thus, there is no specific technology demanded to visualize the base map over the web. The web map service will facilitate: (a) the definition of campus key features; (b) the application of a common feature coding model; (c) the generation of a uniform repository; (d) the control over new collected data; and (e) the editing and storage of new data into the geodatabase. Additional to the WMS, a Web Processing Service (WPS) will be developed using ArcGIS Javascript API, in order to control the elevation data using a digital elevation model (DEM) base map as a reference surface. The campus is divided into several sectors for survey camp operations. Each sector will be compared to the DEM base map through the WPS service. The process will be executed over the web, based on the predefined Geo-Processes, which are assigned to the web service as analytical tasks.

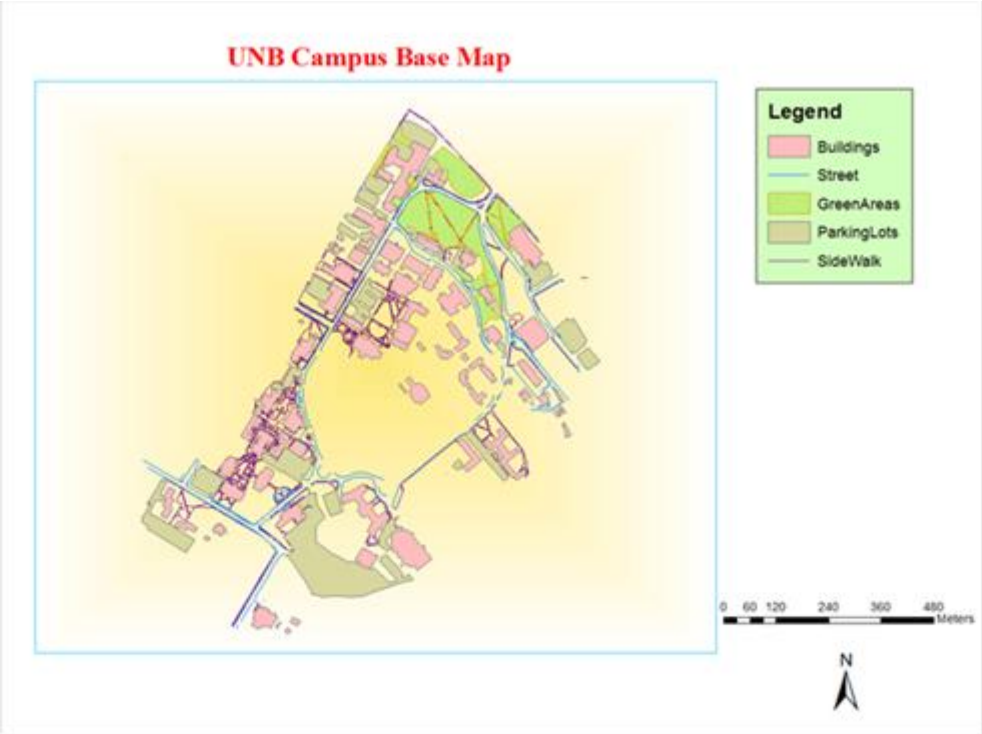


Figure1:
UNB Campus Map

P3.4 | **THE GEOLOGY OF POLISH TATRA MOUNTAINS – DETAIL DIGITAL CARTOGRAPHIC SERIES OF MAP AT SCALE 1:10 000 BASED ON GIS TECHNOLOGY** (#518)

E. Piotrowska
THE POLISH GEOLOGICAL INSTITUTE - NATIONAL RESEARCH INSTITUTE, Geological Mapping Program, Warsaw, Poland

A full-length version is available and can be opened here:

_extendedAbstract\155_proceeding.*

The poster, which I would like to present on the 26th International Cartographic Conference is dedicated to the digital Geological Map of Polish Tatra at scale 1: 10 000. Tatra mountains are called the pearl of Polish mountains. They always have been very important subject of scientific, research and turistic studies. In the last century there was created and printed in traditional form The Geological Map of Polish Tatra at scale 1: 10 000, which was an masterpiece and some other maps in lower scales. Currently it is time to give up-to-date form of continuing scientific work of Polish geologists, it is time to create an digital form of geologic map of Tatra mountains. Some years ago, in The Polish Geological Institute – National Research Institute have begun cartographic author`s compilations, which lead up to gather, modern existing and create new geological data. The final product will be the offset printings of series of 25 sheets at scale 1: 10 000. Maps are in National Coordinate System of Poland – '1992'. But first of all during the process of creating the map, the detail digital geological data is gathering in a database, so the GIS is made for geology in Tatra mountains. At the moment the first and second phase of a map is accomplished. The GIS platform for the digital map is the software of ESRI - ArcGIS Desktop with extensions. On my poster I would like to outline the technological process of creating the map as from data gathering, its analysis by geologists, making database structure, creating of digital libraries and symbolization, to data digitalization and topological control. I also would like to present the opportunity of creating final and interesting composition of map sheet with Cartographic Representation by ESRI and other solutions of present cartography. So in my presentation I would to include the composition of one sheet of a map, which contain, apart from the main map, also the geological section and stratigraphic legend. I will mention other products which are created during the project like elevation model which look very interesting as a background for geological data. The important issue of a map is the close cooperation with The Slovak Geologic Service, which means that the map encloses part of the Slovak Tatra mountains. I would also like to present the opportunity of making it available in internet services. The project of a digital Geological Map of Polish Tatra is sign and finance by Ministry of the Environment and other national organizations and is accomplishing in The Polish Geological Institute – National Research Institute. To sum up, I want to outline that the digital Geological Map of Polish Tatra at scale 1: 10 000 is an attractive product, so I believe that is worth to share this experience with cartographers and other people who have to do with maps.

P3.5 | **Geological-Tourist Maps of Poland National Parks – Important tool for popularization and promotion of Geotourism** (#1453)

A. Tekielska, J. Przasnyska

Geological Mapping Program, Polish Geological Institute – National Research Institute, Warsaw, Poland

In 2010 Polish Geological Institute – National Research Institute (PGI-NRI) created series of Geological-tourist maps of: Białowieski National Park, Babia Góra National Park, Polesie National Park, Roztocze National Park, Wigry National Park. These maps presents lithology and genesis of formations covering surface, geodynamical, hydrogeological and anthropogenic phenomena and tourist information. Currently, the PGI-NRI, based on assumptions developed in the first series, is preparing next 5 maps of national parks: Ojców National Park, Pieniny National Park, Drawa National Park, The Gorce National Park and Warta Mouth National Park . These maps are dedicated to people interested in geology, but not geologists. Therefore, both the professional level and form of presentation should be easy to understand, clear, and provide all the necessary information about the geology and the tourist region. That was a challenge to create new type of thematic map published for the first time. It was very difficult because all new geological-tourist compilations were supposed to be based on technical assumptions prepared for this project. Guidelines have been developed, including an innovative structure of the spatial database with a set of attributes, dictionaries, mock-ups, sets of symbols. ArcGIS tools have been used. The most important aspect of the mapping was correct cartographic visualization. For a series of maps original set of symbols (polygon, line and point) was prepared, illustrating the phenomena common to all the studies, such as topography, the forms of nature protection, topological points, travel information, etc. All symbols have been developed specifically for geological-tourism and they are characteristic for other serial studies of PGI-NRI. Colors for geological features were selected individually for each map, taking account the geological structure and the diversity of the digital terrain model. On each map the complexity of the terrain is visualized using a digital terrain model, which results in diversification of color, that's why the selection of colors is so important. The maps are important tool for popularization and promotion of geotourism. It presents usually appealing and interesting content for the wide audience of tourists.

P3.6 | **Integration of APRS Network with SDI** (#819)

T. Kubik[1,2], W. Penar[1]

[1]*Wroclaw University of Technology, Institute of Computer Engineering, Control and Robotics, Poland;*
[2]*University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, Wroclaw, Poland*

A full-length version is available and can be opened here:

_extendedAbstract\232_proceeding.*

P3.7 | **A Semantic Matching Method of Heterogeneous Geospatial Service Classification Based on the Concept Lattice** (#635)

A. Luo

The geographic information system research center, Chinese Academy of Surveying and Mapping, Beijing, China

A full-length version is available and can be opened here:

_extendedAbstract\168_proceeding.*

P3.8 | **A Service- and Cloud-oriented Solution for Thematic Maps** (#1186)

R. Nétek, A. Vondráková, Z. Dobesova

author, Dept. of Geoinformatics, Olomouc, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\225_proceeding.*

The last trend in publishing maps is solution based on interactive web map application. The complex thematic map is consisting of number input phenomenon. Service-oriented architecture (SOA) allows to creating complex thematic map fully available by web browser, because the output thematic application is based on process of combination of multiple analytics maps. The SOA is an innovative architectural style of map designing from technological point of view. The application should be composed from independent layers as services. It is crucial that layers are provided as services, because the process of map generating is significantly more effective and faster. Based just on this solution the data are not duplicated and every change is reflected immediately. In fact the map is still updated without any process of regenerating map. The traditional approach of providing and working with thematic maps has still numerous limitations, especially in relation to data and programs which user needs "physically" stored in own computer. The general trend in all areas of information technologies is relocation, sharing and distribution both data and programs via the Internet environment. This solution is possible especially due to cloud computing approach; moreover in GIS field it is supplemented by implementation of SOA. These topics were deliberately selected for their significant entry in recent years and a wide distribution in the current web GIS applications, because it allows to centralized management. Due to SOA and cloud computing principles is possible to create live interactive web maps, which brings conventions from robust server solutions into thin flexible web clients. Moreover it provides higher comfort for developers as well as for users. The paper describes the revolutionary concept of thematic map customization with respect to SOA and cloud computing principles. The BotanGIS project has been developed as a case study. It is a unique solution, which combine interactive Geographical Information Systems for botany management necessities. It has been developed at Department of Geoinformatics, Palacký University, Olomouc as educational portal for students, visitors and employers of Botanical Garden in Olomouc. Each layer which enters into map is provides as a public service. In fact the original data are published by ArcGIS Server as a REST services, furthermore Web Map Services (WMS) were chosen for some basemap layers. The process of development and cartographic designing take advantage of cloud computing solution called ArcGIS Online. Due to chosen concept is possible to real-time centralized management. No installation process or server-side generating is required, it is fully available by web browser only.

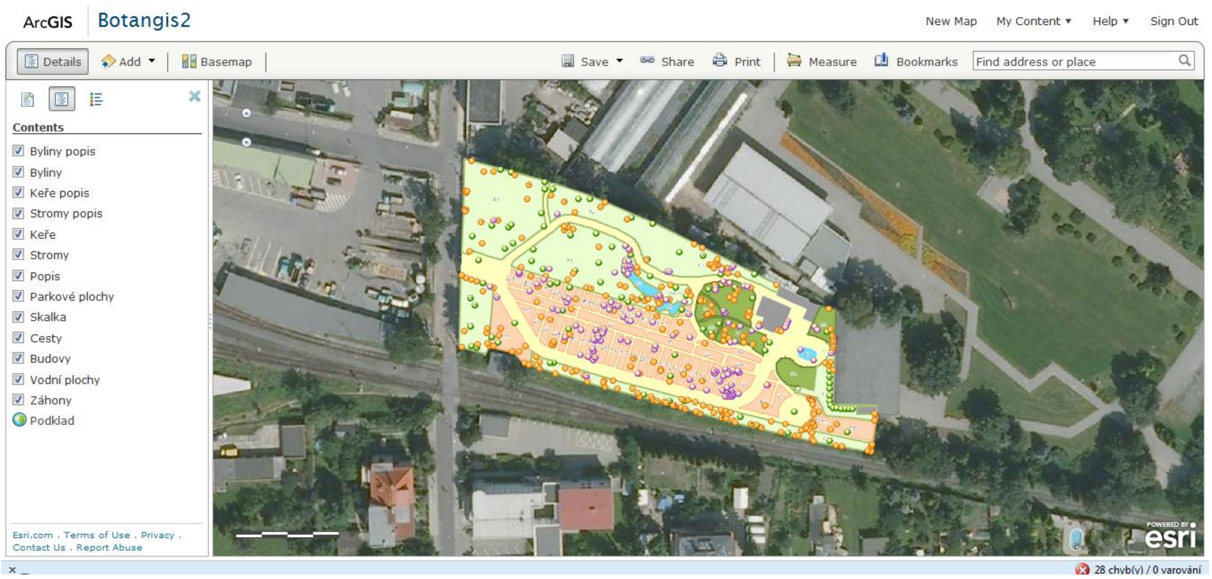


Figure 1.:
Customization of thematic map in cloud computing environment

P3.9 | **Web enabled open source GIS based tourist information system for hue city** (#4)

<u>D. Nguyen</u>

Hanoi University of Mining and Geology, Photogrammetry and Remote Sensing, Vietnam

With the development of information technology, especially the internet explosion, managing and sharing data becomes easier than ever. In addition, the advent of open source software enables Web developers to save a lot of money for their projects. Moreover, current data is not only pure data attributes but also spatial data. Web technology combined with GIS technology, also known as WebGIS technology, has opened a new trend that is the management and sharing of geographic data.

P3.10 | **The use of OpenSource technologies for distributing historic maps and creating search engines for searching though the catalogues** (#1002)

J. Jeney[1,2], M. Buchroithner[2]

[1]Eötvös Loránd University, Department of Cartography of Geoinformatics, Budapest, Hungary; [2]TU Dresden, Institute for Cartography, Germany

A full-length version is available and can be opened here:

_extendedAbstract\1002_abstract.*

P3.12 | **The interactive gazetteer of a 150-year-old globe** (#728)

Z. Ungvári, T. Tokai

Eötvös Loránd University, Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

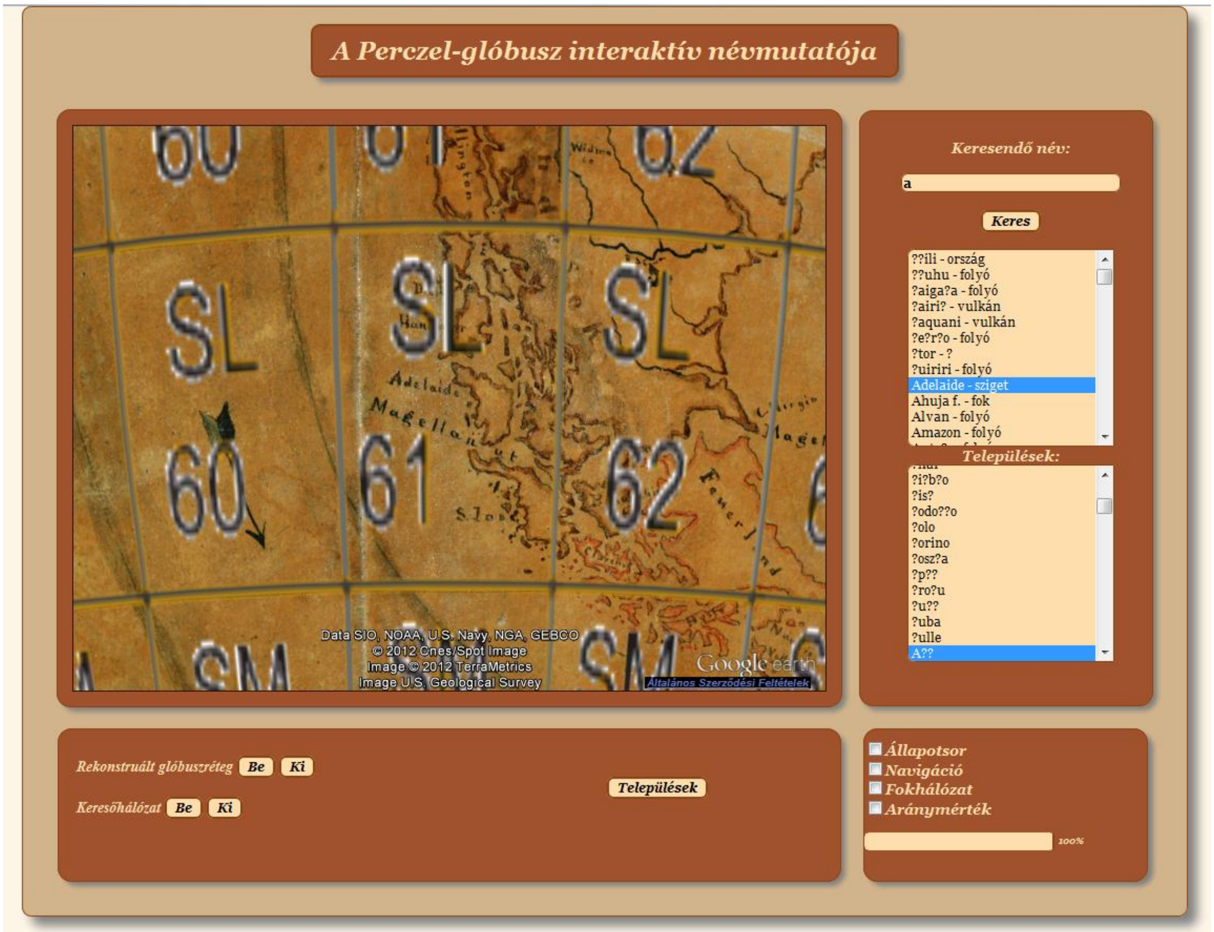
_extendedAbstract\112_proceeding.*

This work was a part of a project to digitize a 150-year-old manuscript globe, and to re-draw it for saving it from further decay. The 132 cm diameter globe was created by László Perczel in Kömlöd, Hungary, in 1862.[1] The project[2] is going on within the framework of the Virtual Globes Museum, but now our digital reconstruction project of the one of the largest globes in Central Europe before long is going to reach the end. A highlight part of the project was saving the names to the posterity. It was not easy work, because the globe surface is badly damaged. It got a lacquer layer, and this layer began turning to yellow soon and dissolving some of the red ink, making a part of the names illegible. Unfortunately, when this globe was moved to shelter during World War II, parts of the globe map tore around the Equator. Despite, the names are of huge cultural value. Using of modern technologies the contemporary names become available for examination. The first part of this subproject was the identification of the names on the globe. Those students who were involved in the work collected every name including also the partially legible names, and created a database in MapInfo. To recognize the names they used the Google Earth. Afterwards, the names were classified in two major categories: the settlement names and the other geographical names like the name of rivers, lands, or seas etc. The principle of this classification is that the settlements can be represented by one coordinate pair in small scale, while the names of other features show up as polylines or polygon objects. In the latter case, another solution is needed. In a gazetteer to a map, the users search for names, and they find the geographical objects by grids. Therefore, the geographical grid by 5 degrees was chosen the network for searching. Each square is numbered from 1 to 72 by five degrees between the longitudes; the sqares between latitudes moving away from the Equator to the poles are lettered A, B, C etc. by five degrees. To avoid the similar lettering on the globe, the sqaures on the northern hemisphere got "N" prefix, and on the southern an "S" prefix (e.g. NA or SE). After every name was entered into the list, a MySQL database was built. The visualization and searching in this database on the net need an HTML page. The HTML page was written in PHP because of the excellent function of this scripting language. However, this is not enough to visualize spatial data. The best choice is to let the names and places be seen in the Google Earth, because the manuscript "map" was originally a globe, and the Google Earth plug-in give several possibilities to developers, for example:

- Switchable layers among the original Perczel's globe, the reconstructed one, and the satellite photos, where the users can set the transparency of the overlays.
- Different KMZ layers for predefined categories in the database (using MySQL queries and PHP).
- In the Infowindow, the users can find information about the selected contemporary name, current name (if known), object type, the coordinates, and the code in the developed searching grid.

As several types of names can be found in this database, it is possible to reduce the name search results by types or geographical regions. This homepage uses the newest HTML techniques, like HTML5, some asynchronous loading functions, and the design is based on CSS3 style sheet.
The digital gazetteer of Perczel's globe allows us to identify the names on an old globe; furthermore, the authors plan to use this method to examine the name changes on globes in education. For details see *http://vgm.elte.hu/perczel*

[1] **M. Márton, G. Gercsák**: The present state of reconstructing a 150 year old globe, ICC 2011, Paris.
[2] M. Gede, M. Márton, Zs. Ungvári: Digital Reconstruction of Perczel's Globe. *5th International Workshop on Digital Approaches in Cartographic Heritage. Vienna, 22-24 February 2010*



The interactive gazetteer:

The looked up name is showing on Google Earth with switched on searching grid

P3.13 | **Advances and Recent Challenges in Cartographic Pattern Recognition**

(#1193)

H. Herold[1,2]

[1]Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany; [2]Technical University of Dresden, Department of Geosciences, Germany

A full-length version is available and can be opened here:

_extendedAbstract\369_proceeding.*

This paper reviews the state-of-the-art in cartographic pattern recognition for automatic map digitization and interpretation in order to identify recent challenges to this research field arising from an increasing spatial and historical coverage of applications. Numerous previous studies have demostrated contemporary and historical topographic maps as important sources of geospatial information for both landscape and urban research. In the same way as remotely sensed imagery, topographic maps contain and preserve snapshots of landscape and human settlement patterns at a certain point in time. Thus, maps have become, regardless of inherent uncertainties, abstraction and generalization, an extraordinarily valuable data source for many facets of land change research and quantitative historical geography. For spatial explicit land cover and land use information of former times, historic topographic paper documents have in many studies appeared to be the only source of information. However, in order to make the implicit information contained in the scanned paper maps explicitly available and spatially analyzable within (Historical) Geographic Information Systems (GIS/HGIS), techniques of automated image analysis such as image processing and pattern recognition have to be applied. Thus, cartographic pattern recognition for automated map interpretation has evolved as a vivid research field over the past few decades. Early developments have been triggered by the mere need for digital geospatial data. The information acquisition was focused on the most recent maps. Later on, as soon as digital and web cartography emerged, methods of cartographic pattern recognition have also been used to derive generalization rules that are implicitly contained in different scales of one map series. Nowadays, large amounts of scanned map documents are being made digitally available through public libraries, private collections as well as the national mapping agencies. On the other hand, vast amounts of up-to-date digital geospatial information are recently available. Thus, the focus of the research field has been started to change. In the first part of the paper, an overview of advances in this active field of research is given. Recently proposed approaches are categorized and evaluated concerning various criteria such as complete and sectional interpretation techniques. The second part of the paper identifies recent challenges to these techniques emerging from a changing focus in the fields of application. Spatially and temporal extensive studies as well as the integration of vast amounts of digitally available, yet heterogeneous map data give rise to new research needs. Algorithms have to not only cope with changing but also coalesced and blurred graphical representations of the sought geospatial information. In conclusion, a summary of research needs and an outlook on methodical concepts such as adaptive systems in order to overcome some of the stated issues are given.

P3.14 | **3-D DIGITIZING AND REPRESENTATION OF HISTORICAL BOUND ATLASES AND MAPS USING LOW COST SOLUTIONS** (#770)

V. Tsioukas[1], A. Koussoulakou[2], M. Daniil[2], E. Livieratos[1]

[1]Aristotle University of Thessaloniki, Geodesy and Surveying, Greece; [2]Aristotle University of Thessaloniki, Cadastre, Photogrammetry and Cartography, Greece

A full-length version is available and can be opened here:

_extendedAbstract\418_proceeding.*

Old bound atlases and maps constitute a particular case of cartographic documents, with respect to their digitizing. This is mainly because of the curved, undulated and in general irregular surface of their pages, which creates specific demands and difficulties when converting them to digital form. In order to properly digitize bound atlases and maps their metric quality has to be preserved after digital conversion: this means that after converting them to digital form, they can be used for conducting accurate measurements on their surface, such as e.g. obtaining (originally) curved distances by measuring on the digital copy of an atlas page. In order to achieve this, a two-step procedure is followed, involving:

1. The creation of a 3D digital surface model (DSM) of the irregular surface of an atlas page.
2. The possibility to measure 3D distances on the DSM, as if using the original analog copy –in other words to fully retain the metric quality of the map on the digitized document.

In our work we attempt to accomplish this task by means of low cost solutions such as free and home-made software tools. For the purpose of the research an historical 18th century bound atlas by the German cartographer J. B. Homann is used; pages are scanned in different parts of the book, in order to accommodate for various curvatures and irregularities in page shape. The first step i.e. the creation of pages' DSMs is accomplished by means of a two-fold procedure, namely: a low cost 3D technique to extract the geometry of the object's relief and consequently the scanning of the atlas map and registration of the map image on the DSM using automated procedures. For the second step i.e. the measurement of true 3D distances on the digital map, we apply an algorithm for the calculation of curved distances (as opposed to projected distances on the orthoimage of the scanned map). The critical point here is that if we attempt to measure on the orthoimage which is draped on the DSM we will not obtain the true curved distance (i.e. the one on the original analog map), since the orthoimage is actually a projection of the curved surface. An algorithm therefore is used, for unwrapping digitally the deformed map and obtaining the distance as it is on the original paper map. The results of the algorithm are tested by measuring curved distances on the original analogue atlas and using them as the ground truth for the comparisons.

P3.15 | **Georeferencer and Old Maps Online: How to turn scanned maps into attractive discoverable resource** (#1129)

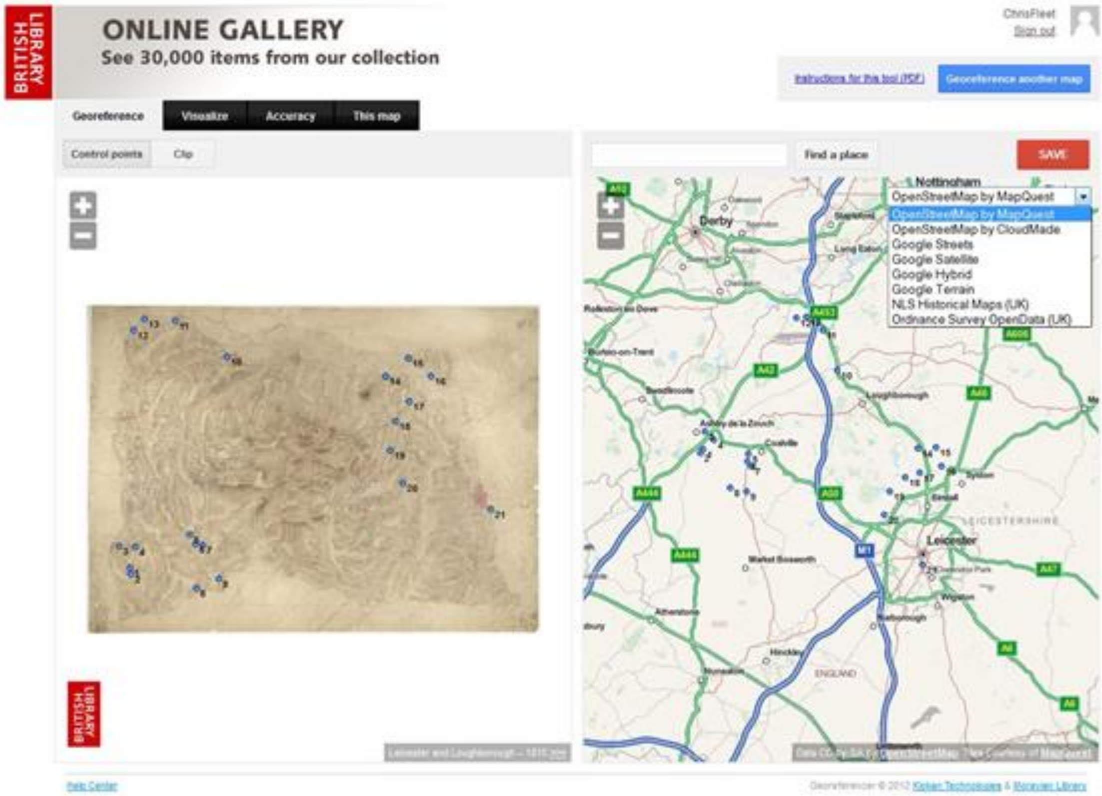
P. Pridal[1,2]

[1]Moravian Library in Brno, Research & Development, Czech Republic; [2]Klokan Technologies GmbH, Baar, Switzerland

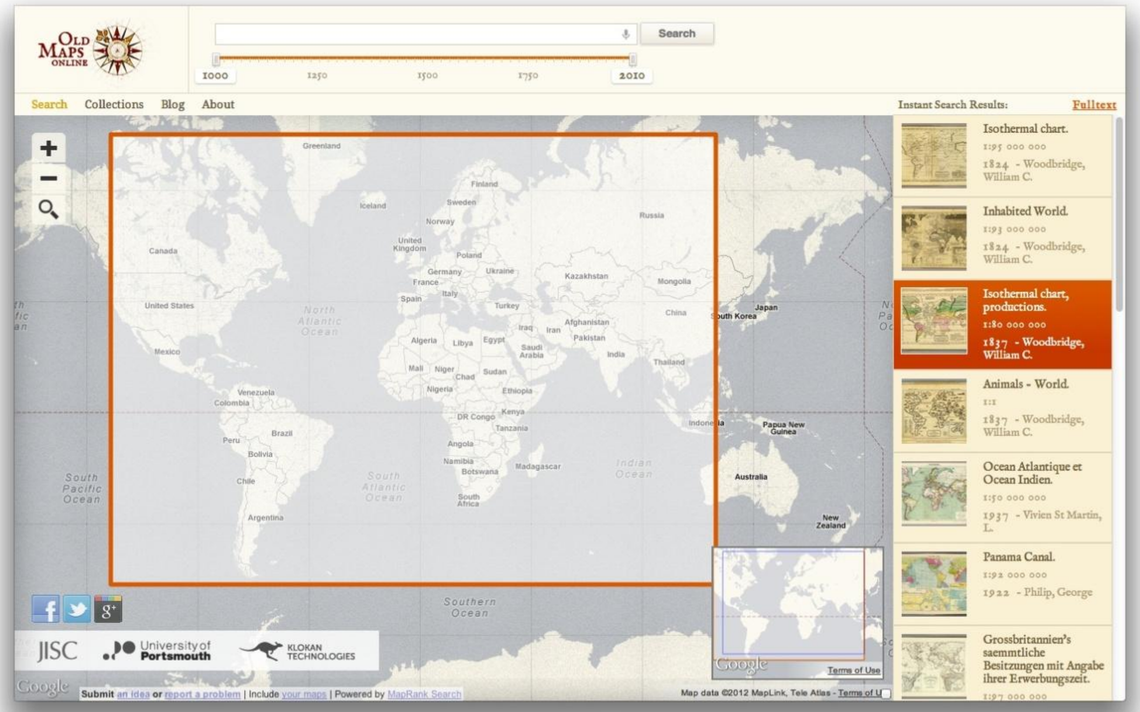
A full-length version is available and can be opened here:

_extendedAbstract\347_proceeding.*

Hundreds of thousands of historical maps have now been scanned and made available on-line by libraries around the world, and this has been a great boon to anyone interested in the history of cartography. Despite this fact it is hard to find scanned maps covering area of interest in the large number of online catalogs, library systems and web presentations on the web. The traditional fulltext search engines, such as Google, is failing to index the scanned maps properly. Old Maps Online is a search system tailored just for historical maps. Pick a location on a world map, or type in a place-name, narrow the search by selecting a date range. A listing of all possible maps covering that location appears, ordered by best geographical match. Select a map, click on the link and you go directly to view the map on the original library's website. You don't need to know who holds the map, just where in the world you want to look at. This system is designed to complement rather than compete with libraries' own search interfaces. The system is powered by the enhanced version of the MapRank Search technology and indexes over 130.000 scanned high-resolution maps already. Many major collections in the US, UK and elsewhere have agreed to contribute: The British Library, Harvard Library, National Library of Scotland, David Rumsey Map Collection, Dutch National Archives, Moravian Library, New York Public Library, Norman B. Leventhal Map Center at the Boston Public Library, National Library of Australia, etc. Our aim is to include as many collections as possible, so map libraries and collectors are encouraged to participate. To be able to index the scanned maps geographically, we must be supplied with minimal metadata (title, creator/publisher, date, identifier, and a stable url), plus geographic coordinates for the area covered, for each map. We can suggest/provide tools you can use to create the coordinates. One of the tools is the Georeferencer online service, which allows rapid collaborative georeferencing, 3D visualization, annotation and accuracy analysis of scanned online maps directly in a web browser environment, without the need to install any software on a local computer. The online visitors can help with the metadata enrichment and georeferencing of the scanned maps - and they are motivated with competitions, rewarding, community participation and recognition during this crowdsourcing effort. The Georeferencer service is applied in several institutions such as the British Library (London), the Moravian Library (Brno), the Nationaal Archief (The Hague), the National Library of Scotland (Edinburgh), and the Institut Cartografic de Catalunya (Barcelona). It's development is supported from the research project TEMAP in Czech Republic and from collaborative efforts of the institutions who are using it.



Georeferencer Interface:
The British Library Georeferencer Pilot



OldMapsOnline Interface:
OldMapsOnline Search Engine User Interface

P3.16 | **Time animations from early maps of the 19th century** (#1145)

M. Mikloš[1], V. Voženílek[2]

[1]Palacky University, Olomouc, Dept. of Geoinformatics, Czech Republic; [2]Military Geographic and Hydrometeorologic Office, Dobruška, Czech Republic

The paper presents representative collection of 15 time animations of early maps released until the 19 century. All animations aim to significantly accelerate and facilitate the acquisition of information from early maps and also popularise historical cartography. The authors discuss the best programming approaches of time animations of early maps. All time animations involve maximal possible preservation (zachování) of map content. Time animation includes expression of changes in position of topographical objects which were drawn by traditional static symbols in the maps. The animations include multimedia elements. The early maps were used with courtesy of several libraries and archives in the Czech Republic. The animations are published in Czech language and shared via internet to be used in teaching history at elementary and secondary school.

P3.17 | **Map Archive on Institute of Geography, Masaryk University – New Possibilities** (#1180)

Z. Stachon, M. Konečný

Masaryk University, Institute of Geography, Brno, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\361_proceeding.*

Map archiving on Institute of Geography started shortly after foundation of the Masaryk University in 1919. Currently there are over 18000 maps and atlases while most famous are collections of Comenius´ map of Moravia from the 17th century and atlases published by famous Dutch cartographer Abraham Ortelius. Most of the archived maps are still not in digital form; therefore these maps are not accessible to the specialists and the general public at all. Described situation is changing due to cooperation with Moravian Library and Charles University in Prague on project called Technology for access to Czech map collections (TEMAP). Aims of the project can be divided into two main parts. At first there is digitization and accessibility of map archives of each partner. On the other hand there is development of various tools for simplifying of mentioned process. Both parts will contribute to broad old map information accessibility and usage. The aim of the poster is to present ongoing process of digitization and accessibility old map archive and introduce tools developed for old map cataloguing and processing. This contribution was created with the support of the Ministry of Culture of the Czech Republic, Nr. DF11P01OVV003: TEMAP: Technology for access to Czech map collections: methodology and software for protection and re-use of national cartographic heritage.

Comenius´map of Moravia:
Comenius´map of Moravia

P3.18 | **Visualizations of the river Danube based on László Vörös' 1833 hydrographic map** (#1125)

Z. Török[1], D. Hillier[2]

[1]*Associate Professor, Cartography and Geoinformatics, Budapest, Hungary;* [2]*PhD Student, Cartography and Geoinformatics, Budapest, Hungary*

Systematic survey of the waters in Hungary started as a late Enlightenment project in the early 19th century and hydrographic maps were produced by a new generation of civil engineers. László Vörös (1790-1860), who studied at the *Institutum Geometricum et Hydrotechnicum,* the world' first university level engineering school (founded 1782), worked as surveyor, engineer, engraver and map maker for the Danube Mapping Project from 1828. The mapping of the river's section between Buda and Pest became a priority task for the regular floods threatening the developing and expanding sister cities. Vörös was commissioned to construct a detailed and accurate map from the available topographic and hydrographic data. The large, detailed and elegant map was lithographed by the author and was published with the support of the Bridge Builder's Union in 1833 in Pest. The building of a permanent bridge connecting Buda and Pest became part of the national development movement led by count *István Széchenyi*. Vörös' early thematic map is considered as a milestone in the history of Hungarian cartography and the *Chain Bridge* (1849), a symbol of the Hungarian capital, is the evidence for its importance. How can we read and understand this decorative map? At first sight it looks like another early city map, but the interpretation of its rich data content is very difficult, especially for the modern reader as it was produced by a specific, hydrographic mapping mode which can not be fully understood in the topographic paradigm. In our presentation we would like to demonstrate that the map's data content, its thematic layer, can be interpreted in historical contexts. We put the map into contemporary technical, cultural and social contexts to make its numeric data meaningful. The interactive exploration of the map, the visualization of the spatio-temporal database by the modern reader requires - apart from modern geoinformation technology - the expertise of the historian of cartography.

Fig.2:
Detail of 19th century map of Budapest with Margaret Island in Google Earth

Flash-based visualization:
The interactive visualization of the city of Budapest compares the 1833 map and the present satellite image

P3.19 | **Finding the sources of data used for making ethnic maps** (#1007)

J. Jeney[1,2], M. Buchroithner[2]

[1]Eötvös Loránd University, Department of Cartography of Geoinformatics, Budapest, Hungary; [2]TU Dresden, Institute for Cartography, Germany

A full-length version is available and can be opened here:

_extendedAbstract\1007_abstract.*

P3.20 | **Semiotics, Syntactic and Cartometric Analysis of Müller´s Manuscript Maps of the Czech Regions** (#689)

V. Cada, M. Vichrová

University of West Bohemia, Faculty of Applied Sciences, Department of Mathematics, Pilsen, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\414_proceeding.*

P3.21 | **Ethnic maps of the Hungarian settlement areas from around the world**

(#1005)

J. Jeney[1,2], M. Buchroithner[2]

[1]*Eötvös Loránd University, Department of Cartography of Geoinformatics, Budapest, Hungary;* [2]*TU Dresden, Institute for Cartography, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\1005_abstract.*

P3.23 | **The variable radius cartography - History and perspectives** (#365)

G. Scalera

INGV - Istituto Nazionale di Geofisica e Vulcanologia, Geodynamics, Roma, Italy

The map that Toscanelli sent to Columbus was an unconscious application of cartography at a smaller radius than the real. The first really conscious attempts to represent the geography of Earth on globes of radius less than the current one occurred after the formulation of the concept of expanding Earth through geological time. In 1928 J.A.H. Kerkhoff. (Under the pseudonym 'Aero-dilettant') published a series of paleogeographic globes on which the modern oceans disappeared. With the same artisan methods of transfer continental outlines from a sphere to a smaller one, in 1933 O.C. Hilgenberg represented three different geological epochs, and, later, for the first time mapped paleopoles with their site-pole segments of meridian. Even today the traditional method of Hilgenberg is followed by senior researchers (Vogel, 2003) and younger geologists (Maxlow). In England Hugh Owen applied the methods of traditional cartography to the variable radius one. His 'Atlas of Continental Displacement' was in the 70s and 80s, for this discipline, a real milestone. While in the field of constant radius paleogeography the adherents to plate tectonics created many computer codes of automatic mapping (Bullard et al., 1965; Smith & Hallam, 1970, Scotese et al., 1979, and many others), in the variable radius field few tried to reach the same task. In 1972 in United States a first very simple attempt (but was not furtherly developed) came from a private, R.B. Perry, followed by the still not-computerized Atlas of Owen, and both them constituted inspiration for the construction of a variable radius mapping code at INGV, with which it is now possible to represent paleopoles, site-pole segments of meridian, and their uncertainty ellipses (Scalera, 1988, 1990). In all paleogeographic reconstructions of the various authors, cartography is used in a way more or less complex, more or less intertwined with other disciplines and databases, not as pure representation or in the spirit of the simple 'fits' that supported plate tectonics, but as experiments of greater complexity with a value of proof in favor of the planet expansion. Today a common feeling among followers of the expanding Earth is that is now necessary to develop an interactive and ‘user friendly’ program code, which could be distributed or used in the web.

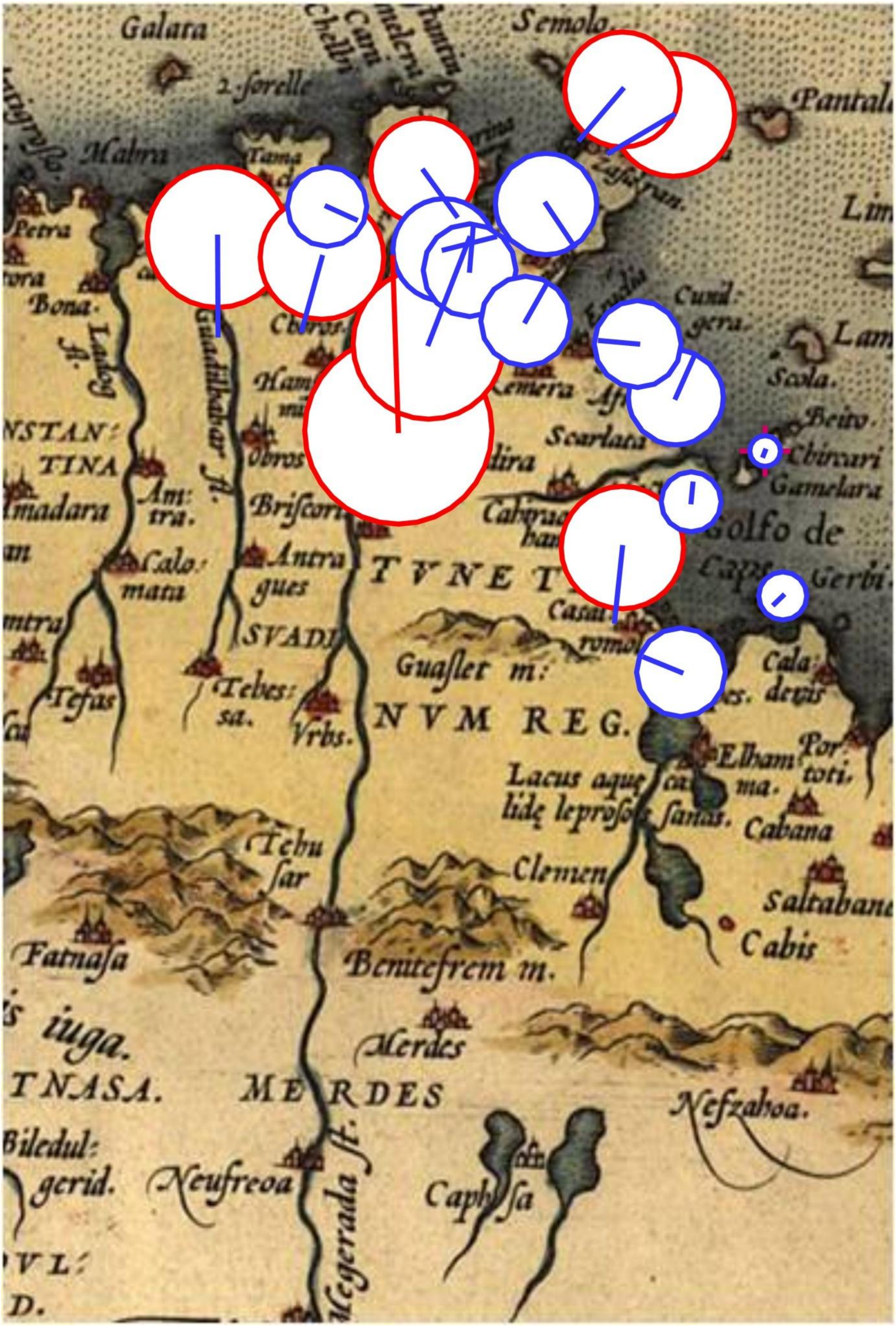
P3.24 | **The Ortelius Map of Tunisia: an historical and cartographical systematic study.** (#789)

S. Afef, D. Mohsen

afef saada, Menzel Jemil, Tunisia

After the Italian and Iberian flowering map schools and in the apparition of the Scientific Renaissance, the second part of the 16th century corresponded to the golden age of Dutch cartography. The development of cartographic products is due in particular to the work of Abraham Ortelius on the one hand and Gerhard Mercator and his son on the other. Ortelius created one of the most outstanding master's works of the Dutch school mapping, the establishment of the map "Tunisia. Indeed, Tunisia was designed with divergent approximation of contours and topographic features. Little attention was given to mountains and the semiological and toponymic aspects. The maps reveal also the cartographic methods and the techniques in use at that time. They resemble to the iconographic figures of this period. However a real change in the transcription of names may be observed: abandon of Latin transcription and some other common uses. In this paper, we analyze the cartographic image of Tunisia through some specimens produced by Ortelius focusing particularly on shape configuration by using Darcy and Map Analyst Software. we take on presenting the characteristics of the Ortélius map of Tunisia being illustrated by figures such as distortion grids, vectors of displacement, accuracy and inaccuracy circles, and isolines of local scale and rotation. The statistical results are so important to show the spatial distortions. GIS software such as Arc View is also necessary for the establishment of georeferencing and the superimposition of many layers of information which relate to Ortelius map of Tunisia.

Grid distorsion :
The rotation of distorsion grid is 28°



Important variability:

vectors of displacement, accuracy and inaccuracy circles of different places

P3.25 | **Analysis of the Historic Development of Maps of Istria** (#1306)

A. So□ić[1], B. J. Rojc[2], D. Petrovič[3]

[1]*State Geodetic Administration, Rovinj, Croatia;* [2]*none, Prebold, Slovenia;* [3]*University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia*

The article describes the research dealing with an analysis of the historic development of cartographic means of expression and cartographic design on maps of Istria. Chronological monitoring of cartographic expression and the analysis of the methods of presenting individual natural and built structures of the geographic area of Istria directly from key maps of Istria, by periods and important authors, resulted in an analysis that studied the degree of changes in cartographic expression on maps and plans and the relevant time periods in which they appear. The aim of the research was to find out the relations among types of signs that form the whole cartographic expression of an individual map, especially the relations between ideogrammic and iconographic signs, between geometric signs and stylised pictograms, analysed in real cases of the cartography of Istria. The whole analysis of the cartography of Istria from the presented standpoint was carried out based on the existing literature and the published cartographic documents; for maps of recent periods – 19th and 20th century – as well as based on research into archives and search for examples of issues in existing cartographic collections. Considering the fact that there are no catalogues of maps in some public and private cartographic collections, the analysis does not include all the existing maps. However, this research shall show the main directions of development of the cartography of Istria and the basic changes in the cartographic expression throughout centuries, with the emphasis on the last few centuries, when the quantity and quality of maps presenting the Istrian peninsula have improved significantly. The research analysed maps from several points of view. However, all analyses were based on previous identification of the present geographic structures and their recognition on the maps. A helpful tool in this task was geographic names, as well as other studies and researches. Analysis of correctness of the presented shapes, orientations of presentation and position accuracy was performed by comparing the map to a present day topographic map. Since different coordinate systems were used in history, no direct comparison of coordinates was possible. For this reason, the comparison included individual structures, based on which the (non)homogeneity of map scales was calculated. The matching of shapes and internal deformation was analysed with the help of a grid of triangles or squares. The research showed very noticeable sharp advance in location adequacy of presentation. While in the first, antique maps only very generalised, rough shapes can be noticed, later on the maps show increasingly accurate matching and recognisable shapes. The orientation of maps improves significantly only towards the end of the 17th century, which is somehow unusual, but could also be the consequence of very practical reasons and considering the format of the medium. Homogeneity of the scale, and thus also correct distances between the presented structures, can be noticed only on maps from the periods, when the surveying technique improved, especially with the establishment of the national triangulation networks

P3.26 | **Historic Towns Atlases of Poland – A State of Today's Advanced** (#10)

<u>Z. Kozieł</u>

Nicolaus Copernicus University Faculty of Earth Sciences, Cartography, Remote Sensing and GIS, Toruń, Poland

These projects, i.e. Historic Towns Atlases of Poland, included in the first of all informations on publication of historic town atlases in Poland: Bydgoszcz, Chełmno, Elbląg, Giżycko, Grudziądz, Kraków, Toruń, Wrocław, and the other. In preparations for a print there are in many other historic atlases for: Fordon, Ostróda, Sandomierz, Włocławek, and many other. It is the right moment to publish the full list of atlases for Polish towns in print. Urban developments in general but also urban research are today confronted with some fundamental choices which must take into consideration the topographical development of a town and other vestiges of its past (historical street-plan, monuments, fortifications etc. (A. Verhulst 1994 - President of The Int. Comm. for the History of Towns). Today, i.e. 20 years from start in this European project, we have still methodological problem, how to present elements of maps and plans in atlases.

P3.27 | **3d representations in the service of historical** (#1241)

M. Constantoglou

researcher Department of Cultural Technology and Communication, University Hill, 8100 Mytilene, Greece

This paper will focus on the way that a 3d virtual environment can be built with the use of old maps and drawings and with the aid of advanced information technology techniques. These last years there is a growing demand on for a more representative, educational, communicative and world wide spread digital cartography. Three dimensional maps can depict quantitative and qualitative data with great accuracy. They also have the advantage to effectively communicate all available information. 3D digital cartography seems to be more suitable to recover the historical maps content. In the same time animation techniques can used in order to communicate all available and sometimes hidden information that exists in a historic map. A map o Skyros by Choissel Gouffier is examined and is represented in a 3D environment.

P3.28 | **Summary and Achievements of City Atlases in China** (#732)

Q. Qi, L. Jiang, A. Zhang

Institute of Geographical Science and Natural Resources Research, Chinese Academy of Sciences, Cartographic division, Chaoyang district, China

A full-length version is available and can be opened here:

_extendedAbstract\732_abstract.*

P3.29 | **COMPLEX ATLAS OF LVIV CITY** (#222)

R. Sossa[1], O. Shabliy[2], O. Vistak[2]

[1]*State Scientific and Production Enterprise "Kartographia", Kyiv-94, Ukraine;* [2]*Ivan Franko National University of Lviv, Department of Economic and Social Geography, Ukraine*

A full-length version is available and can be opened here:

_extendedAbstract\275_proceeding.*

The Department of Economic and Social Geography of the Ivan Franko National University of Lviv together with the State Scientific and Production Enterprise "Kartographia" has prepared a scientific and informational complex atlas of Lviv, the first complex atlas of a big town in Ukraine, issued in 2012. For the development of the Atlas and its separate maps a special attention was paid to the particular traits of Lviv, its *originality* and *peculiarity*, which mark out the town among the towns of the kind. These traits include:

- Location of Lviv on the main European watershed and, thus, absence of a major waterway, which frequently becomes a town architectural and planning axis;
- Considerably broken ground (roughness) of the town surface, which is reflected in layout of its street and communications network on the whole, park areas as well as layout of architectural and planning dominants;
- Location of the historical centre with social and economic nucleus within the Lviv lobe;
- Repeated changes in the ethnical and social structure of the town at a general dominance of its fundamental Ukrainian substrate;
- Hypertrophied inconsistent industrial development of Lviv in the Soviet post-war period;
- "Horizontal" and "vertical" contrast of Lviv, dominance in the silhouette of the town centre of the Renaissance and Baroque traits that adds singular beauty and colour originality to the town. The Atlas is based on seven principles: fundamentality, integration, systemacy, humanization, Ukrainian Centrism, principles of ecology and direct history.

The content, structure and collection of the maps in the Atlas ensue from the aims, theoretical and methodological principles of its development and publication. The fundamental character of the Atlas, the interpretation of Lviv as a big and integrated system needs introduction into the structure of this work of such big parts: a) history and archaeology b) environment c) population d) economics (including production and social sphere) e) territory layout (or town planning situation). The order of the parts is principal one. The Atlas envisages their following sequence: I. Geographical position of Lviv II. Environment III. Archaeology. History IV. Population. Migration V. Social market and institutional infrastructures VI. Production and investment infrastructures VII. Industry VIII. Territory layout. General plan (2010-2025). This sequence order for the parts has its specific advantages. First, it is more logical in case when the Atlas has the simplest name: "Complex Atlas of Lviv". Secondly, "introductory" (factorial) here are three first parts. First, we consider the geographical position of Lviv, then the natural basis for human activity, then the historical and geographical conditions. After this comes (the forth part) a human being itself ("Population"). Further come the results and social consequences of its activity: different types of infrastructures and economics. This sequence gives an opportunity for an easier “reading” of the latest part "Territory layout ". This order provides user with possibility of a continuous search for correspondence of the historical information with the modern one that is presented in several sections of the Atlas. The Atlas has 740 pictures including 243 maps, schematic and thematic maps (including 46 insert maps), many photos, transparencies, short texts. The book includes town maps and plans, beginning from the end of the seventeenth century. The inserts reflect dynamic and structural characteristics of phenomena and processes. The maps are composed in four basic scales 1:100 000, 1:75 000, 1:60 000, 1:30 000. For several maps, especially those, where Lviv is presented with its suburbs or on maps of Ukraine, its part or Europe, we have chosen the small scales from 1:100 000 up to 1:55 500 000. The Atlas of Lviv is a result of cooperation of more than 100 persons (editorial board members, authors of maps and their series, reviewers, editors, consultants, publishers etc.).

P3.30 | **Consistency Matching in the Integration of Contour and River Data by Spatial Knowledge** (#1083)

T. Ai
Wuhan university, Cartography Department, wuhan, China

A full-length version is available and can be opened here:

_extendedAbstract\277_proceeding.*

P3.31 | **New approaches to cartographic relief representation with morphometric variables** (#1264)

S. Koshel[1,2], O. Mikhalyov[1]

[1]Lomonosov MSU, Faculty of Geography, Department of Cartography and Geoinformatics, Moscow, Russia; [2]Yaroslavl State UNiversity, Delaunay Laboratory of Discrete and Computational Geometry, Russia

A full-length version is available and can be opened here:

_extendedAbstract\373_proceeding.*

Currently analytical hillshading is intensively used in relief representation. Light reflection intensity is used to imitate shadows on the surface using different reflection models. Typically, Lambert reflection model is applied with one or more point sources of light with the addition of a constant diffuse light (Kennelly & Stewart 2006). Many methods to improve hillshading are proposed, but these improvements relate primarily transmitted to emphasize surface shape and, more rarely, structural lines. Various relief form types are represented in the images to a lesser extent. Therefore, in the last 10-15 years experiments emerged that try to emphasize relief structure by using of different morphometric variables, such as angles, various types of curvatures (Kennelly 2008), openness (positive, negative and average) (Yokoyama et al 2002), sky view factor (Zakšek et al, 2011) and so on. A typical example of this is the method called by the authors Red Relief Image Map (Chiba et al 2008). In this paper, all approaches are systematized; their advantages and disadvantages are analyzed. Methods are applied to different types of terrain, as well as new ways of creating images of terrain using a combination of different morphometric variables are developed. We also experimented with combination of gray-scale (usually) topography image obtained by hillshading and morphometric indicators with thematic content (for example, colored elevation or geological regions). All methods applied in this work are implemented in custom software and illustrated on different morphological relief types (Figures 1 and 2). **References** Chiba T, Kaneta S, Suzuki Y, 2008, Red Relief Image Map: New visualization method for three dimensional data. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences.* Vol. XXXVII. Part B2:1071–1076. Kennelly PJ, Stewart JA, 2006, A Uniform Sky Illumination Model to Enhance Shading of Terrain and Urban Areas. *Cartography and Geographic Information Science*, 33(1):567–577. Kennelly PJ, 2008, Terrain maps displaying hill-shading with curvature. *Geomorphology*, 102:567–577. Yokoyama R, Shirasawa M, Pike RJ, 2002, Visualizing Topography by Openness: A New Application of Image Processing to Digital Elevation Models. *Photogrammetric Engineering & Remote Sensing*, 68(3):257–265. Zakšek K, Oštir K, Kokalj Ž, 2011, Sky-view factor as a relief visualization technique. *Remote Sensing*, 3(2):398-415.

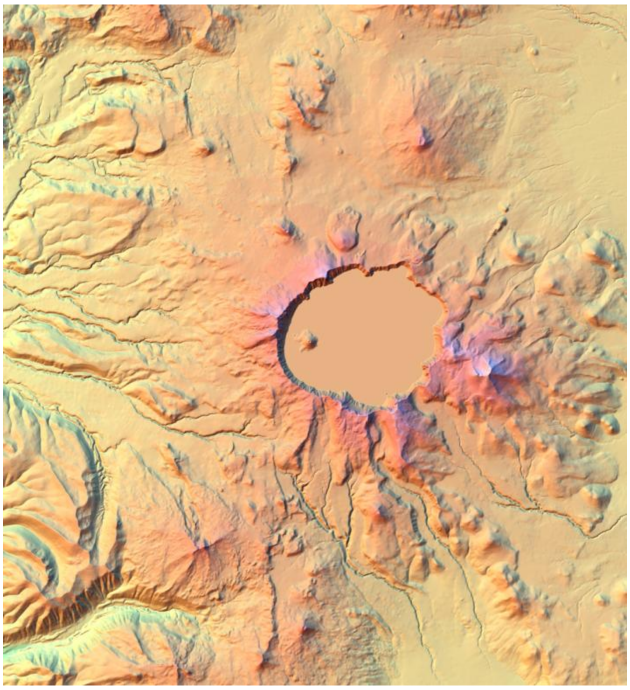


Figure 1:
Combination of analytical hillshading and elevation tinting

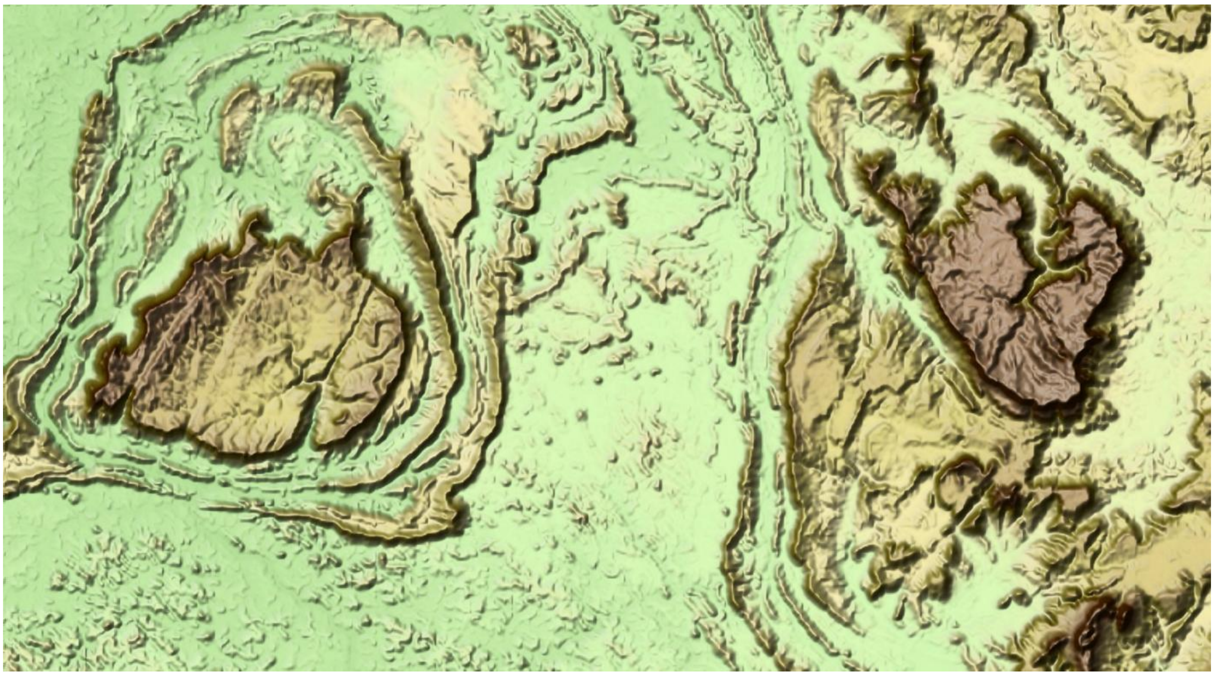


Figure 2:
Combination of topographic openness and elevation tinting

P3.32 | **Mapping geomorphodiversity. Case study – Bucegi Mountains (The Southern Carpathians, Romania)** (#342)

L. Comanescu, A. Nedelea, R. Dobre

University of Bucharest, Faculty of Geography, Geomorphology-Pedology-Geomatics, Romania

A full-length version is available and can be opened here:

_extendedAbstract\9_proceeding.*

The present paper aims at developing a new type of map, namely the map of geomorphodiversity of the Bucegi Mts., an area that is representative for the Romanian Carpathians. The term geomorphodiversity refers to “the critical and specific assessment of the geomorphological features of a territory, by comparing them in an extrinsic and in intrinsic way, taking into account the scale of investigation, the purpose of the research and the level of scientific quality” (M. Panizza, 2009). One may consider that the complexity of geosites generates geodiversity, while the diversity of the geomorphosites leads to geomorphodiversity. Geomorphosites are multifunctional entities representing a real network, which despite its discontinuous and random distribution in space can offer important data regarding geomorphodiversity. In the case of the latter, the evaluation is also qualitative, whilst the geomorphosites are assessed only quantitatively, depending on the measurable parameters. The geomorphodiversity map has been done in several stages:

- The first stage investigated the geological conditions of the study area based on specialty literature and on the existing graphic and cartographic sources (geological and geomorphological maps, as well as aerial photographs). In this respect, the geological map has a significant relevance, because structure and petrography generate specific landforms that acquire value thorough the human perception. This so-called geomorphosites lead to high values of geomorphodiversity. In order to correlate them with the geological conditions they were outlined on the geological maps.
- At the base of the geomorphodiversity assessment lies the general geomorphological map, which was developed after several field trips undertaken with the purpose of making measurements and detailed mappings using a Garmin GPS receiver. The general geomorphological map, which was filled with additional data derived from aerial imagery (the flight of 2005), also gave us the possibility to make an inventory of the geomorphosites that can be seen in the study area.
- In order to complete the database, we mapped all the geomorphosites and finally came up with a geomorphosite map.
- By making a synthesis of the information collected in the previous stages we were able to compute the geomorphodiversity index based on the formula below:

$Gmd = (\sum EgXn + Gm)/S$ where Gmd = geomorphodiversity index; Eg = the number of landforms; n = the number of the genetic types of landforms; Gm = the number of geomorphosites; S = area (in sq. km)

- A close attention was paid to the geomorphosites, which were taken into account twice, both in the first category (as landforms) and in the second one, in order to assign them an additional value. Thus, if two areas have the same number of landforms and the same typology, geomorphodiversity will be higher where the number of geomorphosites is higher.
- The geomorphodiversity map is prepared by using the GIS techniques, which allow the overlapping of several thematic layers (geology, geomorphology and geomorphosites), and the cartographic algebra. For a greater accuracy and a higher level of detail, we used standard areas of 0.5 km^2.

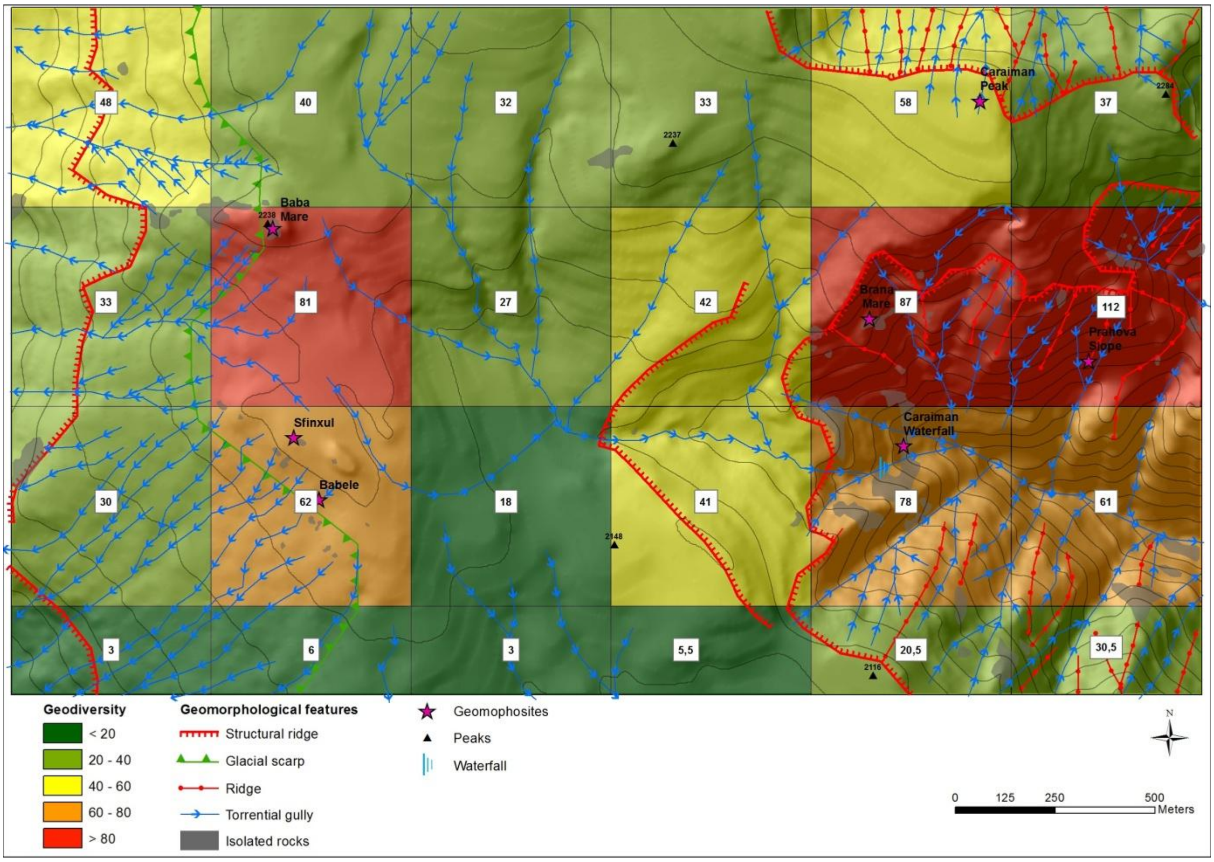


Fig.1:
The geomorphodiversity map

P3.33 | **Geobrowsers vs. Cartographic Artworks: Virtual Planetary Globes Designed for K–12 Education** (#1252)

H. Hargitai[1], M. Gede[2], Z. Merk[2]

[1]*Eötvös Loránd University, Dept of Physical Geography, Budapest, Hungary;* [2]*Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary*

A full-length version is available and can be opened here:

_extendedAbstract\1252_abstract.*

P3.34 | **HIGH RESOLUTION VESTA LAMO ATLAS DERIVED FROM DAWN FC IMAGES** (#623)

T. Roatsch[1], E. Kersten[1], K. - D. Matz[1], F. Preusker[1], F. Scholten[1], R. Jaumann[1], C. Raymond[2], C. Russell[3]

[1]German Aerospace Center, Institue for Planetary Exploration, Berlin, Germany; [2]JetPropulsion Laboratory, California Institute of Technology, Pasadena, United States; [3]UCLA, Institute of Geophysics, Los Angeles, United States

Introduction: NASA's Dawn spacecraft entered orbit of the inner main belt asteroid 4 Vesta on July 16, 2011, and spent about one year in orbit to characterize the geology, elemental and mineralogical composition, topography, shape, and internal structure of Vesta before it departed to asteroid 1 Ceres in late 2012. One of the major goals of the mission was a global mapping of Vesta. **Data:** The DAWN mission was mapping Vesta from three different orbit heights during Survey orbit (3100 km altitude), HAMO (High Altitude Mapping Orbit, 700 km altitude), and LAMO (Low Altitude Mapping Orbit, 210 km altitude) [1]. The Dawn mission is equipped with a framing camera (FC) [2] which was the prime instrument during the LAMO phase. DAWN orbited Vesta during LAMO in 21 cycles between December 2011 and end of April 2012. The framing camera took about 10,000 clear filter images with a resolution of about 20 m/pixel during these cycles. The images were taken with different viewing angles and different illumination conditions. We selected about 8,000 images for the global coverage of Vesta. **Data Processing:** The first step of the processing chain is to ortho rectify the images to the proper scale and map projection type. This process requires detailed high-resolution information of the local topography of Vesta. The global topgraphy was calculated during the stereo processing of the HAMO images [3] and was used here. The shape model was used for the calculation of the ray intersection points while the map projection itself was done onto a sphere with a mean radius of 255 km. The next step was the mosaicking of all images to one global mosaic of Vesta, the so called basemap. **Vesta map tiles:** The Vesta atlas was produced in a scale of 1:200,000 and consists of 30 tiles that conform to the quadrangle scheme proposed by Greeley and Batson [4] and is used for example for mapping Mars in a scale of 1:5,000,000. A map scale of 1:200,000 guarantees a mapping at the highest available DAWN resolution in LAMO and results in an acceptable printing scale for the hardcopy map of 10 pixel/mm. The individual tiles were separately mosaicked and reprojected. **Nomenclature:** The DAWN team proposed to the International Astronomical Union (IAU) to use the names of vestal virgins and famous Roman women as names for the craters and to use names of places and festivals associated with vestal virgins for other feature names. This proposal was accepted by the IAU and the team could propose 50 names for geological features to the IAU which were also approved [5]. These feature names were applied to the map tiles and are shown in Figure 1. The entire Vesta atlas consisting of 30 map tiles will become available to the public through the Planetary Photojournal and the PDS. **References:** [1] Russell, C.T. and Raymond, C.A., Space Sci. Review, 163, DOI 10.1007/s11214-011-9836-2; [2] Sierks, et al., 2011, Space Sci. Rev., 163, DOI 10.1007/s11214-011-9745-4; [3] Preusker, F. et al., this session; [4] Greeley, R. and Batson, G., 1990, Planetary Mapping, Cambridge University Press; [5] http://planetarynames.wr.usgs.gov/Page/VESTA/target

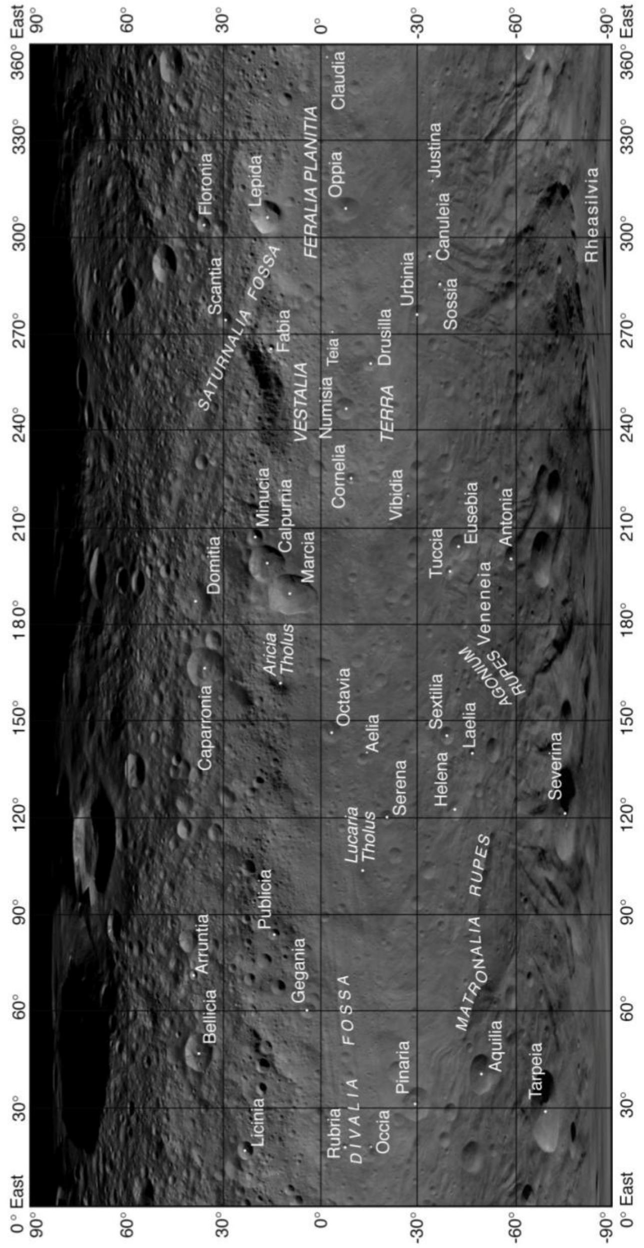


Fig.1 :
Global Mosaic of Vesta with approved nomenclature for geological features.

P3.35 | **Cartographic Mapping of the Icy Satellites using Cassini ISS images.**

(#632)

E. Kersten[1], T. Roatsch[1], A. Hoffmeister[1], C. Porco[2]

[1]German Aerospace Center, Institue for Planetary Exploration, Berlin, Germany; [2]Space Science Institute, CICLOPS, Boulder, United States

The Cassini spacecraft started its tour through the Saturnian system in July 2004. The Imaging Science Subsystem onboard the orbiter consists of a high-resolution Narrow Angle Camera (NAC) with a focal length of 2000 mm and a Wide Angle Camera (WAC) with a focal length of 200 mm. The stated objective of the ISS is to obtain global coverage for all medium-sized icy satellites (Mimas, Enceladus, Tethys, Dione, Rhea, Ipaetus, and Phoebe) with a resolution better than 1 km/pixel and high-resolution coverage of selected areas. This goal was achieved with image sequences obtained during close flybys supplemented by images from greater distances to complete the coverage. Remaining gaps in the Northern parts of the satellite coverage will be filled until the end of the mission in September 2017. Though the Cassini-ISS camera takes images using many different filters, we used only images taken with the filters CL1, CL2 or GRN, as these images show similar contrast. The processing of the Cassini images follows the typical processing chain for framing cameras: radiometric correction, geometric correction and map projection, and mosaicking. For the Cassini mission, spacecraft position and camera pointing data are available in the form of SPICE kernels [http://naif.jpl.nasa.gov]. While the orbit information is sufficiently accurate to be used directly for mapping purposes, the pointing information must be corrected using limb fits. High-resolution images that do not contain the limb were registered to limb images to improve the pointing. Digital global mosaics that are also called basemaps were prepared in simple cylindrical projection. Fig. 1 shows the basemap of Enceladus as an example. The most prominent features were marked with their names. Some features were already named based on the Voyager images. Many new feature names were suggested by the Cassini imaging team and approved by the International Astronomical Union (IAU). High-resolution atlases were produced to conform to the design and standards of the USGS airbrush maps and photomosaics which are widely used in planetary cartography. The selection of the atlas format depends on the resolution of the mosaics and the size of the satellites. Three different formats were used for the generation of the atlases:

- The synoptic format for making planetwide maps on a single sheet was used for Phoebe.
- The subdivision of the synoptic format for making planetwide maps with four quadrangles on three sheets were used for Mimas and Iapetus.
- The 15 quadrangles format for medium sized bodies and high-resolution imaging was used for Enceladus, Tethys, Dione, and Rhea.

Examples of these atlases will be shown in this presentation.

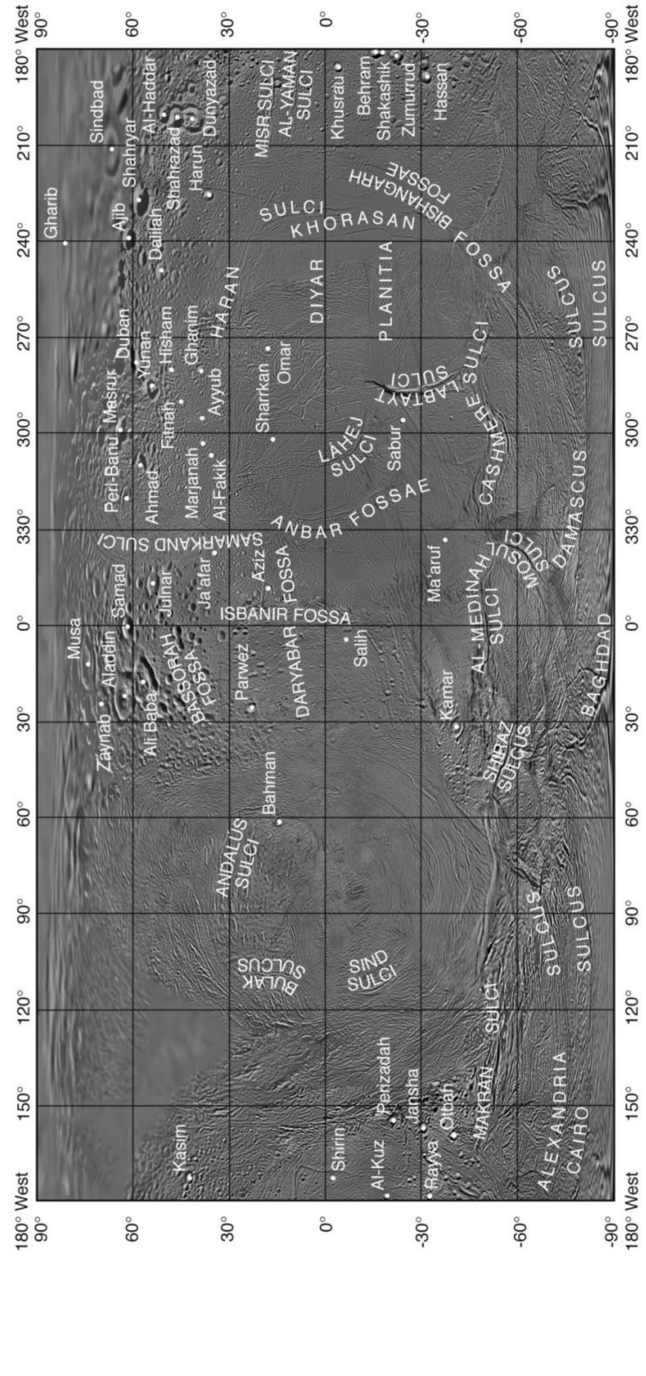


Fig. 1:
Global mosaic of Enceladus with approved nomenclature for geological features.

P3.36 | **Main Characteristics of Coordinate and Cartographic Support of Luna-Glob Mission** (#706)

A. Zubarev, N. Kozlova, I. Nadezhdina, A. Kokhanov, I. Karachevtseva

Moscow State University of Geodesy and Cartography, Extraterrestrial Laboratory (MExLab), Russia

Russian spacecraft Luna-Glob is scheduled for launch near 2016. To supply it with essential coordinate information a special technique of stereo processing and creating DEMs using LROC NAC images was worked out at MExLab. Three detailed DEMs for previous candidate landing sites in North subpolar region were created by means of "PHOTOMOD" software using this technique. Now we are analyzing available data for new candidate landing sites near the South Pole. **1. Introduction** Russian spacecraft Luna-Glob is scheduled for launch near 2016. It will carry a lander to work on the lunar surface for a year or more, collecting information about the Earth's Moon. Coordinate and cartographic information is essential to provide a soft landing and successful mission, therefore detailed DEMs (Digital Elevation Models) of the landing sites are required. **2. Main Characteristics of Coordinate and Cartographic Support of Luna-Glob Mission** Initially, it was planned to investigate North subpolar region and three candidate landing sites were chosen there. Special fly-bys by LRO (Lunar Reconnaissance Orbiter) spacecraft were made to obtain stereo images for these areas. While most of these images have a pixel scale of 1.8 m [1], detailed DEMs with resolution of 5 m/pixel for three landing sites were created using a special technique of stereo processing of scanner images, which was developed at MExLab. Stereo image processing is only possible when the stereo angle between two images is not less than 20° and the data about the location of the spacecraft on the orbit during the observations is known [2]. Relative accuracy of exterior orientation data must not be worse than 20 m, otherwise there will be considerable discrepancies in height values between stereo models. Creating DEMs for large areas is connected with high computational complexity. Thus, if several stereo pairs are necessary to cover the whole selected area, they have to be processed separately and then tied to each other to obtain a complete DEM. Moreover, too dark and too bright pixels lead to outliers in the DEM, which have to be removed manually. **3. Conclusion** Nowadays, three new candidate landing sites near the South Pole are in discussion. Unfortunately, now there is no stereo coverage of the selected areas by LROC NAC (Narrow Angle Camera) images. Thus, we are processing data from other sources such as LOLA etc. **4. Acknowledgements** This work has been supported by a grant from the Ministry of Education and Science of the Russian Federation (Agreement № 11.G 4. 1.0021 dd. 30/11/2010). **References** [1] http://wms.lroc.asu.edu/lroc/search [2] http://naif.jpl.nasa.gov/naif/

P3.37 | **Choosing a Suitable Projection for Navigation in the Arctic** (#930)

A. Skopeliti, L. Tsoulos
National Technical University of Athens, Cartography Laboratory, Zographos, Greece

A full-length version is available and can be opened here:

_extendedAbstract\930_abstract.*

P3.38 | **Considerations about the worldwide and Brazilian experiences for the adoption of Geocentric Datum** (#188)

V. de Oliveira Fernandes[1], R. Nogueira[2], G. Schmitt[3]

[1]Federal University of Bahia, Transport and Geodesy, Salvador, Brazil; [2]Federal University of Santa Catarina, Geosciences, Florianópolis, Brazil; [3]Karlsruhe Institute of Technology, Geodetic Institute, Germany

A full-length version is available and can be opened here:

_extendedAbstract\68_proceeding.*

P3.40 | **Renewing Cahill's Equal-Area Butterfly Projection** (#960)

K. Kerkovits, J. Györffy, M. Gede

Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\170_proceeding.*

Today, as computer-assisted cartography is getting more popular, maps are usually created from databases or other digital data formats. Exact formulas of projections are needed to be known to create programs that can handle them. Heuristic or graphically descripted, old projections may be brought up and be renewed for digital applications. English cartographer B. J. S. Cahill made three variants of butterfly maps in the beginning of the 20th century. Although they had low distortions and looked really aesthetic, these maps were not popular due to their complexity. Furthermore, one of the three variants – the equal-area map – had no mathematical projection formulas. Due to these reasons we decided to renew this projection. Our aim was to create a new projection by using exact mathematical formulas to approximate the original map. It does not have to be equal-area at every points of the map, as Cahill's butterfly is also not truly equal-area because of the manual distortions. However, we wanted to keep area distortions low. Additionally, all graticule lines have to be smooth. We developed two solutions: The first one is an orthogonal variant, using the Albers equal-area conic projection in the temperate latitudes and the modified orthogonal polyconic projection in polar regions and tropic zones. The second one is also an equal-area projection using Bonne equal-area pseudoconoic projection around the poles, and a modified equal-area polyconic one near the Equator. A JavaScript implementation of the projections was also developed to facilitate their use in webcartographic applications. Its practical use is illustrated by a sample web page using the OpenLayers framework.

P3.41 | **Methodology for Generating a Low Cost Tourist Mapping applied to Small Brazilian Municipalities** (#403)

S. S. Sato[1], K. M. C. Machado[1], L. A. C. Marques de Sá[1], M. Carneiro[2]

[1]*Universidade Federal de Pernambuco, Engenharia Cartográfica, Recife, Brazil;* [2]*Instituto Brasileiro de Geografia e Estatística, Base Territorial, Recife, Brazil*

A full-length version is available and can be opened here:

_extendedAbstract\135_proceeding.*

P3.42 | **The scholar cartography in brazilians universities: an experience in Ourinhos/Sao Paulo** (#837)

C. C. R. G. D. Sena
UNESP, Geography, Ourinhos, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\350_proceeding.*

The map has always been a tool used by man to guide, locate, inform, finally, to communicate. It is used by the scientist and the layman, in professional, social, cultural and touristic activities. In this sense, somehow, sometime, with more or less frequency, everybody run over maps to express themselves. To use the map in a coherent manner, realizing that it is a representation and therefore has a symbolism, result of generalizations and omissions, the user must master the language mapping. This dominion is a necessity in the formation of any citizen, appearing as an important topic in the scholar curriculum. It is at school that the student must develop its capacity to represent, even in simply way, your living space, and more than that, read, interpret and critically analyze graphical representations. In Brazil, the scholar cartography has been developing as an area of academic research and content in basic education. The scholar cartography is an interface of Cartography, Geography and Education, because it considers techniques for teaching that is originated in cartography, relies on Geography, that uses Cartography to represent geographic space in school and search in Pedagogy and Psychology the theoretical and methodological bases for understanding how children learn about space and its representation. However, the experience as a teacher of elementary and high school for 20 years and recent experience as a university professor in Geography coursedemonstrates that teachers in this area are not prepared to teach cartography in the school. This unpreparedness causes a deficiency in the education of children and young people, and when they need to read a map, both for its orientation and mobility and to understanding spatial dynamics represented, they have great difficulty, doing misreadings. This paper presents the experience of implantation the discipline Scholar Cartography in Geography Course from UNESP (University - "Júlio de Mesquita Filho") in Ourinhos, Sao Paulo. This discipline was proposed as optional for licensure and BA in Geography and aims to: understand the development of the concept of space in the school-age child; resume concepts worked in Cartography and adapt them to the Geography teaching; build and implement educational resources for teaching Geography and reinforce the importance of cartography as a resource of inclusion of the students with disabilities. We attempted to rescue the cartographic knowledge worked in specific disciplines of cartography within the curriculum of Geography with emphasis on the application of that knowledge in primary and secondary education, in order to make the work with maps more relevant and mapmakers more critical. The course had great support from the students, especially the students in the final year of graduation and provided experimentation with new approaches to cartography taught in school. Themes such as cartographic scale, orientation, geographic coordinates, projections, among others were presented, discussed and practiced by students in simulated classroom situations. In addition, work it was an extensive analysis of graphical representations in textbooks, demonstrating that it still needs to be thought about the quality and use of these maps. Finally, we highlight the importance of Tactile Cartography in the inclusion of students with visual impairment in school, worked during the discipline from my experience in the research of building, reproduction and application of tactile graphic representations in teaching.

P3.43 | **TRAINING OF STUDENTS FOR WORK IN THE FIELD OF CARTOGRAPHY** (#214)

J. Strauhmanis, J. Strauhmanis, J. Strauhmanis, **J. Strauhmanis**
professor, Department of Geomatics, Riga, Latvia

The Department of Geomatics of Riga Technical University offers only professional study programmes: bachelor and master professional study programmes. The length of the bachelor study programme is four and a half years, but in the master programme the studies last for one and a half years. Special attention is paid to the practical training of students, because the graduates of the Department of Geomatics work in geodesy, land surveying and cartography companies. Practical training starts already in the first semester when the students within the framework of the subject of geodesy have to do practical work, including work with a topographic map. The next stage is practical work while studying the basic course of cartography and here the main attention is paid to the mathematical base, cartographic generalization, projecting and creating a map. During the eighth semester of the bachelor study programme the students have on – the - job practice when they spend the whole term working in state or private cartography companies as well in the companies that deal with photogrammetry. Only after a successful defence of their accounts of this on – the – job training the students can obtain the professional qualification of an engineer of geodesy and cartography. It should be noted that our students within the framework of the ERASMUS programme have practical training in foreign countries, for example, in satellite geodesy and cartography at Valensia Politechnical University. Some students of this university have had practical training also in the Department of Geomatics, but for the time being only in connection with geodesic works. The practical training for the students of the master programme who have completed a bachelor study programme lasts for almost two semesters, because they also need to obtain the above mentioned qualification. The studies in the master programme for the students who have completed a professional study programme are organized according to an individual study plan, because many students who have completed a bachelor study programme in other fields, for example, in computer science, geography, environmental sciences, land management, continue their studies in the master study programme of the Department of Geomatics. The main problems concerning the on – the – job training are the following:It is not always possible for the students to complete all the tasks envisaged in the practical training programme and therefore it is necessary for the Department to stay in contact with the students all the time during their on – the – job training in order to be able to change a certain task, if it is needed.

- Unfortunately, only a few students were offered a permanent job at the cartography company. After completing the on - the – job training, although the references about the completed work were good.

At present, the Department of Geomatics in cooperation with Valensia Politechnical University and Karlsruhe Higher School of Applied Sciences are preparing a new international professional bachelor study programme „Geomatics". In this study programme also special attention will be paid to the practical training of students in cartography. **References** Strauhmanis J. (2008) Practical Training in Geomatics Studies in Latvia. FIG WWW-Integrating Generations. - CD – Stockholm. Proceedings. Strauhmanis J. (2012) The Problems of Preparing an International Coursebook in Cartography. (in Latvian) Scientific Journal of Riga Technical University. Vol.8. pp.30 – 33.

P3.44 | **CARTOGRAPHIC EDUCATION OF SURVEYORS WITHIN THE UNIVERSITY OF PRISHTINA** (#1178)

B. Idrizi
University of Prishtina, Surveying department, Kosovo (Republik Kosovo)

A full-length version is available and can be opened here:

_extendedAbstract\351_proceeding.*

University of Prishtina with 14 faculties and 3 high schools is the most important educational, scientific and cultural institution in Kosova, with 42 year experience in higher education system. High education of surveyors within the University of Prishtina is organized in the Faculty of civil engineering and architecture, as 3 year bachelor studies. The course is very young, which was begun in year 2003. Within very short period of 9 year experience, two totally different curricula's were in use. First one was in use from the beginning till year 2009, and the second one from academic year 2007/08. Compared with the older one, new curricula's consists more cartographic subjects, as map projections, topographic cartography, web cartography, geodetic maps, general cartography etc. As software platforms, both, commercial and free/open source software uses for data processing, editing, compilation and publishing. From commercial software, ArcGIS, geomedia, global mapper and AutoCADMap 3D are in use, and from free and open source software as most utilized are map maker, micro dem, quantum GIS, Merkaator, grass gis, map window gis, autodesk 123d, ArcGIS online, map server, geo server etc. As results from the process of cartographic education within the surveying department of the University of Prishtina, bellow list of products will be presented in paper and presentation: creating of road map of Kosova, touristic maps of some Kosova cities, calculation of the state area of Kosova, using Civil 3d and autocad map 3d for geodetic calculations/transformations, research of alternative map projections for Kosova, analyses of Gauss-Kryger projection in a case of Kosovaref01, analyses of creating DTM and its quality, developing Kosova's GM dataset, automation of tiling reference systems for the area of Kosova, creating digital cartographic key and geodatabase structure for topographic maps in scale 1:25000, as well as in scale 1:50000 based on NATO standards, etc. In full paper and presentation, all details of curricula's, cartographic products and cartographic literature in Albanian language will be given.

P3.45 | **PHYSICAL MAPS WITH TACTILE AND VISUAL INFORMATION ACCESSIBLE ALSO TO BLIND AND VISUALLY IMPAIRED PERSONS** (#58)

P. Ruiz-Prieto[1], F. García-Soria[2], M. J. Vicente-Mosquete[2], M. D. M. Díez-Álvarez[3], J. Sánchez-Abiétar[4], J. M. Durán-Vélez[5], M. Baldrich-Caselles[6]

[1]ONCE (National Organization of Spanish Blind Persons), Education, Employment and Culture, Madrid, Spain; [2]ONCE (National Organization of Spanish Blind Persons), Accesibility and Personal Autonomy, Madrid, Spain; [3]ONCE (National Organization of Spanish Blind Persons), Bibiographic Services, Barcelona, Spain; [4]ONCE (National Organization of Spanish Blind Persons), Bibliographic Services, Madrid, Spain; [5]ONCE (National Organization of Spanish Blind Persons, School for Blind Persons, Sevilla, Spain; [6]ONCE (National Organization of Spanish Blind Persons), School for Blind Persons, Barcelona, Spain

The aim of this poster is to disseminate the research carried out by the Tactile Materials Group of the Spanish Braille Commission with the objective of defining the criteria to be taken into account when producing accessible maps, suitable for persons both with and without a visual disability. Thus, high-contrast colours are used to define the various physical elements represented in the map (levels, seas, and rivers). These elements are also made tactually different by applying various heights, reliefs, and textures to them. In order to define these tactual and visual elements, prototypes of physical maps have been evaluated by a wide group of people, representing various visual impairments and with ages ranging from 12 to elderly individuals. This work aims at completing the study carried out by the same group of researchers on political maps, which was presented to the XXII International Cartographic Conference (A Coruña, Spain, 2005).

P3.46 | **AUSTRIAN-HUNGARIAN SURVEY ON CHERNOFF FACES: AN ALTERNATIVE METHOD OF REPRESENTATION IN SCHOOL CARTOGRAPHY**

(#363)

E. Simonné-Dombóvári[1], J. J. Reyes Nunez[2], G. Gartner[1], M. Schmidt[1], A. Rohonczi[3]

[1]Vienna University of Technology, Geoinformation and Cartography, Research Group Cartography, Austria; [2]Eotvos Lorand University, Department of Cartography and Geoinformatics, Budapest, Hungary; [3]Cartographia Editorial House, Budapest, Hungary

In 2008 and 2009 was developed an international research project on Chernoff faces, with the participation of Argentine and Hungarian researchers. Chernoff faces are a method to represent multivariate data, using a human face as a multivariate symbol, on which its features (eyes, ear, nose, mouth etc.) can represent different variables. After a theoretical research to study the possibilities of this method in School Cartography, researchers made two questionnaires to examine different aspects of the use of Chernoff faces that were filled by Argentine and Hungarian pupils. After the analysis of the results, they were resumed in general proposals, but some questions still remained without a clear answer. This situation motivated Hungarian colleagues to organize a project with a new participant country (Austria) in 2010 and 2011. The results of the Austrian survey were compared with the results previously obtained by Argentine and Hungarian pupils in 2009, finding answers that helped us to clarify the previous contradictory results. At same time, a new Hungarian questionnaire was applied in early grades (grades 3 to 5) of two Elementary Schools in Budapest. This test filled the gap left during the 2009 survey, studying how younger children can read the data represented using Chernoff faces and pictograms modified according to the Chernoff principle, comparing them with a traditional method of thematic representation. This Hungarian survey was a first step to determine the grade of acceptance between the younger pupils, as well as the practical usability of these alternative methods in School Cartography. Concluding the project, both research teams worked out suggestions related to the possible use of Chernoff faces in School Cartography that can be applied in a more general context. All the databases, results of analysis, conclusions, etc. can be downloaded on the project website (http://cartography.tuwien.ac.at/chernoff/).

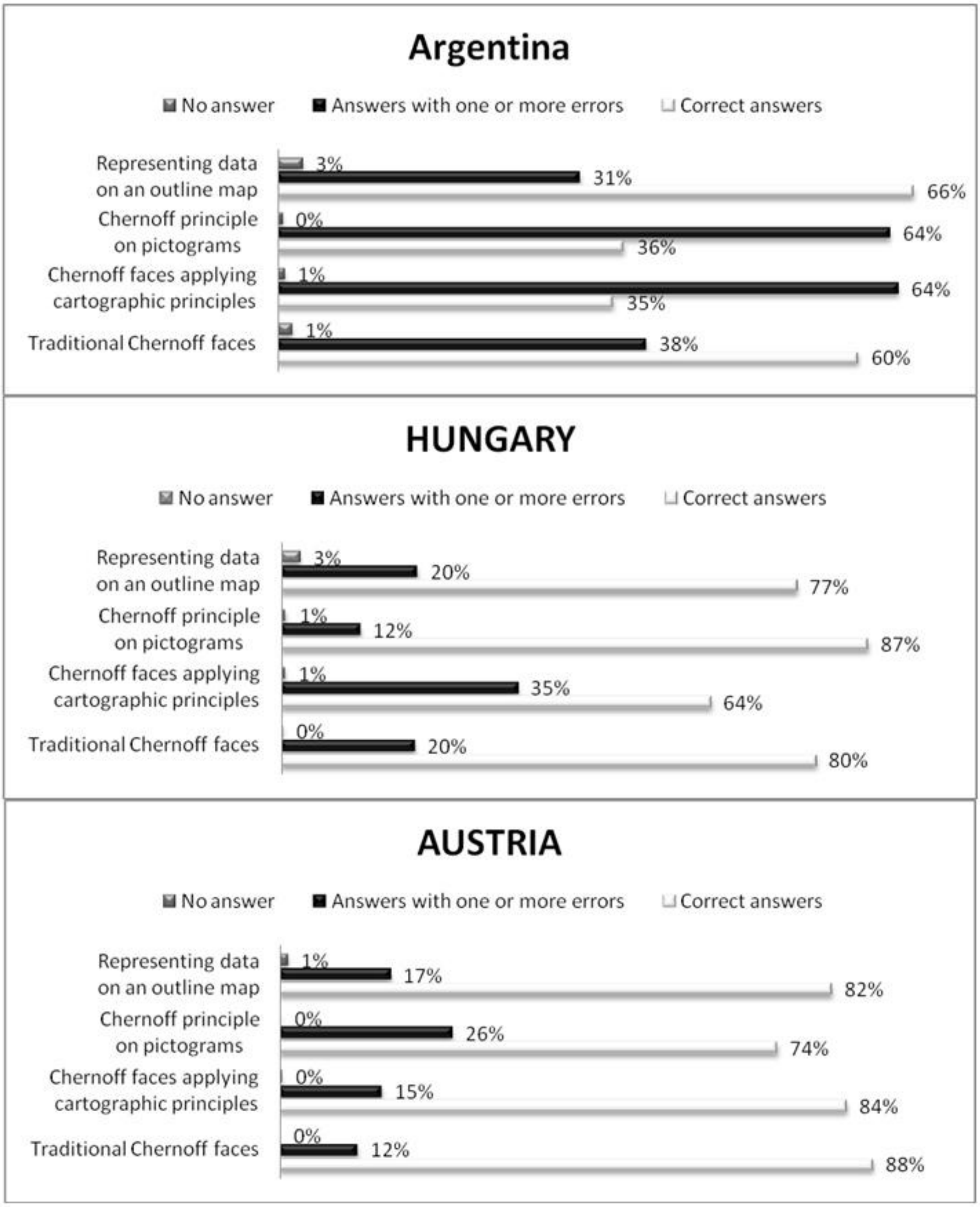


figure1.jpg:
Diagram comparing the percentage of correct and incorrect answers by questions in Argentina, Austria and Hungary

HUNGARIAN QUESTIONNAIRE		
TASKS	**QUESTIONS**	**METHOD OF REPRESENTATION**
First task	Which is the region of the country with the highest number of Secondary Schools?	Traditional method: Simplified bar graph
	Where is the number of elementary schools lower: in Central Transdanubia or North Hungary?	Alternative method: Pictogram made according to the Chernoff principle
Second task	Which is the region of the country with the highest number of pupils in elementary schools?	Two traditional methods applied together: - Choroplets (hatching) - Proportional circles (change of size and fill)
	Where is the number of Secondary School pupils lower: in West Transdanubia or Northern Alföld (Great Hungarian Plain)?	Alternative method: Chernoff faces

SELECTION OF THE METHOD OF REPRESENTATION IN BOTH SCHOOLS								
	First task				**Second task**			
	1st question		**2nd question**		**1st question**		**2nd question**	
	T.M.	A.M.	T.M.	A.M.	T.M.	A.M.	T.M.	A.M.
Only correct answers	75 (73%)	25 (24%)	63 (73%)	20 (23%)	54 (52%)	44 (42%)	46 (49%)	44 (47%)
Difference	50 (49%)		43 (50%)		10 (10%)		2 (2%)	
T.M. – *Traditional method of thematic representation* A.M. – *Alternative method of thematic representation*								

figure2.jpg:
Content of the Hungarian questionnaire and comparison of results obtained in Hungarian schools, considering only the correct answers

P3.48 | **Historic Town Atlases of Poland - the Progress up of Today** (#283)

Z. Kozieł, Roman Czaja, Radosław Golba, Agnieszka Pilarska

Nicolaus Copernicus University, Department of Cartography, Remote Sensing and GIS, Toruń, Poland

A full-length version is available and can be opened here:

_extendedAbstract\283_abstract.*

P3.49 | **Using Chorems to Create Visual Summaries of the Recurring Places Appearing in Human Movements** (#1013)

T. Kelviste[1], R. Aunap[1], M. - J. Kraak[2]

[1]*University of Tartu, Department of Geography, Estonia;* [2]*University of Twente, Department of Geo-information Processing, Enschede, Netherlands*

A full-length version is available and can be opened here:

_extendedAbstract\437_proceeding.*

1. Introduction Currently there is an increasing interest in studying human movement patterns. To understand these patterns one is not only interested in the path but also in those places which are frequently visited by an individual. Getting inside in the pattern of these recurring places can improve understanding of human behaviour. Due to the large data quantities and typical nature of movement data the traditional cartographic methods (like point density maps and flow maps) often cause over-plotting and cluttering. In this paper, we explore an alternative graphic representation method to create visual summaries of spatial structures and processes known as chorems (Brunet 1987), to visualize recurring places from movement data. **2. Background** The main difference between creating traditional cartographic representations and chorems is the starting-point. The first is object oriented, where identification of the individual features is followed by symbolization according to spatial data type. The second is process oriented, where the focus is on the interaction between objects (conflict, diffusion, and separation e.g.) and symbolization is applied to express different process related aspects. The theoretical framework originates back to 1980's, when French cartographer, Roger Brunet, developed his spatial graphic toolset called *chorèmes*. Since then chorems have been infrequently used and the method only supported manual creation. Recently the interest in their automatic construction has emerged. However, researchers (Reimer 2010, Del Fatto 2009) mainly focus on creating the shape of the chorem area. Our focus is on developing automatic symbolization of chorem content. **3. Approach** The example dataset for developing general approach to this method consisted of one year (January 1, 2010 to December 31, 2010) active positioning data of 4 volunteers living in Tartu, Estonia. Active positioning data means that the location of the user's mobile phone was registered continuously after every 15 minutes. To automate the chorem creation process several statistical methods were applied to pre-process the data in order to identify the interactions between objects and to get the necessary attribute data for chorem content elements. The chorem content included basic shape of the research area, descriptive elements of the primal process movement (characteristics like distance, direction, origin-destination points, and time) and spatial organization likely affecting the process (road network, land cover, points of interest at the area). Data mining methods to locate key locations like home and work (Ahas *et al*. 2010) and clustering algorithms to identify other recurring places based on spatial density distribution and time spent at location were used. In chorem two spatial scale levels were separated: 1) movements inside highly populated areas (towns) and 2) movements within the whole country. Accordingly, temporal scale summarizing seasons in the country level and weekdays/weekends in town scale were used. The final construction was made by a computer driven set of pre-defined graphic placement rules (like relocate, replace, hide, emphasize) that uses the result values recorded in the database after the detection and analyze process. **4. Conclusion** We see a great potential in the methodology of chorems to create representations of complex spatial processes as movements. In the future, we intend to work on how this method can be adapted to much larger dataset. **References** Ahas R, Silm S, Järv O, Saluveer E, Tiru M (2010) Using Mobile Positioning Data to Model Locations Meaningful to Users of Mobile Phones. Journal of Urban Technology, 17(1): 3-27 Brunet R (1987) La carte: Mode d'Emploi. Fayard-Reclus, Paris Del Fatto V (2009) Visual Summaries of Geographic Databases by Chorems. Ph.D Thesis. University of Salerno, Italy. INSA of Lyon, France Reimer A (2010) Understanding Chorematic Diagrams: Towards a Taxonomy. The Cartographic Journal 47:330–350

P3.50 | **The production of orienteering maps in Austria** (#1192)

R. Ditz

Ministry of Defence and Sports, Institute for Military Geography, Vienna, Austria

A full-length version is available and can be opened here:

_extendedAbstract\427_proceeding.*

Due to changing technologies in collecting data, the production of orienteering maps has changed in the last few years. The use of orthophotographs combined with airborne laser scanning data as well as new hardware and software supporting this hardware reduced the time and the costs of the production of orienteering maps. This article will present the current situation of orienteering maps and map making in Austria. It will be shown, where the data can be acquired, what costs have to be calculated and what quality can be expected.

P3.51 | **Quo Vadis, Geo-Scientific Mapping of States?** (#485)

E. Sandner
retired person, Radeberg, Germany

A full-length version is available and can be opened here:

_extendedAbstract\409_proceeding.*

Geo-scientific mapping of federal state territories is seen as a complicated and complex system of mapping geo-components or a natural landscape in total by the author. It principally serves an optimization of the contents of map series in terms of features portrayed and presented. The most important issue is consistency and actuality of geo-scientific map series of states (or whole countries). Demand for reliable geo-scientific map series is increasing. Topical challenges (such as global and regional climate change or exhaustion of natural resources) support this statement. The need of a national economy for geo-scientific references must be satisfied. Hereto, international standards and long term demands have to be considered. This inevitably leads to the question: How will geo-scientific mapping carry on in the future? Starting position: Saxony has set international standards in respect to geo-scientific maps in history. Therefore it makes sense to build this article on analyses and comparisons of actual Saxon geo-scientific map series. The analysis basically tries to pinpoint drawbacks of these map series. Two categories were formed, namely frequent and serious deficiencies (table 1). Serious deficiencies are: incompleteness (exemplary maps), missing base map, no use of dimension-specific units, pure academic content (lack of relation to the practitioner), historical content (missing update), missing complementary character, "century work" in respect to an intended completion, and missing national standardization. Improvements to geo-scientific map series: From the stated serious deficiencies solutions for an improvement can easily be derived. A list of demands looks as follows: Comprehensive map series (no gaps), character of base maps, a use of dimension-specific units, relation to the practitioner and comprehensible contents, complementary map series, reduced implementation time, national and international standardization. Future geo-scientific map series: Geo-scientific map series of the Federal State of Saxony will be presented and discussed. They seem to be best-suited for various derivatives of new geo-scientific maps, for combinations, and for a wide range of interpretations.

Map Series	Dimens. of Spat. Units	Base Maps	Generalization	Updating	Completeness
GK 25	0	1	1	(1)	0
HGK 50	1	1	1	0	1
GMK 750	0	0	1	0	1
KK 300	0	0	1	0	1
BK 50	1	0	1	0	1
PNV-K 50,200	0	0	(1)	0	1
BSK 10	(1)	1	1	(1)	1
FSK 10	1	1	1	(1)	1
MMK 100	1	0	0	0	1
NRK 50	1	0	1	0	1

Table 1: Frequent and serious deficiencies within geo-scientific maps of Saxony.

Map abbreviations:

- GK 25: Geologische Karte [geological map] 1:25.000
- HGK 50: Hydrogeologisches Kartenwerk [hydro-geological map series] 1:50.000
- GMK 750: Geomorphologische Karte [geomorphologic map] 1:750.000
- KK 300: Klimakarte [map of climate] 1:300.000
- BK 50: Bodenkarte [soil map] 1:50.000
- PNV-K 50, 200: Karten der potentiellen natürlichen Vegetation [maps of the potential natural vegetation] 1:50.000, 1:200.000
- BSK 10: Bodenschätzungskarten [maps of the soil taxation] 1:10.000
- FSK 10: Forstliche Standortskarte [forest site map] 1:10.000
- MMK 100: Mittelmaßstäbige Landwirtschaftliche Standortkartierung [medium-scaled agricultural site mapping] 1:100.000
- NRK 50: Naturraumkarte [natural landscape map] 1:50.000.

Table entries:

- 1: existing
- (1): partially or latently existing
- 0: not existing.

Table 1:

Table 1: Frequent and serious deficiencies within geo-scientific maps of Saxony.

P3.52 | **The Theory of Geographical Dimensions** (#486)

E. Sandner
retired person, Radeberg, Germany

A full-length version is available and can be opened here:

_extendedAbstract\410_proceeding.*

Only after Neef (1963) had shaped and defined the term geographical dimension, a theory of geographical dimensions could develop. This theory is every now and then reflected within technical literature since the 1970s. At present, German technical literature distinguishes 5 (6) geographical dimensions. Methods: The theory of geographical dimensions is an empirical theory. Like any theory it fulfills two functions, namely to explain observed facts and to predict new ones. Empirical sentences are a point of origin. They will be firstly structured, and subsequently be generalized. If the general sentences can explain empirical facts, one arrives at hypotheses. Afterwards it will be proved, if unknown statements can be derived using these hypotheses. If further studies (experiments, observations, etc.) proof their correctness, then the hypotheses are considered valid. Thus, new regularities can be found and systematized. The resulting system is termed theory (Klaus and Buhr 1971). General sentences: At first, the empirical and general sentences will be applied to natural landscape units. The following relations between natural landscape units and the geographical dimensions have been found and can be stated:

- A geographical dimension is a function of the distance between the subject and the natural landscape units.
- All geographical dimensions carry a hierarchical rank. The larger the distance between subject and the natural landscape units, the higher is the rank of the geographical dimension.
- At minimum two geographical dimensions exist, one with the smallest distance and one with the largest distance between subject and the natural landscape units.
- Every natural landscape unit is an element of a geographical dimension.
- Every natural landscape unit is an element of a natural landscape unit of a higher geographical dimension in the same time.
- Every natural landscape unit consists of a set of natural landscape units of lower geographical dimension.
- Natural landscape units of any geographical dimension add up to the same total surface area on our planet.
- The number of the natural landscape units is inversely proportional to their average surface areas for every geographical dimension.
- The rank of a geographical dimension behaves proportional to the surfaces area and in inversely proportional to the number of the natural landscape units.

These general sentences are not only valid for the example of natural landscape units, but also for units related to various other geo-scientific topics. As hypotheses they exemplarily refer to soil and geomorphologic units. Research proves these hypotheses. Consequently, a strong connection exists between natural landscape units and geographical dimensions. Hypotheses: With highest probability it can be stated, that a similar relation exists between units of any geo-science (geology, geomorphology, climatology, geo-botany etc.) and the geographical dimensions, even if many dimension-specific geo-scientific units are still undefined at present (neither discerned nor termed). Finally, units of an arbitrary geo-science can be replaced by territories of geographical objects of a completely different character (such as administrative units). Again we can presume that the same relations exist between the scopes of these geographical objects and the geographical dimensions. Theory of the geographical dimensions: The theory of the geographical dimensions, like any theory, consists of a system of basic principles, axioms and rules. Neef (1967) has formulated the geographical axioms. The theory of the geographical dimensions consists of a larger number of specific relations between the scope (spatial influence) of geographical objects of a specific object class and the geographical dimensions. These relations express a lawful connection. **Keywords:** geographical dimension, natural landscape units, theory.

P3.53 | **Location in Granular Multimedia Digital Cultural Heritage** (#337)

K. Horst

CODATA-Germany, Berlin, Germany

Cartography has always been the central field of application for georeferencing objects of Digital Cultural Heritage. Its special important role becomes evident in enabling spatial relation analysis between any amount of DCH objects or of their granular details (video and film single scenes, text elements etc.). In addition to the pure geometric aspects, also the cognitive relations that lead to knowledge representation and derivation of innovative use processes are of increasing importance. The geometrically-logical-cognitive potential for multimedia databases of digital cultural heritage are so high that handling, transmission and processing operations are expected with guaranteed long-term availability for all other stakeholders. After all, in the future applications and information demands are not only for finding and linking individual library, archive or collection items but whole areas of digital multimedia databases need to be processed for the purposes of promoting an understanding of historical and cultural contexts. This is an extremely important concern of the information society and there is an extensive challenge that raises the role of cartography in all these domains.

P3.55 | **Mapping the Olympic Park** (#1093)

P. Naylor, C. Wesson

Ordnance Survey, Cartographic Design, Southampton, Great Britain

From 27 July to 12 August 2012 London, England played host to the **Games of the XXX Olympiad** and the Olympic Park was at the heart of the games. Set across a 200-hectare (490-acre) former industrial site at Stratford, East London the park encompassed nine new world class sporting venues, Olympic and Paralympic Village and media centres. In 2005 the 2.5 square kilometre site was home to light industry, dominated by overhead powerlines, and broken up by rivers, roads and railways. Work to transform the Park began in 2007 with civil engineers preparing the land for construction, demolishing old structures and cleaning the contaminated soil, improving the many waterways that cross the Park, burying the overhead power lines and ensuring that any wildlife and plant species are protected. At the same time civil engineers, working as part of a multi disciplinary team, got to work designing and building stadiums, roads, bridges, waterways and electricity systems. Many of the stadiums and bridges were cleverly designed so that they can be quickly and efficiently removed – partially or entirely – once they are no longer required after the Games. Beyond 2012 people living in east London will benefit from the facilities and infrastructure put in place; from high-quality sports and community facilities, including health centres and schools to the new roads, waterways and energy systems In 2010 the Institute of Civil Engineering (ICE) approached Ordnance Survey (OS) with a view to creating a map of the Olympic Park highlighting the important role civil engineering played in the development and construction of the site and the infrastructure supporting it. In 2012 OS were approached by the London Legacy Development Corporation (LLDC) to produce a legacy map, depicting how, after the games, the park would transform into the Queen Elizabeth Olympic Park. The LLDC are responsible for takeover of the Olympic Park after the conclusion of the Paralympics and will continue the parks legacy long after the Games have finished. This poster will demonstrate how, using a variety of disparate datasets from OS, LLDC and the Olympic Delivery Authority (ODA), the two maps were planned, designed and created. The poster will highlight the reasoning behind the map layout and scale as well as discussing styling choices and decisions including colour palettes. We will break down the production methods used for both maps including how the third party data was translated and filtered. It will also visualise how the maps were produced through applying the design principles recently created by the Cartographic Design department at Ordnance Survey. Most importantly the poster will demonstrate how through a set of complex ideas both maps were communicated with clarity, precision, and efficiency resulting in a set of two maps designed to work in unison with each other. Many maps were designed to show how the Olympic Park could be navigated - our remit was very different…

P3.57 | **Application of a Simple Method for Coordinates Conversion** (#1046)

J. P. Dos Santos

State University of Feira de Santana - Bahia, technology, Brazil

The conversion of longitude and latitude coordinates to the UTM model (Universal Transverse Mercator) has been a problem faced by teachers and students in the areas of geosciences, military, airmen, professionals that use GPS nowadays and others who face this issue. There is a lack of debate about the subject by specialized literature, leaving a gap for its complete understanding by users in general, even though there are several Javascript software in the WEB specialized to perform such transformations. The longitude and latitude coordinates are easily shown and explained to students since the early years of school through maps and globes, allowing them to have a clear picture of its distribution over the spherical figure of the earth, although they are imaginary lines that form a network of coordinates over the planet. The UTM coordinates rather do not have a frame of reference easy to understand at first glance. Anyone who owns a simple sextant and a watch that defines the time in Greenwich can, from observing the stars, determine the latitude and longitude of where you are and consequently obtain the geographic coordinates. Regarding UTM coordinates, they are not as easy to be determined except by means of calculations which, depending on the required accuracy, are quite complex. In Network or grid of UTM coordinates there is a completely artificial construction**,** and the only way to plot them in a map is to calculate them from latitude and longitude networks and superimpose them on these. Coordinates networks on the earth's surface are used to determine points, distances and geographic areas. These networks are formed by meridian and parallel arches**,** which their intersection correspond to a point of coordinate (Φ, l) or UTM (X, Y). This academic work intends to discuss traditional methods and Javascript conversion of Geographic coordinates to UTM and vice versa, and at the same time, it presents a simple arithmetic method that does not involve algebra or trigonometry. It aims to fill in a gap in the understanding of this issue which the author's experience has allowed students of cartography and related fields who are interested in the subject, to understand the process more clearly.

P3.58 | **Raster editing and map production in a National Mapping Agency using ArcGIS** (#524)

R. Patrucco, D. Bigwood

Ordnance Survey, Cartographic Production, Southampton, Great Britain

Since 1992 the existing Ordnance Survey production system has proven to be a reliable and robust environment for the production of 1:25,000 and 1:50,000 raster data. With the development of new computer designs and specifications this system is now unsupported by most commercial software and ArcGIS is currently being investigated as a replacement. This presentation identifies:- - how the ArcGIS functionality has been manipulated to form the final stage in the production of a print ready CMYK 4 channel raster - how problems with the colour combination of a large number of 1bit raster tiffs have been overcome; -the expansion of line data on specific colour tiffs; - the creation of blank areas within specific line detail to insert contour lines; -the selection and manipulation of tiffs that contain no data - how future ArcGIS versions may affect the development our map production processes

P3.59 | **ANALYSIS OF SATELLITE DATA AIMED AT ENVIRONMENTAL RISK MONITORING** (#613)

M. Caprioli
POLITECNICO DI BARI, DICATECH, Italy

A full-length version is available and can be opened here:

_extendedAbstract\188_proceeding.*

The automation and repeatability of the procedure on constantly updated data will permit the development of a monitoring system for land cover transformations with environmental risk, not only to support preliminarily decisions in strategic planning contexts, but also as a tool to verify strategies and accomplishments, allowing modification of actions when the expected effects are not achieved. To detect and classify a landslide, it is necessary to view the size and contrast of its features and the morphological expression of the topography within and around the landslide. Determining parameters are the type of movement that has occurred, the degree of present activity of the landslide, and the depth to which movement has occurred. The most common remote sensing tools used for the detection and classification of landslides are satellite imagery and aerial photography. Monitoring landslide movement involves the comparison of landslide conditions over time, including the aerial extent of a landslide, its speed of movement, and the change in its surface topography (i.e. DEM comparison) . The fundamental merits of the high resolution remote sensing are the ability to perform surveys at regular intervals in the operation, the characteristics of the image and the revisit times. These features are very useful in environmental monitoring. In the last years the topic of Environmental monitoring has raised a particular importance, also according to minor short-term stability and predictability of climatic events. Facing this situation, often in terms of emergency, involves high and unpredictable costs for public Agencies. Prevention of damages caused by natural disasters does not regard only weather forecasts, but requires constant attention and practice of monitoring and control of human activity on territory. Practically, the problem is not knowing if and when an event will affect a determined area, but recognizing the possible damages if this event happened, by adopting the adequate measures to reduce them to a minimum, and requiring the necessary tools for a timely intervention. On the other hand, the surveying technologies should be the most possible accurate and updatable in order to guarantee high standards, involving the analysis of a great amount of data. The management of such data requires the integration and calculation systems with specialized software and fast and reliable connection and communication networks. To solve such requirements, current satellite technology, with recurrent data acquisition for the timely generation of cartographic products updated and coherent to the territorial investigation, offers the possibility to fill the temporal gap between the need of urgent information and official reference information. Among evolved image processing techniques, Change detection analysis is useful to facilitate individuation of environmental temporal variations, contributing to reduce the users intervention by means of the processes automation and improving in a progressive way the qualitative and quantitative accuracy of results. The research investigate automatic methods on land cover transformations by means of "Change detection" techniques executable on satellite data that are heterogeneous for spatial and spectral resolution with homogenization and registration in an unique digital information environment. In the present work we tested some areas of study particularly interesting for the knowledge of the morphology changes of land cover, in particular the area of Fasano in Apulia Region (Italy) and protected area of the Park of Alta Murgia, both of them with frequent episodes of land transformation. We tested the usability of heterogeneous and freely available images to realize a DEM extraction process to achieve fast and low cost system of analysis. We used archival stereo-pairs Ikonos and LIDAR survey comparing with Aerial photogrammetric DEM extraction.

P3.60 | **Soil Map 1:200,000 (BUEK 200) – The Distribution of Soils in Germany**

(#922)

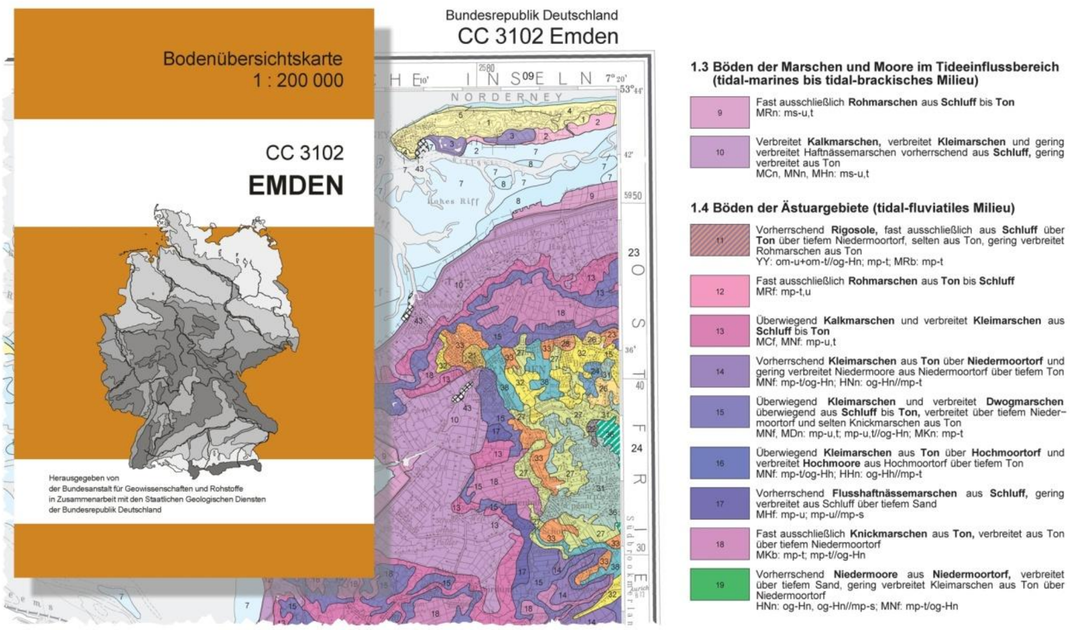
D. Krug[1], U. Stegger[1], E. Eberhardt[1,2], S. Richter[2]

[1]*Federal Institute for Geosciences and Natural Resources, Hannover, Germany;* [2]*Federal Institute for Geosciences and Natural Resources, Berlin, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\23_proceeding.*

The soil map 1:200,000 (BUEK 200) is prepared by the Federal Institute for Geosciences and Natural Resources (BGR) in cooperation with the National Geological Surveys (SGD) of the federal states in the sheet line system of the Topographic Map 1:200,000 (TUEK 200) and is published in 55 individual map sheets.   The map shows the spatial distribution and association of soils and their properties. The BUEK 200 is the first nation-wide consistent soil map at medium scale with full spatial coverage. By the end of 2012, 48 map sheets have been published as printed and digital versions.   The Geological Surveys are responsible for the content of the map and for the underlying soil information (attribute data), while BGR coordinates the quality assurance of the layout and the overall consistency of the map series. The resulting map is homogeneous and seamless, and the digital dataset holds uniform, corresponding background information on any map unit.   The BUEK 200 is completely digitally produced within a Geographical Information System (GIS). Spatial and attribute data are recorded in a central database and can be used for evaluations across state boundaries for soil use and soil conservation. The sheet-wise processing requires for each new sheet the modification of map graphics as well as content of adjoining sheets such that the current digital dataset is ready to use for data evaluation. The map series is distributed in various formats via the GeoShop Hannover (www.geoshop-hannover.de), partly free of charge. In addition, BGR provides the data as a web map service (WMS, www.bgr.de/app/FISBoBGR_MapServer/OpenLayers/buek200.html).   After completion of the dataset for the whole of Germany, a further aggregation of map units will be carried out in order to yield a nation-wide, homogeneous legend. This will be paralleled by a revision of the boundaries of spatial aggregation units (Great Soilscapes, Soil Regions). With this overall picture, quality of all map, map unit and soil profile data will again be checked. Besides this, the work will focus on thematic evaluations and aggregation for maps at even smaller scales.



Detail of a map sheet :
Title page and detail of the BUEK 200-map sheet "Emden"

P3.61 | **PARADIGMATIC TENDENCIES IN CARTOGRAPHY AND MAPPING DURING THE SCIENTIFIC AND POSTMODERN PERIODS** (#1069)

D. P. Azócar Fernández

Universidad Tecnológica Metropolitana, Cartografía, Santiago, Chile

A full-length version is available and can be opened here:

_extendedAbstract\340_proceeding.*

A theoretical revision in cartography and mapping since 1950s until today demonstrates many tendencies which can be considered as paradigmatic in Kuhnian terminology. This study incorporates the idea or concept of paradigm which has been taken from epistemology of sciences and consequently this concept opens a space to analyze cartography in terms of a paradigm shift. Inside of the contemporary cartography this study covers from traditional until post-modernist cartography. The first period includes a scientific cartography (from A. Robinson until A. MacEachren) which presents the following cartographic tendencies: cartographic language, cartographic communication, analytical cartography, cartographic visualization and cyber-cartography (D. Fraser Taylor). These mentioned tendencies have their own study object, methods and techniques (or approaches) and specific cartographic products as results. Linguistic-semiotics, perceptual-cognitive, analytical-mathematical and cognitive-semiotics approaches have prevailed during the development of the scientific cartography. On the other hand, in a second period alternative tendencies have been established especially since 1980s which are framed in a post-modernist context. Critical cartography arises with J. B. Harley and his successors offering an optional cartography and mapping in comparison with the scientific point of view. Also in this so-called postmodern period, post-representational cartography is presented as another alternative trend to the scientific perspective of the discipline. In this way, approaches such as hermeneutic-deconstructivist and ethnographical-processual are risen. According to the difference of the approaches, study objects, research aims and results, all these tendencies can be considered as paradigmatic shifts during the developing of the discipline.

P3.62 | **Contextual mapping - the importance of the right base map** (#1158)

C. Wesson

Ordnance Survey, Cartographic Design & Development, SOUTHAMPTON, Great Britain

A full-length version is available and can be opened here:

_extendedAbstract\255_proceeding.*

The poster will focus on the importance of selecting the right base map in achieving the correct balance for contextual mapping and explore how that base map can be created by applying some colour science to the cartography. The work concentrates on screen-based media but uses our backdrop mapping products from the Ordnance Survey's OS VectorMap® product family that have been designed to transfer quite comfortably to printed media also. Over the past decade we have witnessed a huge increase in the use of user geographic or location-based data being displayed over maps. Many of the maps that one sees on the internet or on phone and tablet applications - everything from push-pins to heat maps to third party cartographic datasets - fall into this contextual category. As cartographic designers and developers, we are all trying to find a better way of visualising these overlays but the authors believe that in many instances the larger proportion of blame lies with an inappropriate base map and this poster aims to showcase this theory. Topographic maps not by definition but by product design are generally too cluttered and too busy a backdrop for displaying further geodata. The colour palette of many topographic maps is too strong for overlaying further information. There may also be other unwanted information already present. At Ordnance Survey for example, our mid-scale raster products are not purely topographic; they often stem from other more thematic product requirements such as walking or tourism. This is normal, if one served up a true topographic map then many customers would want to know where all of the information was, for example geographical object and area names. Leading web map services are also something of a compromise by catering for both 'full map' and 'backdrop map' audiences and end up with an unhappy compromise both in terms of content and fullness of colour. The poster will also seek to dissolve the theories that turning topographic maps to greyscale or simply applying a white wash or a transparency to the base map offers a good solution. The latter will have the desired result in reducing perceived colour brightness but the steps between feature hierarchy and the level of content will never be as good as a bespoke base map. This 'bespoke base map' is what we have tried to achieve with our background style. The poster will explain some of the colour science behind this which is borrowed from the web design and television industries where algorithms consider the measure of Luma, or the effective brightness of a colour on screen. By the use of illustrative examples based upon those found in the real world, the poster will seek to visually prove that a bespoke backdrop style serves not only as a far better base map but also facilitates better communication of the overlain information no matter how well or badly that happens to be symbolised.

P3.63 | **The latest research about Fernando Consag (1703-1759), On the occasion of 310th anniversary of his birth** (#1210)

M. Husak

-, -, Varaž din, Croatia

A full-length version is available and can be opened here:

_extendedAbstract\1210_abstract.*

P3.64 | **The developpement of an interactif forest atlas using an open source webmapping solution, case study of the wilaya of Mascara (west of Algeria)**

(#1385)

F. Youcef[1], M. Khalladi[1,1], H. Mohamed Amine[1,1], A. Djamel[1,2]
[1]LRSBG, Mascara University, Algeria; [2]Department of Biology, saida, Algeria

A full-length version is available and can be opened here:

_extendedAbstract\413_proceeding.*

Geographic information is central to any process of sustainable management. It is today an increasingly important in terms of economic growth. To facilitate handling, a set of solutions have been proposed by the development of an inclusive technology called GIS. With the advent of computer networks and Internet, Web Mapping, or dissemination of cards via the Web is a growing field through the development of open source solutions. This paper presents the result of work conducted on the design and implementation of a Forest Atlas as a Web Mapping application based on open source solutions. Around the inevitable Geoserver, the work was carried out in two phases. The first phase was to understand how GIS and design an architecture for the application. The second phase resulted in the completion of the application in open source environments.

P3.65 | **Atlas of Quality of Life and Sustainable Development in the Region Cienega, the state of Jalisco, Mexico: premise for an operational approach to the concept of Quality of Life."** (#1440)

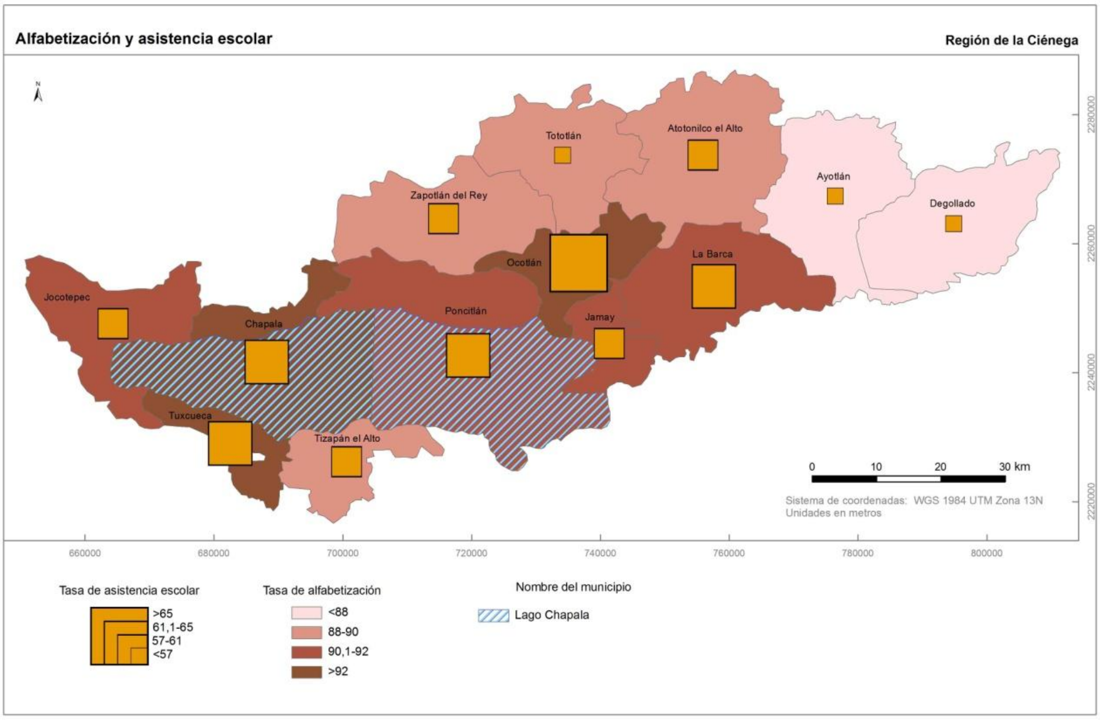
A. A. Domech González[1,2]

[1]Centro Universitario de la Ciénega, Universidad de Guadalajara, Departamento de de Estudios Económicos e Internacionales, Ocotlán, Mexico; [2]Instituto de Geografía Tropical, Vice dirección de Geomática, Ciudad de La Habana, Cuba

A full-length version is available and can be opened here:

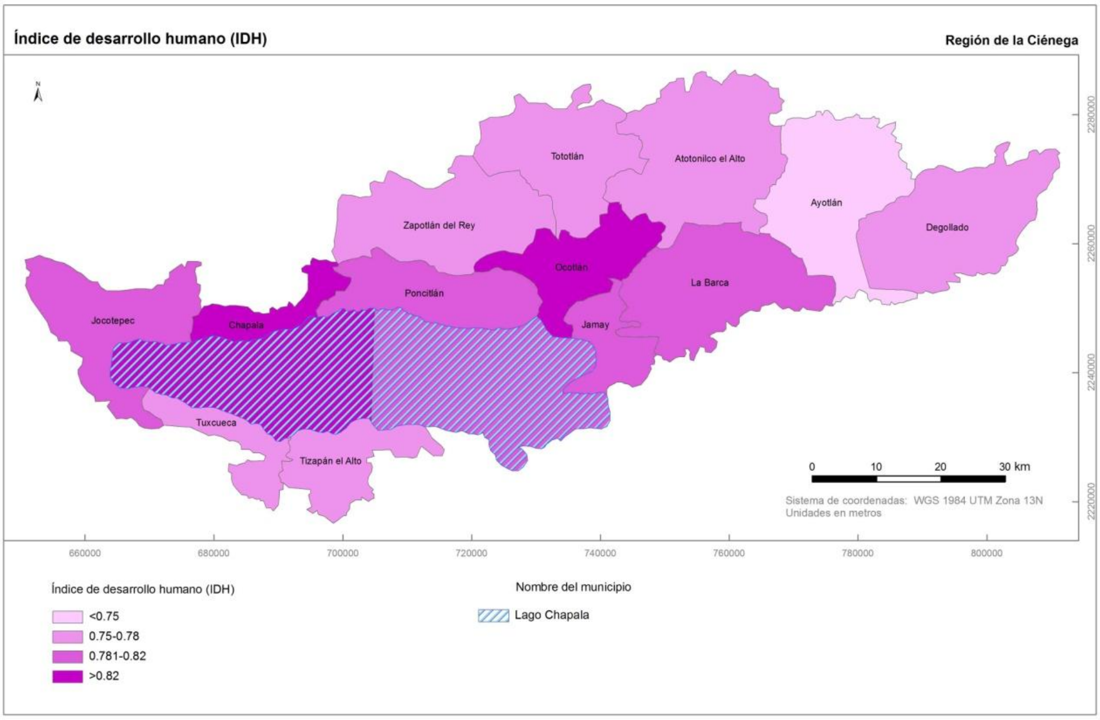
_extendedAbstract\434_proceeding.*

Title: **Atlas of Quality of Life and Sustainable Development in the Region Cienega, the state of Jalisco, Mexico: premise for an operational approach to the concept of Quality of Life."** ***Dr. Armando Antonio Domech Gonzalez, Guadalajara University, Jalisco, Mexico. Dr. Orlando Novúa Alvarez*** **RESUMEN: INTRODUCTION OBJECTIVES:** To develop a Geographic Atlas based on the concept of Quality of Life and Sustainable Development, in a region of the territory of Jalisco, Mexico. To analize the space distribution and the temporal indicators of the Quality of Life, of the inhabitants of the Cienega Region, as an indispensable element of the sustainable development of the region. **METHODOLOGY:** The proper methodology of the Thematic Cartography, the cartographic method of investigation and geographic analysis. The creation of a Geographic Atlas of special character that represents in cartographic manner, the temporal and spacial expression of the fundamental indicators of the Quality of Life in the region. This concept and its cartographic expression, is new and never applied to this moment to these studies in the country. **PRINCIPAL GEOGRAPHIC CONTRIBUTION**: The creation of a Geographic Atlas, stemming from a very new concept not yet applied for these studies in Mexico that will provide the implementation of means and public politics that would enhance the Quality of Life in the region. **KEY WORDS:** Geographic Atlas, Quality of Life, Cartographic Method of Investigation, Sustainable Development. **CONTENT:** During the decade of the 50's and at the start of the 60's, the growing interest to know the human wellbeing and the concern regarding the industrialization consequences upon the society, prompts the need to measure this reality thru the objective data available. Then, by means of the Social Sciences, a process is started to develop the social indicators and statistics that allow, to measure data and events connected to the social wellbeing of the people. These indicators had their own evolution that provided references of the initial objective conditions of social and economic type that later on provided elements of subjective type . From the institution of the General Development and Social Law in 2004, it was decreed that all mexicans should have the right to social development, education, adequate health, nutrition, dwelling, a healthy environment, employment, social security and no discrimination. According to the Cartographic Expression representing the following indicators: Current income per-capita, average educational level in the home, access to health services, access to social security, quality, spaces and basic services in the home, access to proper nutrition, a certain degree of social cohesion and other indicators, such as those related to poverty, social imbalance, and some other demographic indicators that would complement the basis for this investigation. Thematic Axis #9: Territorial Order and Sustainable Development. **Author: Armando Antonio Domech Gonzalez, Titular Professor "C" Full Time, International Economic Studies Department. Centro Universitario de la Cienega, Universidad de Guadalajara, Jalisco, Mexico. E-mail: adomech@hotmail.com. Celular: 3921049600**



Crecimiento Población:

Crecimiento de la población por municipio Región Ciénega



Indice Desarrollo Humano :

Indice de Desarrollo Humano a nivel municipal Región Ciénega

P3.66 | **Visualization of trends and tendencies based on a spatial analysis as a demonstrator for a Local Information System (LIS) based on a sample region** (#1506)

L. Zhao

TU München, Germany

Will follow.

P3.67 | **Smart Campus Map** (#1507)

S. Nikoohemat

TU München, Germany

Will follow.

P3.68 | **3D-modelling and visualization of archeological data - Investigation in Lost-Cost Methods for 3D Reconstruction** (#1508)

<u>P. Zhang</u>
TU München, Germany

Will follow.

P3.69 | **Web mapping and online analysis of lightning cell tracks** (#1509)

<u>M. Abusohyon</u>

TU München, Germany

Will follow.

P3.70 | **Users and Uses of OpenStreetMap** (#1510)

J. Behrens
TU Wien, Austria

Will follow.

P3.71 | **Modeling individual's familiarity of places using social media** (#1511)

W. Wang
TU Wien, Austria

Will follow.

P3.72 | **Persistent Physical Patterns of a Mountain Landscape – Detection and Map Representation** (#1512)

C. Vázquez Arias
TU-Dresden, Germany

Will follow.

P3.73 | **A web mapping application for operative fire & water services** (#1513)

M. Elfouly

TU-Dresden, Germany

Will follow.

P3.74 | **3D Mapping of Volumetric Changes of Selected East Alpine Glaciers**

(#1514)

<u>K. Zöphel</u>

TU-Dresden, Germany

Will follow.

P3.75 | **Cross-Media 3D Cartography of 'Europe at the Last Ice Age' Based on Initial Data Compilations** (#1515)

M. Jaunsproge
TU-Dresden, Germany

Will follow.

P3.76 | **A Comparison of Hybrid Autostereoscopic 3D Methods for Depicting High Relief Topography: Case Study - Dachstein, Austria** (#1516)

<u>J. Welter</u>

TU-Dresden, Germany

Will follow.

P3.77 | **Derivation of continuous zoomable road network maps through utilisation of Space-Scale-Cube** (#1517)

M. Aliakbarian

TU-Dresden, Germany

Will follow.

P3.78 | **Categorization and visualization of Twitter data** (#1518)

R. Nicola
TU-Dresden, Germany

Will follow.

ORAL

Session S13-A

Map Design 5

Thursday, 29 August, 2013

14:45 - 16:00

13A.1 | **TEXTURE MAPS – What they are; How to create them; Why and where you should use them.** (#603)

R. Smith

Managing Director, Geographx, Wellington, New Zealand

The paper is not written from an academic perspective but from that of a practising commercial cartographer. It is about raster images that display the surface detail of planet Earth in plan view. This definition includes orthorectified aerial photographs, satellite imagery, scanned paper maps, and maps designed specifically for digital display. However the paper focuses on a data type I will call "**Texture Maps**". **Texture Maps** are composite images created from pre-existing vector map data. They are not "maps" in the accepted sense as they feature no type labels, graticules, administrative boundaries or marginalia. They are simply pseudo-photorealistic interpretations of the earth's surface, with its landforms, landcover and associated topographic features. **Texture Maps** are designed to display landcover and surface detail in a way that can be intuitively understood by laypersons – without recourse to labels or legend. Feature types are selected and layered in a pre-determined hierarchal order. Each is coloured, pattened and styled to create the desired effect – a natural harmony when viewed as a whole, yet with clear definition and differentiation of the contributing individual elements. The additive process ensures that texture maps contain only the information intended, there is no extraneous clutter. **Texture maps** do not compete with remotely sensed data types, but they do complement them. They are cheaper, seamless, and free from clouds, specular reflectivity, shadow and tonal variation. **Texture Maps** are designed for use as plan 2D or 3D backdrops for added overlying thematic material or cartographic artwork. They can be used as contextual data layers for land information geoportals. They can be draped over terrain and visualised/explored in a 3D virtual environment, and they make publishable images in their own right. The paper explains what texture maps really are, how they are constructed, and how they can be best used. It explores their strengths and weaknesses compared to other types of raster "earth maps". It argues that because texture maps have the potential to communicate important contextual information at a subliminal level, they should be used more to help effectively communicate spatial information and relationships to a wider audience. The presentation will make frequent reference to two newly developed texture map datasets. The first is a texture map of New Zealand, developed by Geographx in 2012. This dataset maps landcover, relief and other topographical features at 4 metre pixel resolution. It pulls data from multiple pre-existing source datasets and includes up to 100 feature types. Processing is scripted and non-destructive, so the texture map can be easily maintained, updated, customised and improved. It replaces a less versatile, coarser, earlier version developed by Geographx some years ago. The second is a texture map of planet Earth (currently under development). The planned pixel resolution is 1.5 arcseconds. The process and workflow will be based on that already developed and will have similar attributes. Texture maps are not new nor championed only by Geographx. "Natural Earth" data is a global dataset in the public domain, developed and maintained by a collaboration of volunteer contributors. It is considerably coarser in resolution than the Geographx dataset now being developed, with raster images of 60 arcsecond resolution. *Author's Note Depending on time available for the presentation, I would propose to run sequentially:*

1. *an introductory presentation with slides.*
2. *a live Photoshop CS6 session to illustrate how the texture maps are structured and the workflow used to create them.*
3. *a live demonstration of the texture maps in a dynamic, interactive 3D virtual environment (SkylineGlobe)*

13A.2 | **Hot geospatial intelligence from a Cold War: the Soviet military mapping of towns and cities** (#659)

A. J. Kent[1], J. Davies[2]

[1]Canterbury Christ Church University, Geographical and Life Sciences, Great Britain; [2]Retired, London, Great Britain

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 248-253

As part of its secret military mapping programme the Soviet Union produced large-scale maps and plans of hundreds of towns and cities around the world. The end of the Cold War and the subsequent fall of com-munism saw the eventual closure or transformation of cartographic factories in the former Soviet republics and these highly detailed products of geospatial intelligence became available to a wider audience for the first time. This paper focuses on maps and plans of non-Soviet towns and cities that were produced from the 1940s to the 1990s. Through a comparison of their style and content with contemporary cartographic and documentary sources it aims to examine the key questions of how and why they were made, before exploring their possible strategic value.

13A.3 | **The International Bathymetric Chart of the Southern Ocean (IBCSO) – New ‘classic’ and lenticular Maps of Antarctica for Science and Outreach** (#1397)

J. E. Arndt[1], H. W. Schenke[1], M. Buchroithner[2], L. Radig[2], T. Schwenn[2]

[1]Alfred Wegener Institute, Geophysics, Bremerhaven, Germany; [2]Technische Universität Dresden, Institute for Cartography, Germany

The International Bathymetric Chart of the Southern Ocean (IBCSO) is a regional mapping project of the General Bathymetric Chart of the Ocean (GEBCO) operated under guidance of the UNESCO Intergovernmental Oceanographic Commission (IOC) and the International Hydrographic Organization (IHO). Moreover, IBCSO is established as an expert group of the Scientific Committee on Antarctic Research (SCAR) and its production is located at the Alfred Wegener Institute for Polar and Marine Research (AWI) in Bremerhaven, Germany. The objective of IBCSO was to create a first seamless Digital Bathymetric Model (DBM) covering the entire Southern Ocean. After the creation of the DBM two different maps have been produced based on the bathymetric model in collaboration with the Institute for Cartography of the TU Dresden. One version was designed to provide the scientific community with a new up to date ‘classic’ map of Antarctica. The second is envisaged to achieve largest possible outreach effect in the public by using the lenticular method. This method enables the beholder of the map to see the topography of the DBM in three dimensions without the necessity of auxiliary objects. The two different map versions of the IBCSO will be presented. The introduction includes a rough description of the working steps from ocean soundings to a combined digital bathymetric/topographic model. Furthermore, the steps to create the ‘classic’ and the lenticular map are described in detail.

13A.4 | **Integrating LiDAR data into the workflow of cartographic representation**

(#488)

T. Gloor
OCAD Inc., Baar, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\318_proceeding.*

In former days, the production of topographic maps required a lot of different data sources and the use of various (software-) applications. For instance, contour lines had to be derived by plotting them from aerial photos with a 3-D stereograph, water bodies, forest boundaries and man-made features were vectorized from rectified orthophotos, relief shading had to be created by hand in hundreds of hours . Finally, missing map objects had to be identified and captured in the terrain.   Since ten years ago, mapping, cadastral and land registration authorities are carrying out airborne laser scanning (LiDAR) to produce a Digital Elevation Model (DEM). It can replace different sources for cartographic representation. For instance, contour lines and relief shading can be derived directly out of DEM. Moreover, due to the high accuracy of the LiDAR data, its relief shading pictures allows identifying small ditches in the field, rock faces in slopes and even footpaths in forests, covered by trees. However, to create such data sets out of LiDAR data and vectorizing them for cartographic representations, various software applications are often needed. The result is reduced efficiency of map production and increasing costs. In order to optimize the whole workflow of cartographic representation and reduce its field work as much as possible, a DEM module has been integrated into the cartographic software OCAD. This allows almost unlimited use of LiDAR data and employs its specific cartographic drawing and editing tools at the same (see Fig 1).   Experience shows, integrating LiDAR data into the workflow of cartographic representation improves the accuracy of the map, reduces the amount of work in the field highly and results in more efficient map production.

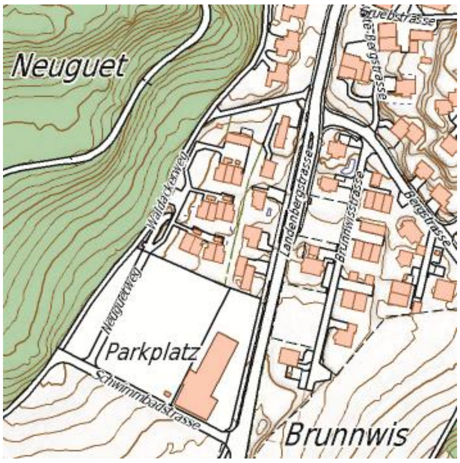


Fig. 1:
Final topographic map with the aid of LiDAR data

ORAL

Session S13-B

Usability 2

Thursday, 29 August, 2013

14:45 - 16:00

13B.1 | **Research into the Usability of the Space-Time Cube** (#1119)

I. Kveladze, M. - J. Kraak, C. van Elzakker
University of Twente, ITC, Enschede, Netherlands

A full-length version is available and can be opened here:

_extendedAbstract\1119_abstract.*

13B.2 | **Hands-on Maps: a Multi-touch Map Application in a Public Space** (#512)

M. Rönneberg, H. - M. Halkosaari, T. Sarjakoski, L. T. Sarjakoski
Finnish Geodetic Institute, Geoinformatics and Cartography, Masala, Finland

A full-length version of this contribution has been published in: KN (Kartographische Nachrichten), Vol. 63, Number 4 (Summer 2013), Pages 210-215

The paper presents a multi-touch map application and its usability evaluation. The multi-touch map application is one of the channels in a map-based, multi-channel service for hikers that is being developed as a part of an on-going research project. The map application on the multi-touch screen was exhibited in the centre of Helsinki, in Finland, for one week. During the exhibition, we observed the users and asked them to fill out a questionnaire. The findings revealed that most users grasped the idea of the multi-touch user interface rather quickly, but we also received suggestions to refine the application within regard to functionality and design. The maps were considered interesting and they grabbed the public‟s attention quite well; however, many people needed encouragement before they would touch the maps.

13B.3 | **Identifying Built-up Areas for 2011 Census Outputs** (#276)

J. Harding[1], B. South[2], M. Freeman[1], S. Zhou[1], A. Babington[1]

[1]*Ordnance Survey, Research, Southampton, Great Britain;* [2]*Office for National Statistics, Regional and Local Division, Titchfield, Great Britain*

A full-length version is available and can be opened here:

_extendedAbstract\163_proceeding.*

Introduction This paper discusses collaborative work between Ordnance Survey (GB), and a government consortium led by the UK Office for National Statistics (ONS), to produce a fit for purpose and cost effective urban areas dataset for use with 2011 census data. **Background** Census data referenced to urban areas in England and Wales have been produced every 10 years since 1981 by ONS. This provides detailed information on settlements of all sizes, from villages to cities, and allows comparison between urban and non-urban populations at local authority level. Uses of the data include statistical analysis and reporting, the development of policy, monitoring and planning by a wide range of users in public sector bodies, businesses and academia. Ordnance Survey captured urban area data for the 1981, 1991 and 2001 census by digitising urban extents from 1:10000 scale mapping in accordance with guidelines provided by government stakeholders (CLG 2001). Urban development since 2001 meant a revised dataset was needed for use with 2011 census data. **Motivations for developing a new way to produce urban areas data** Manual digitising was resource intensive and made the dataset expensive to produce. It was also subject to some spatial inconsistency in capture between digitising operators. Advances in data structures and analytical tools since 2001, offered the possibility to automate all or part of the process, creating data with improved efficiency, consistency and transparency. An important consideration was that 2011 statistical outputs should be compatible with previous urban area census data. Therefore, the approach for urban areas definition was to be based on capture guidelines used in 2001, though these were not sufficiently defined for an algorithmic interpretation. **Approaches investigated** A survey representing key public sector use contexts for urban areas data was carried out in order to provide wider context for evaluating technical options and addressing specification questions. Results highlighted the importance to users of factors including: spatial consistency of urban area definition; reliability and credibility of methodological approach; temporal consistency of dataset creation for analyses over time. Investigation of technical options included an automated algorithm creating urban area polygons from OS MasterMap® topographic polygons and an automated solution analysing land cover attribution and creating urban area polygons from grid based results. **Conclusions and Benefits** Taking into account results of the user survey, relative costs of the technical options and preliminary analysis of statistical impact, the preferred approach was for grid based automation of urban area polygon creation. Through working closely with users in the project group on iterative development of the dataset, a cost effective and fit for purpose solution was achieved. With the grid based process, an urban areas dataset could be produced for England and Wales in days rather than with months of manual digitising effort. It offers the additional benefits of spatial and temporal consistency in the automated application of its rules base, being easily repeatable and giving potential for more frequent updates. Each of these factors, together with the transparency of the data creation approach, meets key criteria identified in the user survey. **References** CLG (2001) Urban Settlements 2001 Data Methodology Guide. http://www.communities.gov.uk/documents/planningandbuilding/pdf/933242.pdf ONS (2010), Geography Policy for National Statistics, http://www.ons.gov.uk/ons/guide-method/geography/geographic-policy/index.html

13B.4 | **TESTING THE USER-DRIVEN WEB MAP INTERFACE** (#422)

A. Balciunas
Vilnius University, Centre of cartography, Lithuania

A full-length version is available and can be opened here:

_extendedAbstract\190_proceeding.*

Maps have become an integral part of Internet technologies. From social networks to complex web GIS applications, they are used by millions of different users which have different experience of using the maps. Today's users of web maps are no longer specialists, generally they are non-experts who are primarily interested not in quantity of applied functions but in good usability of most important functions for them. Unlike the initial stage of web maps development when in most cases only technological solutions resulted the quality, today usability becomes one of the most important indicator of the successful using and application of web maps. Usability is not the new topic in web maps creations and researches. Accordance with the guidance of user-centered design, which are described in ISO 9241 standard, and also by using different techniques of usability research, creation process of web maps are more and more oriented to the user's needs. But there are some disadvantages applying these methods and principles not for already deployed maps, i.e. in practice, but for the methodological purposes. In the first part of the paper author presents problematic related with the use of standard usability tests establishing the relationship between user experience and his expectation to user interface (UI) and functionality. Users have different skills of maps usage which are not congenital but more or less acquired from use of different web maps (like Google or Bing maps), them functionality etc. User accumulates knowledge of functionality usage and when he opens new web map window for the first time, naturally he tries to apply these knowledge. The successful use of new web map can be analyzed by applying standard usability tests, for example researcher can analyze actions of the user and measure success rate, or use questionnaires etc. However, in order to really determine the vision of user for the optimal interface and functionality, it is not enough just to identify the gaps between the tested object and user skills. We have to be able to determine not only what is wrong with the tested map, but how user actually imaging how this maps must work. For this reason, the author formed a new technique of web maps usability research called "Testing the user-driven web map interface", which is presented in second part of the paper. The essence of user-driven web map interface testing study is to give the user freedom to create his own web map interface for different geo-tasks to perform (from standard to complex task in web maps) and indetify how different users imaging how UI must look. Participants of the test in accordance with their own web maps using experience and knowledge interactively build web maps interface using speciallly designed testing web application. The main principles of used new usability reasearch technique is:

- Social survey of users to indentify how much time they spend using the Internet and web maps, etc.
- Applied opportunity for the users to decide what functionality it will be necessary for the requested maps (f.e. Web map for search of tourist objects) to create.
- Applied tools for the users to drag and drop the choosed functions anywhere in the web map layout, also to change interface theme and graphic elements (icons).
- Grouping of users-created maps according asked general social questions, and comparing with each other to identify a common UI design feature.

The reaseach results allows to determine:

- How user imagines optimal web map interface for the different tasks.
- How user applies his usability experience for the web map interface creation and identify possible sources of this experience.
- What is the relationship between the users experience and developed interface complexity, completeness.
- Is it allready formed the unified image of a UI or some of the UI elements for the users.
- Possibilities for individually adaptation of web maps UI for certain users groups for different purposes of map use.

ORAL

Session S13-C

User Needs in Map Reading

Thursday, 29 August, 2013

14:45 - 16:00

13C.1 | **Influence of Non-technological Aspect on the Map Information Perception** (#777)

A. Vondráková

Palacký University Olomouc, Department of Geoinformatics, Czech Republic

Map perception is influenced by many aspects. In addition to technological aspects such as the form of production – web, digital or analogue, there is a large influence of number of non-technological aspects to the map production. Among non-technological aspects of map creation and production there are generally considered aspects of economy, aesthetics, ethics, geoinformatics, history, legislation, politics, organization, methodology, psychology, sociology, visualization and other. Most of them can be also characterized as user aspects; some of them deal more with economy and map production. User aspects play very important role in the cartographic production, because they can significantly influence the map perception. The first research question was: How large measure of influence has the use of different cartographic methods on the information perception from a map by different groups of users? Tests with eye-tracking tools have shown that incorrectly chosen or incorrectly applied cartographic method can adversely affect the user's perception of information from a map. The users studied a series of maps completed by different cartographic methods from the same dataset while the accuracy and speed of their responses to questions were measured as the evaluation criterion. The results identify the cartographic methods that are suitable for the presentation of certain data (qualitative and quantitative) to the specific groups of users and for the defined purpose. Results of the study identify in the group of respondents a significant difference between the sub-groups of cartographers and non-cartographers in the term of answer accuracy and response time. At the same time statistical evaluation demonstrates that the selection of method of cartographic visualization has a crucial influence on the map information perception. Using appropriate visualization methods significantly reduces the time needed for users to obtain required information, and may affect the success of obtaining this information. The second research question was: are currently produced maps user-appropriate and accessible? Evaluation is based on extensive online questionnaire in combination with the results of eye-tracking experiments. The questionnaire investigation included mainly questions focused on economic aspects and evaluation of thematic orientation maps. The eye-tracking experiment was designed to evaluate whether users easily obtain the required information from the map. Non-technological aspects of map creation and user issues are very important especially in connection with the development of modern technologies. With easy access of geographic information systems and other graphic tools maps are created by specialists without cartographic education or even by lay public, which often results in the production of poor quality and user inappropriate maps. This should, however, be objectively identified and subsequently it is possible to draw conclusions and recommendations to create cartographically correct maps.

13C.3 | **Variation of geospatial thinking in answering geography questions based on topographic maps** (#476)

Y. Wakabayashi, Y. Matsui

Tokyo Metropolitan University, Department of Geography, Hachioji-shi, Japan

A full-length version is available and can be opened here:

_extendedAbstract\43_proceeding.*

Map reading is a fundamental skill for not only geography education but also geospatial thinking in everyday life. In particular, Japanese high schools use topographic maps as an important teaching aid for geography education. Thus, university entrance examinations frequently incorporate geography questions based on topographic maps. Although many studies have largely focused on the perception and cognition of limited elements of a map, such as contour lines and map symbols, few attempts have been made to understand higher-order cognitive processes of geospatial thinking. In particular, little is known about the variations in the map reading process and the factors affecting this process. This study aims to examine the variations and processes of geospatial thinking in answering geographic questions based on a variety of topographic maps and to reveal the factors affecting this process to explore the implications for geospatial thinking. This study analyzed geography test questions used in the university entrance examinations held by the National Center for University Entrance Examination of Japan. For the subsequent experiment and questionnaire, 7 questions about various types of topographic maps were selected, including the association of a contour map with a photograph, drainage estimation, judgment of landform classification, and comparison between old and new topographic maps. The aim was to find the students' pattern of answering these questions and to verify the factors affecting this pattern. The answers obtained from 118 undergraduate students were analyzed quantitatively with regard to the relationship between the performance on the test, experience of geography education, and spatial abilities. In addition, an experiment was conducted in which think aloud verbal protocols from ten subjects were collected to analyze the detailed process behind their answers. Factor analysis of the answers to the questions yielded three factors: Factor 1 was correlated with the questions of comparison between new and old maps; Factor 2 was closely related to the questions that require reading of contour lines; and Factor 3 was solely related to the question of land use change. Thus, the pattern of the answers to the questions can be classified into three types. The relationship between the types of the answers and the attributes of the respondents were examined by using rank correlation statistics. The results indicated that the effects of the experience of geography education and spatial abilities on the students' test performance varied with the types of questions. Although this highlights the difference between the knowledge and skills required to read topographic maps, the experience of geography education had a significant effect on the answers. Qualitative analysis of the verbal reports obtained from ten students also revealed that the cognitive process of reading topographic maps varied with the types of questions and maps. Specifically, a detailed analysis of the verbal protocols showed that these questions could be classified into the following three types with regard to the knowledge and skills required for the answers: the questions answered with basic spatial abilities (e.g., visualization), the ones demanding to relate geographic concepts with features on the map, and the ones requiring specification and inference of changes on the earth's surface. The results obtained imply that higher-order geospatial thinking based on topographic maps requires not only a bottom-up processing of information on the map but also a top-down processing that involves schemata containing geospatial knowledge structured based on one's prior experience or learning at school.

13C.4 | **Closing the "uncertainty chain": Enhancing trust by communicating uncertainty information with maps** (#555)

J. Schiewe[1], M. K. Schweer[2]

[1]HafenCity University Hamburg, Lab for Geoinformatics and Geovisualization, Germany; [2]University of Vechta, Chair for Pedagogical Psychology, Germany

A full-length version is available and can be opened here:

_extendedAbstract\120_proceeding.*

Motivation It is well known that various geometric, thematic or temporal uncertainties come along with spatial data and information. So far most of the previous work in the domains of GI Science and Cartography has concentrated on modeling and visualization of this type of information. For selective tasks it could already proved that the actual usage of uncertainty information (i.e., the existence of a closed "uncertainty chain") leads to qualitatively improved decisions with respect to economic, ecologic or other criteria; for instance, for the prediction of flooded areas and derived evacuation measures. On the other hand, so far the step of using cartographically communicated uncertainty information and its linkage to the previous processing steps has not been investigated very intensively. In this context, usability parameters play an important role. Going even further, disciplines like cognition psychology and human-computer-interaction also emphasize aspects of user experience which deals with those perceptions and reactions of persons that might occur prior or during the usage of a product. Of course, a positive user experience is strongly correlated with a good usability. But besides that there are also a couple of "soft" factors like aesthetics, emotionality, anticipation or trust. In this contribution, the central user experience factor "trust" will be picked out and investigated in a systematic and empirical manner. Trust is always necessary if there are any risks or uncertainties in a task or decision. With the existence and knowledge of uncertainties in the given spatial data, the very interesting – and so far not addressed – research question arises whether the visualization of uncertainty information really is a trust improving feature (which corresponds to our working hypothesis), or, alternatively, leads to a reduction in trust and – as a worst case scenario – to no further use of the respective map. **Methodology** Obviously, there will be no single answer to the raised research question. Firstly, there are several other map-based factors like source, up-to-dateness or design that might influence trust in maps. In order to describe this set of factors and to consider the following interplay, a general theoretical framework has been set up. This framework considers a dynamic and interactive paradigm and attaches the factors to the categories "map user", "context and purpose of usage", as well as to the "map" itself. In order to understand the importance and interplay of uncertainty and others factors we have already performed an empirical study in form of guideline based interviews. Secondly, the trust building process depends on the actual application scenario, that also includes the purpose or type of decision (e.g., the more critical a decision, the more trust is necessary) and the users (e.g., expert and non-expert users certainly have to be distinguished). Currently we are setting up selected application scenarios and design quantitative studies using a reasonable number of participants. **Results** First results of the above mentioned guideline based interviews show that generally the communication of uncertainties is seen as a meaningful operation, also by non-experts. On the other hand, there are only few examples in daily life so that hardly any experience exists with the usage of uncertainties. Consequently, there is hardly any evidence, neither about expectations of users, nor about an additional value of such a process. Finally, a systematization of the evaluation results about trust building through uncertainty visualization will lead to the recommendation and development of target group and application specific visualization formats. First experiences show that this might not always correspond to traditional cartographical rules. As a consequence, those rules have to be reflected in a critical manner in order to close the still existing gaps in the "uncertainty chain".

ORAL

Session S13-D

Ontologies and Standards in SDI

Thursday, 29 August, 2013

14:45 - 16:00

13D.1 | **Standards are the Bones of an SDI, but Where's the Beef?** (#352)

M. Brylski[1], A. Kmiecik[1], V. Smith[2], **B. Westcott**[2]

[1]*Intergraph Polska Sp.z.o.o., SG&I: Product development, Lodz, Poland;* [2]*Intergraph Corporation, SG&I: Product development, Madison, United States*

In recent decades, much progress has been made in the global interoperability of computing technologies and software application development from the vendor's point of view, due to growing adherence to formal and de facto standards. The purpose of any standard is to assure the users of standards-based computer solutions that they will find no surprises. Instead, they should experience full convergence between the expected, declared and actually displayed system's characteristics. Vendors comply with OGC® interoperability standards so that customers will have no surprises when using products featuring OGC interfaces with compliant products offered by other vendors. European data producers comply with ISO or INSPIRE specifications so that users of their data will have no surprises when it is exchanged, integrated, and used across the EU community. Ideally, we should all be able to bank on such interoperability, just as we presume that electrical current flows without our attention from wall sockets around the globe into our mobile devices, no matter what the country, no matter what brand the device. But users of standardized products, services, and data may be surprised to find that standards only provide the most essential elements of compatibility. Technical standards jargon may be bewildering to users, and they may be challenged to make implementation choices they had assumed the standard would take care of. In fact, standards may provide little more than a low common denominator across products, leaving much to the choices made by implementers. Returning to the electricity allegory: though we can obtain power from wall sockets all around the world, when moving between countries we often need to have power adapters to connect our mobile devices due to the sockets' diversity. The vendor's opportunity is to approach standards compliance from the user's point of view by understanding the important business workflows that the user wants to accomplish. How can we design products that allow users to complete their workflows reliably and easily, and so that adherence to important standards enhances those workflows and does not introduce technical hurdles? How can we help users accomplish what they REALLY need and want to do in a way that provides transparent standards compliance? Intergraph strives to answer these questions by offering solutions that go above and beyond the call of standards, and provide high-quality, value-added solutions. This presentation will provide an overview of Intergraph's product development methodology and the areas in which standards compliance guides the planning of user workflows. We will provide examples of creative functionality built into our solutions, and examples of how our solutions offer more than simple standards compliance, while insulating users from their technical complexities. **Marek Brylski** is Product Line Director for Geospatial Server products at Intergraph Corporation. **Alina Kmiecik** is Software System Architect at Intergraph Corporation, and is an INSPIRE TWG Expert. **Vince Smith** is GeoMedia Product Line Executive and **Bruce Westcott** is an Executive Consultant (Geospatial Metadata) and at SG&I Product Center at Intergraph Corporation. Intergraph was a founding member of OGC. Intergraph adopts OGC interoperability standards, as well as global ISO TC-211 geospatial norms and Europe's INSPIRE implementing rules in the solutions we offer in the SDI marketplace.

Connectors for Standards:
Standards provide just the first component needed to achieve interoperability

13D.2 | **Heterogeneous user requirements on GI standards – Implementation strategies in an Ethiopian perspective** (#1179)

A. Östman[1], M. Alemayehu[2], E. Teshome[2]
[1]*Swedesurvey AB, Gävle, Sweden;* [2]*PRIME CONSULTANTS Plc, Addis Ababa, Ethiopia*

A full-length version is available and can be opened here:

_extendedAbstract\97_proceeding.*

By tradition, national GI standards tend to be decided at a high level and implemented in a top-down approach. Such an approach has its advantages from a decision making point of view. However, experiences from several countries around the world also report severe problems in the implementation phase. Some of the problems are related to changing requirements. One such example is the metadata standards, where for instance regional governments in Sweden have faced five different metadata standards during the last 10 years. Other problems are related to the limited amount of testing of the standards. The specifications developed by the OGC as well as the INSPIRE implementation are exceptions to this, although neither are actually developing formal standards. As a consequence, the benefits the standards are expected to provide may be difficult or costly to realize in practice. A third problem is caused by the heterogeneity of user environments, where the standards are to be implemented. In many African countries, the GI maturity varies a lot between different authorities and organizations, even within the same country. Specifying GI standards that are meaningful for such diversity of organizations is a challenge. Swedesurvey has, in cooperation with their partner Prime Consultant Inc, specified an implementation strategy for GI standards in Ethiopia. The scope of the standard and guidelines being specified relates to metadata, database, spatial data, web services and GIS business strategies. The initial user survey showed clearly the heterogeneity within the potential target group, with respect to GI maturity, SDI readiness and level of IT maturity. Being well aware of experiences from other countries, a strategy for implementing GI standards was outlined, which address the problems of limited testing of standards as well as the heterogeneity within the user community. The key factor to consider when specifying this strategy was the benefits for user having various levels of GI maturity. The problem of different levels of maturity within the target group is a problem that is less recognized. Within IT industry there are however several different stack-based approaches for gradually complying with increasing complexity of requirements. One such model is the 5-star model of Tim Berners-Lee. Other successful stack-oriented models are the web service stack model of the World Wide Web Consortium (W3C) and the ISO/OSI model for data communication. The stack-based model being developed also has the advantage of being directly linked to benefits. In practice it means that less mature organizations can focus on making their data digital while more mature organizations can focus on sharing their information according to standardized XML/GML schemas. All this is achieved within one single model of standards. As a consequence, this also allows each individual organization to grow in maturity in their own speed. In recent years, the question of linked data and RDF structures has become a part of the standardization discussions. Linked data may be seen as one way of achieving organizational interoperability. The upper levels of the 5-star model deal with linked data and associated standards such as RDF. As a consequence, the proposed strategy for the implementation of GI standards in Ethiopia is also scalable to such level of complexity. A study was also conducted in order to understand the level of GIS knowledge and application in the participating institutions. A Capacity Maturity Model (CMM) was applied to categorize them into five classes, each one addressing a certain standard compliance level. But for the time being, the focus is, as well as in other places such as Europe, on the lower levels and on having sustainable standards, agreements and institutional frameworks for data sharing.

13D.3 | **WTF (What Type of Feature)? Classifying Features for Advanced Data Linking, Searching and Analysis Capabilities** (#625)

L. Kostanski[1], P. - G. Zaccheddu[2], L. Merrin[3], R. Atkinson[3]

[1]Commonwealth Scientific and Industrial Research Organisation, Mathematics, Informatics and Statistics, Clayton, Australia; [2]German Federal Agency for Cartography and Geodesy, -, Germany; [3]Commonwealth Scientific and Industrial Research Organisation, Land and Water, Canberra, Australia

A full-length version is available and can be opened here:

_extendedAbstract\421_proceeding.*

Most data about human and natural processes is geographically referenced, usually by some form of identifier such as a town name, administrative area code, address etc. Interpreting these references is the key to integrating and comparing information to support decisions made by a range of government and non-government organisations. The authors contend that understanding the context, or source, of such references is necessary to reliably interpret them, often to distinguish between similarly named but distinctly different ones. For example, a local government area, a suburb name, a tourist destination and a political electorate may have the same name but different semantics and boundaries. Large points of interest databases used for online mapping tools may include many objects with similar names. To understand and disambiguate the identifiers, it is necessary to specify what type of feature is being referred to.   Research into the domains of linked data and the semantic web indicates that reliable, disambiguated geospatial information is fundamentally important to providing clear and consistent understanding of the relationships between many forms of data, including documents, geospatial data and ‘big data’ interpreted through spatial statistics. Linked data mechanisms for geospatial information, such as that proposed by the CSIRO Spatial Identifier Reference Framework (SIRF), specifies that in the process of integrating data from heterogeneous systems, different feature type classifications increase the complexity of any interpretation or searching process. This leads to a range of issues around ambiguity implied by the use of multiple languages, specific domains of use for Spatial Identifier Reference Datasets (SIRDs) and how finely feature types are differentiated within complex geospatial systems.   One challenge in interpreting identifiers is the localised, domain-relevant or culturally-specific feature type designations used to classify features in each source dataset. The other challenge is locating the source datasets for the features of interest. We define the concept of SIRDs as indexes which list names or codes (such as asset numbers or postcodes) of geographic locations representing a wide range of physical or administrative feature types. Feature type catalogues associated with SIRDs are intended to provide users with tools for clarifying the information associated with data instances. Feature type definitions are also often necessary to formulate queries to select relevant features from these datasets.   Methods for integrating heterogeneous feature type catalogues are being published on an increasingly frequent basis. This paper analyses feature type catalogue integration/linking examples proposed by semantic web and ontology researchers. The aim of the authors is to shift the current research paradigm from matching across and between pre-defined catalogues- to a more user-centric method of mapping fine-, mid-, and high-level feature type classifications to broad-definitions defined by end-users.   Examples are provided from Australian, Indonesian, European and International datasetss and their associated feature type catalogues. Reference is made to existing systems and programs including the SIRF project for Social Protection in Indonesia, EuroGeoNames, INSPIRE, LinkedGeoData, Open Street Map and the Alexandria Digital Library. The intention is to outline existing issues in the feature typing domain, particularly as they relate to linked data and systems of systems (SoS) interoperability programs for SDIs, and propose a new comprehensive methodology for linking geospatial data in a way which facilitates improved access and analysis for end-users.

13D.4 | **A formal ontology for historical maps** (#1287)

E. Gkadolou[1], E. Stefanakis[1,2]

[1]Harokopio University of Athens, Department of Geography, Greece; [2]Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada

A full-length version is available and can be opened here:

_extendedAbstract\182_proceeding.*

ORAL

Session S13-E

Applied Issues in Mountain Cartography

Thursday, 29 August, 2013

14:45 - 16:00

13E.1 | **Utilizing a Mobile Smartphone Application in a Mountainous Environment** (#1156)

K. Kriz, B. Hajek

University of Vienna, Department of Geography and Regional Research, Austria

The use of mobile devices with navigational facilities is nowadays becoming ubiquitous in daily life. Practically all high-end smartphones have access to applications that possess map-based functionalities for spatial guidance. The question however arises whether the hardware on the one side and the software as well as the cartographic content on the other side are in combination appropriate for serious use in an outdoor mountainous environment. Utilizing an application is straight forward and results are easily reproducible in a clearly defined secure environment. However if the same procedure is carried out under serious conditions, such as in a snow covered mountainous environment with low temperatures, limited visibility, high humidity and gale force winds the outcome can be very ambiguous. This contribution deals with the theoretical as well as practical approach taken into consideration during the design process of a map-based mobile smartphone application for use in mountainous areas. In order to illustrate the proof of concept a prototype was developed and tested in field. At first the basic components that were required will be described and evaluated from a cartographic perspective. Thereafter the system design will be introduced with a strong emphasis on graphic design issues. In order to efficiently design a mountain compliant mobile smartphone application it is primarily important to understand the user's needs. Therefore results from a user evaluation will round up the contribution.

13E.2 | **Designing Interactive Environment for Examination of 3D Maps for a Mountain Map Study** (#1317)

M. Domajnko, M. Kosmatin Fras, D. Petrovič
University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia

A full-length version is available and can be opened here:

_extendedAbstract\313_proceeding.*

The ability to navigate through virtual space is one of the most important features of mountain 3D maps. The map should not be static to permit the correct perception of the topographic data and the user should at least have an option to select a viewpoint and a zoom extent. The trend of today's 3D geovisualizations is to employ the latest computer technology to create very realistic representations of the real world. Such representations are no longer applicable only for specialists, since in the last few years realistic representations of the world around us have been widely used by the general public - Google Earth, Bing Maps Bird's-eye views, and the upcoming Apple 3D Maps. The number of such tools is increasing, since the modern remote sensing technology (satellite imagery, laser scanning, stereo photography) enables quick and easy creation of realistic mapping applications. These visualization tools provide natural looking representations that are easy to understand also for non-experienced users, therefore they are very suitable for various purposes such as landscape planning, archaeological reconstruction and architectural construction, but also for general "discovering" of the Earth's surface. The cartographic science argues that abstract 3D geovisualizations are more convenient for clear, understandable cartographic communication for the majority of map uses. In this study different design issues regarding photo-realistic and abstract geovisualizations are considered and used in the creation of 3D geovisualizations. The focus of this paper is primarily on the design issues and the creation of mountain 3D maps and further creation of interactive environment for user study on 3D maps. The goal was to gather the latest cartographic findings on the design of 3D maps and use it for creating the various cartographic 3D models of Pohorje highlands near the city of Maribor and area of city of Prague and surroundings. All cartographic models were visualized in the similar manner and assembled in the interactive application, which enables cartographic experts the direct evaluation of different 3D cartographic representations. Questionnaire used in map study will be presented and explained as well.

13E.3 | **The Application and Effects of Sky Models on Hill Shading** (#833)

P. Kennelly[1], J. Stewart[2]

[1]LIU Post, Earth and Environmental Science, Brookville, United States; [2]Queens University, School of Computing, Kingston, Canada

A full-length version is available and can be opened here:

_extendedAbstract\336_proceeding.*

Sky models adopted by the International Commission on Illumination (CIE) define the radiance associated with all sectors of a hemisphere representing the sky dome and are used for illuminating three-dimensional objects and surfaces. Although commonly used in architectural “daylighting” studies and computer graphical renderings, cartographers more often utilize a simple point source illumination model. We present an application and methodology for hill shading terrain with various sky models. The desktop application efficiently samples sectors of various sky models and returns a number of points in the sky representing discrete illumination vectors. It also provides weights associated with the luminance of each sky sector to be used to illuminate the terrain. Sets of approximately 250 tuples (illumination vector azimuth and inclination, along with a weight) can be used to smoothly shade and softly shadow terrain. We also look at the salient qualities of the resulting terrain maps. We classify sky models into directional and non-directional categories, with the latter having rotational symmetry with respect to the sky’s zenith. Directional illumination models include the sharp, clear day, and general sky models. Like point source illumination, all of these are effective for obliquely illuminating terrain when the sectors of most intense radiance are positioned in the northwestern sky. In addition, sky models are able to reveal details of terrain not apparent with point source illumination. Non-directional models include the overcast and uniform sky models. Due to their sky symmetry, both result in shadings similar to slope shading. Important differences exist, however, between slope shading and hill shading with non-directional sky models. While slope shading has been summarized as “the steeper the darker”, shading from overcast and uniform sky, and to a lesser extent clear and general sky, is better summarized as “the less of the sky visible the darker”. This effect is especially apparent in an incised terrain such as a canyon. Although many factors are at play in determining how much of the sky hemisphere is visible, models with radiance distributed throughout the sky result in hill shading in which elevation values correlate to shades of gray in different manners than the shades of gray associated with point source illumination.

13E.4 | **The Application and Effects of Sky Models on Hill Shading** (#833)

H. Künkel[1], M. Buchroithner[2]

[1]*Third Pole, Hospitalstr. 7, 37073 Göttingen, Germany;* [2]*TU Dresden, Institute of Cartography, Dresden, Germany*

The recently opened field of geomorphological route and track research in the Central Himalayas for the first time focused on glacier routes which are the highest traditionally used and seasonally strongly frequented tracks in the world (KÜNKEL 2013).
The combination of expeditive glacial-geomorphological field research and the analysis of multi-temporal remote sensing data (Aster, SRTM and TanDEM-X) made it possible to compare both, glacier and track changes.
It can be shown that frequent track adaptions are necessarily, strongly determined by climate-change induced glacier variations, i.e. surface shrinking, crevasses, supra- and pro-glacial lakes. Of the same importance are hazardous geomorphological side-effects such as: undercutting of side-moraine walls and increasing rockfall, which does not seem to be predominantly caused by melting permafrost but due to lacking ice abutments of the decreased glacier tongues.

The comparison of numerous existing maps and photos taken from expeditions from the early 1950s until today as well as multi-temporal satellite imagery show enormous changes of the tracks themselves and the use and existence of track companions such as camps and shepherd dwellings. Here, most up-to-date ultra-high resolution satellite imagery is of unbeatable value. Even publicly available data can in many instances well serve the cartographers' purpose. On snowfree glacial surfaces, however, trails are mostly hard to identify, a fact which still justifies field verification. Reagarding the relief changes of the glaciers proper and of the glacier forefields the German TanDEM-X interferometric SAR mission is going to offer a quantum-leap in resolution and accuracy which shall well satisfy the cartographers' needs for the updating at medium map-scales.

A route which was tracked during October-November 2011 fieldwork for the new edition of the ARGE Schneider Map Khumbu Himal 1:50.000 is already not up-to-date anymore at the date of its publishing. Under the recent conditions of extremely quick glacier retreats it is simply not possible to produce a map that is totally up-to-date at the time of publication.
It is a dangerous attempt for cartographers to put glacier routes in the maps of high mountain areas today as the glaciers will surely have been changed by the date of publication. Therefore it is important to mark that glacier routes are no defined linear tracks and only recommended for mountaineers with experience in glacial environments. Even locals do often not know the latest conditions.

REFERENCES:
ARGE (2013): Schneider Map Khumbu Himal, 1:50.000 Hrsg.: Arbeitsgemeinschaft für vergleichende Hochgebirgsforschung, München
KÜNKEL, H. (2013): Geomorphologische Wegeuntersuchung und Typologisierung im zentralen Himalaja. Dissertation, Univ. Göttingen. 2Bd., 235 S.

ORAL

Session S13-F

Historical Maps

Thursday, 29 August, 2013

14:45 - 16:00

13F.1 | **KARTEN VON ATTIKA : A MAJOR GERMAN CONTRIBUTION TO GREEK CARTOGRAPHIC HERITAGE AND ITS DIGITAL APPROACH.** (#908)

E. Livieratos[1], C. Boutoura[2], A. Koussoulakou[2], N. Ploutoglou[3], M. Pazarli[3], A. Tsorlini[4,2]

[1]Aristotle University of Thessaloniki, Geodesy and Surveying, Greece; [2]Aristotle University of Thessaloniki, Cadastre, Photogrammetry and Cartography, Greece; [3]National Map Library, Thessaloniki, Greece; [4]ETH Zurich, Institute of Cartography and Geoinformation, Department of Civil, Environmental and Geomatic Engineering, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\423_proceeding.*

A critical period within the history of Cartography is the 19th century, where the establishment of national states is interrelated with the developments in national mapping, which, in turn, are boosted by the scientific and technical dynamism of that period. Within this context, an interesting cartographic “interplay” is taking place between Greece and Germany, during the second half of the 19th century, a prominent work of which is the so called archaeological mapping of Athens, Attica and their surroundings, by H. Curtious and J.A. Kaupert (1862-1897), in cooperation with the German Archaeological Institute. The work, entitled “Karten von Attika”, consisted of 32 map sheets in scale 1:25000 (and four in scale 1:12500), accompanied with 10 map sheets in scale 1:100000, derived by photomechanical reduction. The maps are basically topographic, but they also include a vast amount of other information such as: geophysical, settlements, roads, ports, quarries, forests, as well as archeological information in an impressive degree of detail. The value of this work has been properly acknowledged in literature: it is recognized as a cartographic project of high quality, regarding its technical specifications such as , for instance the distribution of map sheets (neatlines and numbering), the legends etc; its compilation of archaeological and historical information, in particular, is characterized as unprecedented, even until our days. Additionally, it has to be considered that: a)since this 19th century project there hasn't been any other systematic cartographic work in Greece - and consequently in Attica- at this very important scale of 1:25000. b) the area depicted has changed dynamically and dramatically during the last century, especially from the landuse point of view. Nevertheless, there is hardly any digital approach, concerning the treatment, elaboration and evaluation of the maps' geometric infrastructure and content. In our work we attempt to establish a framework for the digital approach, concerning a number of major topics of interest emerging from this monumental cartographic work. More specifically:

1. It is recognized that the accuracy of the cartographic product is remarkable considering its time and scale. In our work we try to demonstrate this in a quantitative way, by proper georeferencing of the map-sheets and their display in a common digital environment with metric quality, for better overview and further processing of their contents.
2. Natural elements such as the relief, depicted with both isarithms and shading, can be optimally compared to its current counterpart using a modern map. Furthermore, other important features are considered, such as forests and vegetation, which is of particular significance for the environment of the area, excessively changed during the last century due to urbanization procedures.
3. The monitoring of this changing in landuse is also a matter of study, using other cartographic and photographic material for the extraction of useful results.
4. Finally, the archaeological information -extremely important for this part of the world- and the way it is depicted on the maps constitutes a real model example, which is hardly found in any other similar map of the area, even until our days. Consequently, this rich information can still be used on modern thematic maps and digital representations for giving valuable overviews of the archaeological heritage in a quite detailed manner, provided through the many types of historical and archeological data of the maps. Attica is a significant area, a central part of the world's cultural heritage and the model way it has been mapped by the German Archaeological Institute, J.A. Kaupert and H. Curtius has been an object of study for many years in different scientific projects in a traditional way; it is now under digital analysis and evaluation, as outlined in our work, giving the possibility of new historical, educational and technical approaches.

13F.2 | Digital Archiving and On-line Publishing of Old Relief Models (#954)

M. Gede, J. Mészáros

Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 293

Relief models are peculiar type of cartographic products. These models are usually hand-made or produced in small number of copies, so their digital archiving is very important. There are special tools for this task, but these equipments are rather expensive, and libraries or other institutes that usually own these models cannot spend too much.
The authors examined various on-line tools to create digital 3D representation of relief models using a set of photographs as source. These tools create point cloud and textured triangle mesh based on matching patterns on the photos. A workflow was developed which uses these web services and produces. This paper introduces the method, discusses the details of successful photographing, the possible post-processing of the results. A new web site, using the X3DOM technology to show the digitized models to the general public, is also introduced.

13F.3 | **Unveiling historical maps - the interdisciplinary Atlas of Geopolitical Imaginaries of East Central Europe** (#1191)

E. Losang
Leibniz Institute for Regional Geography, Geovisualisation, Leipzig, Germany

A full-length version is available and can be opened here:

_extendedAbstract\326_proceeding.*

The *Digital Atlas of Geopolitical Imaginaries of East Central Europe in the 20th Century*, DAPRO - an acronym of the German title (Digitaler Atlas politischer Raumbilder zu Ostmitteleuropa im 20. Jahrhundert) - is a pioneering interdisciplinary project that makes historical maps accessible for research on history and spatial (geo)imaginaries. The chosen research area, East Central Europe, is a region that during the 20th century experienced numerous border changes, and that has historically been shaped by closely entwined ethnic and religious communities. East Central Europe was also located at the fault line of conflicting ideologies with enormous spatial impact after the Second World War. Inspired by the ongoing spatial turn in the humanities and reflecting the concept of critical cartography (Harley 1989) which links geographic knowledge and cartographic dissemination with power and politics, the DAPRO will combine methods from different scientific disciplines to uncover production environments, processes of as well as representations and patterns on maps. In addition to taking a critical cartography perspective, our analysis will reconstruct the mapping processes with respect to the map production environment, the "mapping languages" used and the cartographic methods applied. In this context, DAPRO represents a virtual research environment introducing tools for analysis and visualization, while providing a framework to collaboratively analyse historical maps in different research contexts. DAPRO will also function as a learning management system for initial teacher training/education in historical and political sciences and a reference resource that covers map and mapping-related topics for the humanities. With respect to the diversity of the media to be analysed such as atlases, newspapers, textbooks and even map-like visual representations and their terms of origin and usage, the atlas will not only present a descriptive analysis of maps but also consider the history behind the map production and use, with reference to sources of different provenances. Thus the design process of the maps will be unveiled and can be reproduced in order to provide a distinction between purpose, production, use, perception and utilisation for every map and to identify patterns of geographic information realisation. In this context a cartographic analysis framework is implemented reflecting the modes of use of different mapping elements such as projections, scale and generalisation in the cartographic design process. In addition, the use of graphic variables is thoroughly examined by comparing the theoretic foundations of graphic variables with their implementation (deconstructing by reconstructing). This allows the identification of types and patterns of cartographic manipulation found in a sample of maps and their application to the content of the atlas. The identified patterns will be further examined by employing controlled experimentation within a framework of cognitive science methodologies. The paper will present an outline of the DAPRO atlas project and will focus on the map-related analytic process using both "   examples of analytic maps explaining visual modes of expression or subtle interdependencies and " systematically assembled sets of geographical imaginaries identified during the project research.
Harley, J. B. (1989) Deconstructing the Map. Cartographica 26(2): 1-20.

13F.4 | **Comparative analysis of historical maps from Canton of Zurich - Switzerland in an interactive online platform** (#327)

A. Tsorlini, I. Iosifescu, L. Hurni

ETH Zurich, Institute of Cartography and Geoinformation, Department of Civil, Environmental and Geomatic Engineering, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\147_proceeding.*

Historical maps are a very important part of the World's cultural heritage, offering an image of our past, giving the ability to see the changes taken place in an area over time. For cartographers and scientists dealing with the geographic analysis of the environment, the study and the digital comparison of historical and modern maps offer a variety of benefits and advantages, since it gives them the opportunity to use maps, showing changes in the environment or in the administrative boundaries of an area or in the names of its toponyms. The digital comparison of maps, historical or modern, is a very important procedure for researchers, easily and more effectively done taking advantage of modern digital computational and visualization technologies profusely available nowadays. A system helping in this direction is the GeoVITe (Geodata Visualization and Interactive Training Environment) developed the last few years by the Institute of Cartography and Geoinformation, ETH Zurich, having as main goal to provide a clear and intuitive overview of available products with on-demand data processing and download possibilities over the internet for ETH staff and students. The inclusion of historical maps in a system like GeoVITe which offers a great amount of modern geodata, gives the opportunity to have historical data comparable to modern maps in the system. In this project, we study comparatively, five of the most representative historical maps of the Swiss cartography from 17th to 20th cent. focusing on the Canton of Zurich, in comparison also with modern maps. These historical maps are H. C. Gyger's *Karte des Canton Zürich* (1660), J. R. Meyer's and H. Weiss' *Atlas Suisse* (1796-1802), J. Wild's *Topographische Karte des Kantons Zürich* (1852-1865), the *Topographische Karte der Schweiz* established by the Federal Topographic Bureau under General G.-H. Dufour (1845-1864) and the *Topographischer Atlas der Schweiz* by the same service under Colonel H. Siegfried (1870-1926). Apart from them, we use also modern data, such as the Swiss National Map Series (1938-) and the digital mosaic satellite image by the French satellite Spot 5 (2004-2005). In order to study the maps, a specific procedure is followed so as to have all the maps projected to the same system and thus, comparable to each other. The main steps of this process are (1) the scanning of each historical map, (2) its georeferencing to its projection system -if it is possible- in order to bring it to its physical dimensions, eliminating possible geometric deformations induced by digitizing and (3) the best fitting of the "georeferenced" map to the modern's map reference system taking local deformations into consideration. The final stage of the whole procedure is to load the correctly rectified historical maps to the spatial database of GeoVITe system, to manage them by a GIS using visualizing, geocoding and geoprocessing services and to offer them online in a web server through an interface easily accessible and understandable by researchers interested in the comparative analysis of historical maps. This will give researchers the opportunity to study and compare maps using different techniques, such as reordering them, blending them through transparency or highlighting visually the differences between them. These techniques can benefit researchers also from different scientific areas, since in this way they can have access to geodata easily downloaded in a proper form to be used directly in their study. A next step of this research will go beyond the comparative analysis of historical maps and will focus on the automatic regression of the raster historical maps to vector form. This procedure gives the opportunity to detect and determine more easily differences in an area but it is a challenge to be done, since historical maps are difficult to be vectorized, mainly due to their design (multicolored, with shaded relief), their low graphical quality and the amount of data depicted on them.

ORAL

Session S13-G

Mixed Session

Thursday, 29 August, 2013

14:45 - 16:00

13G.1 | **Mapping Of Candidate Russian Landing Sites On The Moon** (#1148)

A. Kokhanov[1], I. Karachevtseva[1], A. Zubarev[1], J. Oberst[2,3]

[1]*Moscow State University aof Geodesy and Cartography, MIIGAIK Extraterrestrial laboratory (MExLab), Russia;* [2]*German Aerospace Center (DLR), Berlin, Germany;* [3]*Technische Universität Berlin, Institut für Geodäsie und Geoinformationstechnik, Germany*

We present results of our work on cartographical support of future Russian lunar missions “Luna-Glob” and “Luna Resource” which is currently carried out in the MExLab. **Introduction** “Roscosmos” is preparing two landing missions to the lunar south pole (Zeleniy L, 2012). The spacecraft are to provide global mapping of lunar surface and study their landing sites. We assume landing in the southern subpolar area of the lunar nearside, where several landing sites have been proposed, marked as ellipses *(Fig. 1)*. The goals of our work are to analyze these sites and to prepare special thematic maps. **Maps Hypsometric Maps** For characterization of the surface we prepared several maps. The hypsometric map *(Fig. 1)* gives an overview of the territory that was studied. For good representation of the landscape on this map color shaded relief was used. The chosen color spectrum of the height scale emphasizes details of the mapped objects. The large craters were labeled with respect to the USGS nomenclature. For the mapping the Global Lunar DTM (GLD-100) (Scholten et. al. 2012) was used. The potential landing sites were mapped in more detailed scales. On the detailed hypsometrical maps we used the same color spectrum, as for the previous map. On these maps we drew labeled contours with contour intervals of 50 m. **Map Of Slopes** To assess the safety of landing, we evaluated slopes values. Slopes were calculated with baselines of 60 m. On the map *(Fig. 2)* areas with slopes up to 7 degrees were highlighted in green color as the safest for landing. The color scales of the slope values is combined with a hill-shaded map. This map shows the global trend and area distribution of landforms. For mapping the LOLA DEM was used *(Smith D. 2001)*. **Crater Catalog And Maps Of Crater Densities** For the morphometrical surface characterisation all craters with diameters larger than 20 m within the target ellipses were identified on LRO NAC images *(Robinson et al., 2010)* and were added to a catalog *(Karachevtseva, 2012).* On the base of these data maps of craters density were created. These maps together with maps of roughness *(Kokhanov et. al., 2012)* will help to detect the smoothest area, safe for landing. **Future Work** The next step of work is to carry out the mapping using a high-resolution DEM, created from LRO NAC images *(Zubarev et.al, 2012)* and *to* classify detected craters by morphological type. This work will be continued in collaborations with ESA *(D. DeRosa, 2012)*. **Acknowledgements** Work has been supported by a grant from the Ministry of Education and Science of the Russian Federation (Agreements № 11.G34.31.0021 dd. 30/11/2010) and partly supported by a grant № 14.B37.21.1204 «Development of an integrated technology of determination the relief statistical characteristics of the of the planets and moons in the solar system based on DEM derived photogrammetric methods». **References** De Rosa, et al. (2012), Characterisation of potential landing sites for the European Space Agency’s Lunar Lander project. Planetary and Space Science Karachevtseva I.P. (2012) Cartography Support of the Luna-Globe Landing Sites ESA Scientific Preparations for Lunar Exploration The Netherlands, Noordwijk, 6-7 February Kokhanov et. al. (2012) Cartography Support and Assessment of Candidate Landing Sites for the Luna-Glob Mission. 43rd Lunar Planetary Science Conference 19-23 March, Woodlands. Robinson et al. (2010), Lunar Reconnaissance Orbiter Camera (LROC) Instrument Overview Space Science Reviews, 150: 81–124 Smith, D. E. et al, 2001, J. Geophys. Res., 106 (E10), 23689-23722. Scholten, et al. (2012), GLD100: The near-global lunar 100 m raster DTM from LROC WAC stereo image data, J. Geophys. Res., vol. 117, 12 pp. Zeleniy L (2012) The Russian Lunar Program: Goals And Missions. The Third Moscow Solar System Symposium 8-12 october, Moscow Zubarev A. E. et. al. (2012), Lunokhod-1 Panoramic Images and Stereo Topography. European Planetary Science Congress 23-28 Septemper, Madrid

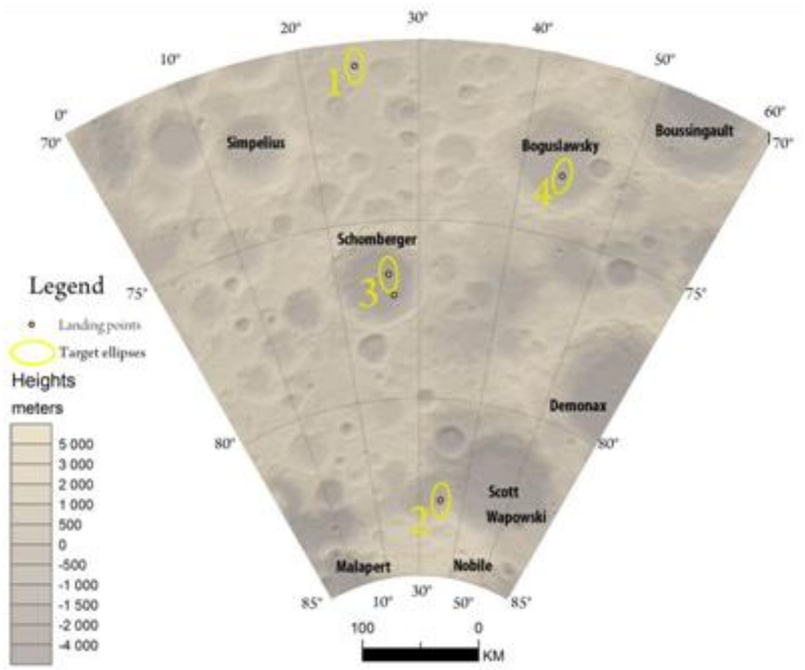


Figure 1:
Hypsometric map of southern subpolar area

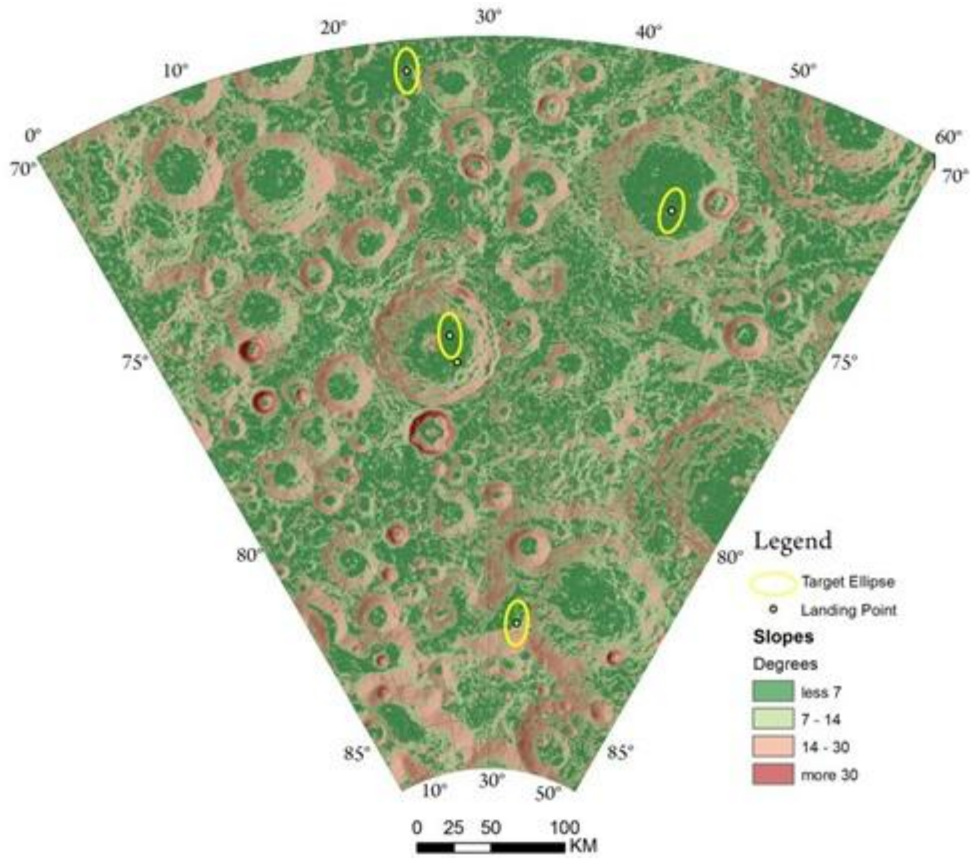


Figure 2:
Map of slopes.

13G.2 | **Municipal School Atlas of Ourinhos/SP: a way from abstract to concrete; from uncertainty to reality** (#762)

A. A. Zacharias, C. C. R. G. D. Sena, E. D. F. F. D. Silva, T. J. Martins, A. P. M. Milena
Universidade Estadual Paulista - UNESP/Campus de Ourinhos, Geografia, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\306_proceeding.*

This article presents the results so far obtained in the project *"The elaboration of the Municipal School Atlas of Ourinhos and the Formation of Tutor Teachers: proposals for the study of the locality"*, linked to the Group of Research on Geotechnology and Cartography –GEOCART and developed by Unesp/ Campus of Ourinhos/SP. It reports the experience of a seven-year work in the production of a paradidatic material which enables the study of the place through a Municipal School Atlas following four interdisciplinary cuts - ***Geographical, Historical, Ambiental and Cartographical*** - the project is unprecedented, as it brings a new proposal of Municipal School Atlas composed by four versions with languages which are different from each other – the **Analogue** version *(analogue language)*, the **Digital and Interactive** version *(digital language),* the **Video Imagetic** version *(audiovisual language)* and the **Tactile** version *(tactile language)* – directed to students from the 5th to 9th grades of Fundamental Education, converging to the study of the space, lived, perceived and conceived by the students – the municipality. The perspective of the use of different languages in the study of the place from the Municipal School Atlas aims to both dynamize Geography teaching and also provide subsides so that the activities – mediated by the teacher – can instigate reflection and the formation of critical students, able to read the World (SILVA, 2012, p. 9). Under these conceptions, the *analogue language* explains the more traditional communication, once this information is systematized on paper. Thus, the human sight is easily trained to read, interpret and understand it. The *digital language* is more recent. It is part of a binary representation, handled through the use of computers. Currently, associated to the new information and communication technologies, this new media allows dynamic and interactive graphic representations and maps with multimedia effects; while the *audiovisual* language is based on the concrete, the immediate, represented and codified by different scenes and images. It explores the sense of sight through spatial relations (near-far, high-low, right-left, big-small, balance - unbalance). The plans and cuts imprint rhythm to the image, associating time, spaces, characters and the narrative itself. Lastly, the *tactile language* itself represents a paradigm shift. Both in the act of teaching by the teacher/educator and in the act of learning by the students with special needs, considering that "[...] integrating an individual is not only about his/her physical insertion in a regular school, but to provide him/her with conditions to participate actively in the school activities" (Venturini; Freitas, 2002). In this case, undoubtedly, the school can and shall provide the necessary subsidies to allow the visually impaired students to explore the environment in which they live, develop the pertainment relations to this place and broaden their reading of the world. Thus, a different proposal of Municipal School Atlas, composed by four versions using different languages for the study of the place is very enriching to the educational process, as the understanding of the symbology of the codified messages and the specificities of each language is a necessary effort in the comprehension of the phenomena in which one is inserted. In Geography teaching, there are several ways to represent and understand the spatial dynamics from the static maps of centuries ago to the contemporary daily strips in newspapers. Therefore, the spatial thinking is fundamental to Geography teaching and can be instigated by different languages – in addition to the cartographic one, which is classical in Geography.

13G.3 | **Low Cost Road Condition Data Capture System for Sustainable Road Maintenance in Uganda** (#1426)

G. Bax[1], L. Mazzi Kayondo – Ndandiko[2], S. Tickodri-Togboa[2]

[1]Blekinge Institute of Technology, Planning and Media Design, Karlshamn, Sweden; [2]Makerere University, CEDAT, Kampala, Uganda

A full-length version is available and can be opened here:

_extendedAbstract\1426_abstract.*

13G.4 | **Empowering Brazilian Unprivileged Communities with High Geotechnological Tools** (#1244)

P. Lustosa Brito[1], D. Nadier Cavalcanti Reis[1], R. Lustosa Brito[2], I. Silva de Jesus[3]

[1]Universidade Federal da Bahia, Escola Politécnica, Salvador, Brazil; [2]Universidade Federal da Bahia, Escola de Medicina Veterinária, Salvador, Brazil; [3]Universidade Federal da Bahia, Instituto de Geociências, Salvador, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\316_proceeding.*

ORAL

Session S13-H

Sister Cities

Thursday, 29 August, 2013

14:45 - 16:00

13H.1 | **Cartographic use of geodata within the Geo Data Infrastructure Dresden (GDI-DD)** (#1489)

M. Dora

Dresden City Administration, City Surveyor's Office, City Surveyor's Office, Germany

In 2005 the Dresden City Surveyor's Office and the Dresden Environmental Office established a framework of geodatabases with uniform metadata and shared tools. This so called „Geo Data Infrastructure Dresden“ (GDI-DD) offers a data repository to use spatial information in an efficient and flexible way within the City of Dresden. Meanwhile many departments and private companies use that infrastructure intensely and more important directly create or update their spatial data back to it. The Dresden City Surveyor's Office acts as service provider, e.g. keeps running the framework, administrates the data access, facilitates software components and provides the basic geospatial data. Setting up a geodata infrastructure like the GDI-DD offers new great technical ways of creating, modelling, presenting and sharing cartographic products. New maps can be produced in a short time, nearly every topic can easily combined into one map and no limits exists in accessing and visualizing spatial information. Besides the benefits there are also challenges in the daily cartographic work while using digital geodata within such a infrastructure. How can traditional cartographic rules persist against the new technological possibilities? How to handle the unprecedented wide variety of cartographic products within the City Administration? What to do with co-workers of other departments who transform increasingly into map makers? In reference to new evolved cartographic guidlines this talk attempts to give answers. By comparing old and new production processes of traditional cartographic products of the Dresden City Surveyor's Office the talk gives an insight into enhanced work flows due to the GDI-DD. Furthermore, strategies to avoid cartographic mistakes of co-workers as well as great examples of modern spatial visualizations, e.g. the Dresden 3D City Model or the Dresden Thematic City Map will be presented.

13H.2 | **Columbus** (#1490)

H. Moellering, O. Ahlqvist
Ohio State University, Columbus, United States

No abstract or full paper available.

13H.3 | **Hamburg** (#1491)

E. Matthias
Landesbetrieb Geoinformation Hamburg, Germany

No abstract or full paper available.

Session S13-I

Business Meeting of the Commission on the History of Cartography

Thursday, 29 August, 2013

14:45 - 16:00

ORAL

Session S14-A

Geospatial Analytics 2

Thursday, 29 August, 2013

16:30 - 17:45

14A.1 | **Identification of Peak Type Based on DEM** (#45)

D. Zhang, Y. Zhang, L. Huang, Y. Zhou
Xi'an Research Institute of Surveying and Mapping, China

A full-length version is available and can be opened here:

_extendedAbstract\7_proceeding.*

14A.2 | **Strabo: A Complete System for Label Recognition in Maps** (#68)

Y. - Y. Chiang[1,2]

[1]*University of Southern California, Information Sciences Institute, Marina del Rey, United States;*
[2]*University of Southern California, Spatial Sciences Institute, Los Angeles, United States*

Cartographers have been creating maps for hundreds of years. Recent advances in technologies make it possible to scan large volumes of these maps in high quality and store the scans in digital achieves. These digital scans is a great source for geographic information that can be integrated (from different map editions) and used to create thematic maps or new map series, compare different map series, and update current map series. However, manually extracting and comparing labels in raster maps is tedious and impractical for processing large volumes of maps because of the large numbers of labels in maps. For example, a typical 1:20,000 maritime chart covering a harbor can have more than 100,000 sounding labels. In addition, due to the complex map contents and various graphical qualities, previous work on automatic or semi-automatic text recognition in raster maps very often solves only a subset of the recognition problem and does not provide an operational software package. This paper presents a complete solution called Strabo for label recognition in raster maps. Strabo is a complete software package built on our previous map processing techniques that exploit the fact that maps use highly consistent rules for topographic surveys and for labeling geographic features to efficiently and robustly recognize labels in raster maps. We show that Strabo employs an easy-to-use user training step and a comprehensive strategy that includes optical character recognition and post-label-editing in a geographic information system to ensure the best results while requires only minimal user intervention. We are in the process of publishing Strabo as an open-source software package.

14A.3 | **Budapest 3D underground map** (#1339)

K. Zsoldi
Eötvös Loránd University, Cartography and Geoinformatic, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\378_proceeding.*

ORAL

Session S14-B

Web Applications

Thursday, 29 August, 2013

16:30 - 17:45

14B.1 | **Prosumers and Webmapping-Applications in Web 2.0** (#943)

K. Hoffmann

University of Osnabrück, Institute for Geoinformatics and Remote Sensing, Germany

A full-length version is available and can be opened here:

_extendedAbstract\282_proceeding.*

Internet users collect and publish an increasing amount of spatio-temporal data and create and distribute their own maps in the so called Web 2.0. Without expert knowledge users can create quite easily their own maps with the aid of programming interfaces (APIs) or with ready to use Webmapping applications in a web browser. According to the term Web 2.0 this kind of map making can be called Webmapping 2.0. Maps can be created by the users in a personalized or collaborative way. Now map users also become map producers and can be called prosumers (producers + consumers). New challenges for cartography and changes in cartographic practice and theory occur. The “new” group of prosumers affects the whole process of cartographic communication from data acquisition, map production until map use. Cartographers provide their knowledge in the form of components (e.g. tools and base maps). Prosumers choose from these elements, combine them in their own manner and design their own maps driven by their interests and needs. The increasing importance of prosumers and user generated maps require detailed analyses of the user requirements and the tools to create maps in the web. Developments for applications in the web are often technology-driven without the consideration of the users. The huge amount of prosumers who create and share a lot of data and maps voluntarily in their free time has great potential. The aim is to better support the prosumers so that they can create more accurate, readable and useful maps. In a case study the users of the Webmapping application StepMap (www.stepmap.de) were analysed by an online survey and were asked for example about their motivations and requirements. With this Webmapping application prosumers can generate maps directly in the web browser with the aid of a graphical user interface and different base maps. The survey proved that male users with a university degree represent the majority of the prosumers of this application. Intrinsic motivations dominate like creating individual maps, fun and map fascination. The themes represented in the maps are mainly related to the subjects travelling, country or regional overview maps and private POIs. Many users like that StepMap is easy to use and for free. Furthermore the application was tested by students regarding their usability and user experience. The usability was evaluated as quite good but some differences occurred between students of Geography and of Geoinformatics. Students of Geoinformatics are more internet savvy and are able use the application more intuitively than the geography students. Otherwise the geographers rate the support possibilities of the application and the functional overviews higher than the students of Geoinformatics. This shows that StepMap is very easy to use and is especially designed for people without any knowledge in cartography and Webmapping. People with some knowledge who already worked with a GIS or mapping software will probably miss some features and try to find them for example with a help dictionary which doesn’t exist. Regarding the user experience StepMap was rated mainly as an activity-oriented application. The application is very easy and intuitively to use but more suitable for amateurs than for experts who are used to more complex tools and applications and who need more design possibilities and features. In this contribution the results of the online survey and the tests with the students will be presented. Conclusions will be drawn how to better support the prosumers in their map creation and how a Webmapping application for prosumers should be designed. The prosumers need applications for a fast, user-friendly and intuitive map creation. A comprehensive concept will be proposed where the prosumers will be guided through a dialogue-oriented step-by-step process so that only relevant features and contents will be offered to them.

14B.2 | **Customizable Map Content and 3D Visualization in the Online Platform GeoVITe** (#332)

C. Iosifescu, I. Iosifescu, L. Hurni
Institute of Cartography and Geoinformation, ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\145_proceeding.*

The project "Geodata Visualization and Interactive Training Environment" (GeoVITe) aims to offer an easy-to-use online access to the most important geodatasets provided by the Federal Office of Topography swisstopo to the ETH Domain. The platform is available for the download of geodata since 2010 and as a GIS Platform for Interdisciplinary Environmental Research since 2011. In this latter form it is being used by researchers of the SwissExperiment/OSPER project working in the environmental domain and therefore many of our requirements for new tools and functionalities, such as 3D on-demand, customizable map content and visualization, are coming from their side. One can visualize and add layers from the available geodata with any free or commercial GIS software and there are also desktop modalities to create dynamical 3D maps. The challenge is to do this online, in the browser, without the need to install specific software on the client-computer. In this paper we will describe our approach to customizable map content and 2D and 3D visualizations for the GeoVITe online platform. We will also describe the technical background and our experiences in developing these functionalities for the platform, so that they can be used and applied to Web-based cartographic products in general, beyond the specifics of the GeoVITe framework. We begin by highlighting the new implemented functionality that allows users to choose all the geodata they need and combine these layers online on the platform. A user custom map may contain for example a vector layer such as buildings, a thematic map such as the geological atlas, a digital elevation model and the airborne orthorectified imagery. One is able to control the opacity of each layer and the visualization order. Moreover, the user has now the possibility to query the features from a layer on their attributes. Another novel functionality on GeoVITe is to visualize the geodata on demand in 3D. In order to cover different user interests, we implemented in our platform two ways of 3D visualization. The first one is to view the current map extent in 3D, scale-dependent, directly in the browser, using the WebGL technology. Intended for users who prefer to download the original data on their computers, we implemented a second 3D visualization option: to download the geodata in 3D. This feature employs a special visualization tool, based on the Terrain Bender software, which is provided in a Java Web Start package. The terrain data is in both cases automatically chosen from the available digital elevation/ surface models, as a function of the scale of the extent. Data visualization in 2D presented as well some challenges, namely in the degree of visualization customization and the integration of different data into the system. It is required to have no restriction in the type of datasets that may be visualized in the GeoVITe/SwissExperiment platform, as long as they have a spatial component. We made it possible to integrate WMS services from foreign servers and data suppliers and even sensor data from dynamically updating databases and sensor midlewares such as Global Sensor Network (GSN). For the latter case, we implemented a tool, by means of the Styled Layer Descriptor, that allows users to customize the visualization according to their wishes. Moreover, for rapidly changing data, like the wind direction, we built an automatic refresh function, which reads the new data (e.g. angle) from the database and changes the visualization accordingly. We conclude with a brief presentation of our experience in providing, developing and updating, and finally maintaining a useful online service for an expert community. We are hence granting certain flexibility by taking user suggestions into account and therefore facilitating communication between different research areas and allowing each researcher to focus on his/hers area of expertise.

14B.3 | **Geo-tagged Twitter collection and visualization system** (#1304)

H. Fujita

The University of Tokyo, Center for Spatial Information Science, Kashiwa, Japan

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 183-191

Mobile social media is generating valuable data for analyzing human behaviors and events in the real world. In this research, we developed a distributed system for collecting geotagged data from Twitter. The proposed method can collect several times as much amount of data as common methods. We also developed a spatiotemporal visualization tool for them. We conduct data collection and visualization experiment around central Tokyo, and showed that the collected data reflected many events in the real world.

14B.4 | **Designing a Web Service to Geo-Locate Subjects of Volunteered, Textual Geographic Information** (#183)

R. Mullins[1], F. Hardisty[1], S. Pezanowski[1], S. Das[2], A. Savelyev[1], A. MacEachren[1], P. Mitra[3], A. Jaiswal[4]

[1]The Pennsylvania State University, Department of Geography, University Park, United States; [2]The Pennsylvania State University, Department of Computer Science and Engineering, University Park, United States; [3]The Pennsylvania State University, College of Information Science and Technology, University Park, United States; [4]Reunify, LLC., Record Linkage Research, Santa Monica, United States

In recent years, the amount of publicly available spatial, or spatially-enable, data has grown tremendously, due in large part to the proliferation of GPS-enabled technologies in mobile devices and in-car navigation systems, and from the location information integrated into web applications, especially social networking services. Networks like Twitter, Four-Square, Facebook, and others allow users to provide insights into current events in real time via short form textual updates or statuses. Parallel to the availability of this type of citizen-produced data, there has been a growing interest in analyzing this data to examine sentiment or track how information disperses through networks. Many modern social networks provide a means to locate the contributor of status updates. The location of a contributor is typically given as geographic coordinates, latitude and longitude, that is accurate to the position provided by the web-enabled device used to submit the status update. This spatial information, along with the temporal information inherent to status updates, enables spatial and temporal analysis of contributor patterns. However, although some updates include information on the location of a contributor, little capacity is provided for geographically locating the subject, or subjects, that contributors are referencing. In this paper we describe a web service, in development at the Pennsylvania State University, that enables the geolocation of people, places, and events described in common status updates from online social networks. We describe the use of techniques from a wide array of research areas – applied linguistics, natural language processing, search engine optimization, and geographic information science – to parse out people, places, and events explicitly or implicitly mentioned in status updates, and then analyze and contextualize these entities to locate them in geographic space. Finally, we outline how this service can be integrated into the development of dynamic, map-based, visual analytical interfaces, specifically in the context of crisis management and emergency response.

ORAL

Session S14-C

Data Enrichment

Thursday, 29 August, 2013

16:30 - 17:45

14C.1 | **Urban building usage labeling by geometric and context analyses of the footprint data** (#526)

H. Huang, B. Kieler, M. Sester
Leibniz University Hannover, Institute of Cartography and Geoinformatics, Germany

A full-length version is available and can be opened here:

_extendedAbstract\271_proceeding.*

We present an automatic building type (usage) labeling based on the footprint data. The usage information of buildings is of great interest for many applications, e.g., navigation, city planning, emergency management. This attribute, however, is generally not be provided by data sources like OpenStreetMap (OSM). Even in the official cadastral maps, building usages are not always available and may be defined in inconsistent way. An approach to enhance OSM data is presented by Werder et al. (2010), in which a classification of spatial data solely based on geometric and topologic characteristics is proposed. Lüscher et al. (2009) presents a classification of buildings also based on topographic vector data by means of an ontology-driven approach. In this work, we classify the usage of individual buildings based exclusively on the geometric and topologic features of the given footprint data. A simple category is defined with four types of usages: (1) residential: single and multiple family houses, apartment buildings; (2) commercial: office buildings, supermarkets, malls; (3) industrial: factory buildings, warehouses and (4) public: museums, memorials, hospitals, stadia, universities/schools, etc. A novel inference framework is proposed, using new high-level (synthetic) geometrical characteristics for individual buildings and the Markov Random Field (MRF) model to incorporate local contextual constraints. Besides the low-level attributes, i.e., the footprint area and the length/width ratio, two synthetic measures are presented: (1) the "effective width", which is simply the average width along the extracted skeleton of the building footprint and (2) the "branching degree", which scores the number and distribution of the "branches" of the skeleton. These two measures are directly relevant to the usage of building as the "effective width" implies the general living/movement space inside the building while the "branching degree" indicates the structural complexity. The context relationship is evaluated in two aspects: the "type consistency" and the "logical neighborhood". The latter reflects reasonable city planning for adjacent areas, e.g., residential buildings are more likely be found near public building instead of industrial zone. MRF models are widely used in image processing and computer vision (Li, 2009) for the labeling/segmentation of the image pixels or sub-regions. In this work, each individual building is represented as a vertex in the graph model and the edges between vertices present the neighborhood relationship. The above mentioned local characteristics are integrated as the unary potential of the individual vertices while the neighborhood inferences are encoded into the binary values. Dealing with the data for dense urban area, the established MRF is thereby highly connected. Gibbs sampler and the Maximum a Posteriori criterion are introduced to solve the high-dimensional optimization task unsupervised with only generic prior information. Experiments are performed on different data-sets of urban areas including that from official cadastral maps and the OpenStreetMap project. The results are evaluated with the available ground truth data and/or that from manual labeling. The introduced framework is easily extendable and adaptable: new attributes/measures can be added into both the unary and binary terms to improve the labeling performance and the user can select certain attribute(s) corresponding to their own definition of building usages. Li, S. Z. (2009): Markov Random Field Modeling in Image Analysis. Springer. Lüscher, P., Weibel, R., Burghardt, D. (2009): Integrating ontological modelling and Bayesian inference for pattern classification in topographic vector data. Computers, Environment and Urban Systems, 33(5), pp. 363-374. Werder, S., Kieler, B. and Sester, M. (2010): Semi-Automatic Interpretation of Buildings and Settlement Areas in User-Generated Spatial Data, ACM-GIS'10, pp. 330-339.

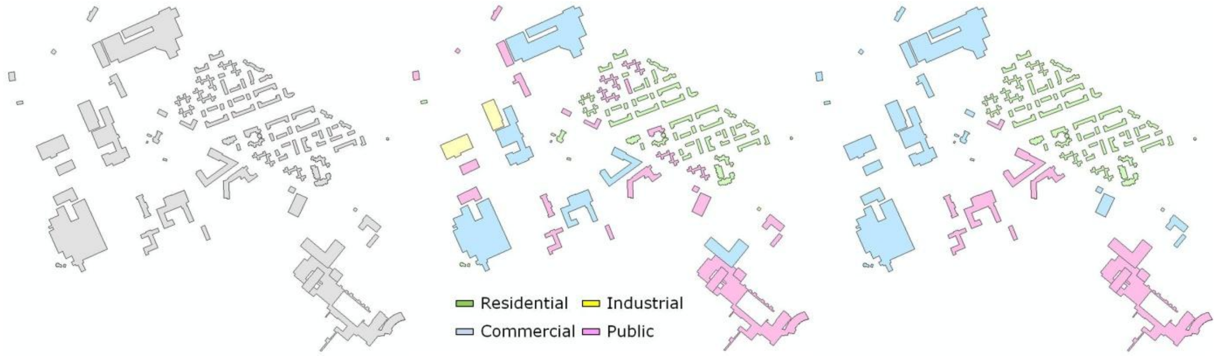


Figure 1:
Building usage labeling with MRF: input OSM data (left), labeling results with only local attributes (middle) and with both unary and binary potential (right)

14C.3 | **Multi-Scale Data Organization and Management of 3D Moving Objects Based on GIS** (#59)

X. Shenghua
Chinese Academy of Surveying and Mapping, Research center of Government GIS, beijing, China

A full-length version is available and can be opened here:

_extendedAbstract\42_proceeding.*

14C.4 | **Grammar Supported Indoor Mapping** (#1424)

M. Peter, S. Becker, **D. Fritsch**

University Stuttgart, Institute for Photogrammetry, Germany

A full-length version is available and can be opened here:

_extendedAbstract\283_proceeding.*

With outdoor mapping being facilitated by generally available GNSS sensors and therefore revolutionized by volunteered geographic information services like OpenStreetMap, the scientific community shows increased interest in problems concerning indoor positioning and navigation. Even more than in outdoor scenarios, accurate indoor maps are needed not only for routing but also for methods of map-matching. Hence, we present an approach for the automatic derivation of indoor maps using photographed evacuation plans, their enhancement using foot-mounted MEMS IMU positioning and first experiences of their procedural prediction using a grammar for building interiors. We will show, that the automatic interpretation of a single photograph of an evacuation plan (compulsory for every publicly used building) allows for the reconstruction of a coarse indoor model, suitable for a number of applications like positioning support and navigation. This interpretation consists of specialized image processing steps for pre-processing, binarization, color-based symbol detection and symbol bridging. Furthermore, an automatic geo-referencing step is carried out by matching the indoor model to a corresponding external building shell (e.g. from OpenStreetMap), and a 2D as well as a 2.5D model is reconstructed. Additionally, these photographed evacuation plans may provide the user with his position relative to the reconstructed model and an approximate value for his orientation, two values necessary as initial values for navigation approaches delivering only relative coordinates (like e.g. in the case of dead reckoning by means of foot-mounted IMUs). Using the tracks acquired by such a positioning approach, the coarse models derived from the photographed plan may be further enhanced. Here, we propose the automatic derivation of door openings as wall impacts in angles around 90 degrees and the semantic annotation (room number, persons, usage) of rooms by an automatic interpretation of photographed door plates. Due to e.g. binarization errors, the resulting indoor maps can be erroneous or incomplete. In order to make our mapping approach robust and independent from the quality of the input data, we enrich the data driven algorithm by individually derived object knowledge. Architectural objects in general, and in particular interiors are subject to numerous geometric and topological conditions: inner walls are often either rectangular or parallel to outer walls; the width and height of rooms, corridors and doors is not arbitrary but instead related to functional issues; rooms can be adjacent but not overlapping etc. Following these conditions, the construction of interiors can be traced back to basic architectural principles and, thus, is appropriate to be described in a formal, rule-based way. A powerful means to facilitate this is using formal grammars. We will present first developments of a formal rule-based description for interiors. Based on concepts of the grammar for façade reconstruction, which has already been developed at the Institute for Photogrammetry, we designed a hierarchical graph-based approach which is able to model interiors in different levels of detail: It starts with the partition of the whole inner space into floors, followed by the partition of each floor into rooms, and it ends with the formal description of each room as a sequence of wall segments. While the general syntax of the grammar is predefined, individual instances of the grammar are automatically derived from the previously determined 2D or 2.5D indoor maps. Dominant or repetitive features and regularities as well as their topological relationship are extracted and automatically transferred into rules. Doing so, each processed evacuation plan finally results in a specialized rule system which contains detailed knowledge about the construction of the building's interior. This knowledge can be used in various aspects: The rules can be applied to verify and complete parts of the indoor model which are erroneous or fragmentary. Furthermore, based on the assumption that the floors of a building have similar layouts, a grammar derived for one floor of the building can be used to generate hypotheses about the layouts of the other floors. Such grammar-based predictions have the potential to support not only indoor mapping but also indoor positioning.

ORAL

Session S14-D

Generalisation 4

Thursday, 29 August, 2013

16:30 - 17:45

14D.1 | **Towards Cartographic Constraint Formalization for Quality Evaluation**

(#826)

X. Zhang[1], T. Ai[1], J. Stoter[2]

[1]School of Resource and Environmental Science, Wuhan University, Cartography and Geoinformatics, China; [2]OTB, Delft University of Technology, Section GIS Technology, Netherlands

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 089-102

This paper presents a first-order representation to formalize cartographic constraints for automated quality evaluation of multi-scale data. Formalizing constraints for cartographic applications is a challenging task. It requires precise definition of entities, spatial and semantic relationships for individuals, groups and classes of objects, and their (intra-/interscale) relationships. Also constraints defining the visual presentation of the same entities can be different depending on the scale and context. This paper categorizes and formalizes different types of information needed for the quality evaluation, based on which cartographic constraints are formalized. The formalism is demonstrated by applying it to group features such as networks and alignments, and finally to constraints of different levels of complexity. We show the potential of the proposed formalism and discuss possibilities for further development.

14D.2 | **Topologically Safe Curved Schematization** (#1052)

A. van Goethem[1], W. Meulemans[1], A. Reimer[2], H. Haverkort[1], B. Speckmann[1]
[1]TU Eindhoven, Netherlands; [2]University of Heidelberg, Germany

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 276

Traditionally schematized maps make extensive use of curves. However, automated methods for schematization are mostly restricted to straight lines. We present a generic framework for topology-preserving curved schematization that allows a choice of quality measures and curve types. Our fully-automated approach does not need critical points or salient features. We illustrate our framework with Bézier curves and circular arcs; the resulting schematizations are of high visual quality.

14D.3 | **New method of creation data for natural objects in MRDB based on new simplification algorithm** (#1262)

K. Kozioł, S. Szombara
AGH University of Science and Technology, Department of Geomatics, Kraków, Poland

A full-length version is available and can be opened here:

_extendedAbstract\348_proceeding.*

14D.4 | **Measuring locations of critical points along cartographic lines with eye movements** (#532)

T. Bargiota, V. Mitropoulos, V. Krassanakis, B. Nakos

National Technical University of Athens, Rural and Surveying Engineering, Zographos, Greece

A full-length version is available and can be opened here:

_extendedAbstract\244_proceeding.*

In a study on visual perception, Attneave (1954) states that during the observation of an object, the human brain receives a great number of stimuli. These stimuli transfer a similarly great amount of information. However, only a small part of this information is essential for the recognition of the object as a specific-individual entity. Attneave points out that the information concentrated along the contours of an object and especially at points of high slope changes is distinctive and suffices in order to describe its shape. The human brain, acting in a number of ways (some of which are conscious and some not) selects and stores the stimuli found in these distinctive points. As line generalization is a process during which cartographer retains only the relevant points so as to configure the derivative line, Attneave's principles became a research topic in cartography. In cartographic literature, these distinctive points are called 'critical points.' Marino (1979) underlines the existence and impact of critical points in an empirical study. In the process, she presented six lines, representing natural phenomena to a group of subjects and asked them to select a set of points they considered as sufficient to retain the character of the line. According to her findings, there was a close agreement between the points subjects selected. In addition, the selected points were detected at locations of high slope change. In digital cartography, many researchers also underline the importance of critical points in line generalization. Among others, Thapa (1988) proposes a critical points' detection algorithm based on the use of zero-crossings. Thapa assesses this algorithm in a theoretical test line, specifically a geometrical model comprised by the representative samples of shapes that line can exhibit. Finally, Nakos and Mitropoulos (2005) also introduce a method for detecting critical points (called LR index), based on geometric principles. Applying it on Marino's and Thapa's lines and comparing the results with the two above mentioned studies' results, they tested the method's credibility. Further, in order to aesthetically assess the LR index, it was applied on the Peristera Island coastline. This paper assesses an experiment performed in order to examine if the observation of cartographic lines is similarly related to locations distinguished by critical points. The measurement of subjects' performance is based on eye movement analysis. The application of eye tracking methodology provides the opportunity to inspect the human gaze. The regions of observed visual scenes where subjects fixate, are revealed through different visualizations, such as fixations' locations and heatmaps. For the performance of the referred experiment, the observed visual scenes compose of three lines studied in Marino's research, Thapa's theoretical line and the coastline of Peristera Island. Subjects are asked to scan these cartographic lines for a predefined duration. The results from eye movement analysis are tested in locations distinguished by critical points indicated on these studies. The results of the study reveal the existence of strong relation between fixation point areas and critical points locations. REFERENCES Attneave F., 1954, "Some Informational Aspects of Visual Perception". Psychological Review, 61(3): 183-193. Marino J.S., 1979, "Identification of Characteristic Points Along Naturally Occurring Lines / An Empirical Study". The Canadian Cartographer, 16(1): 70-80. Nakos B. & Mitropoulos V., 2005, "Critical Points Detection Using the Length Ratio (LR) for Line Generalization". Cartographica, 40(3): 35-51. Thapa K., 1988, "Automatic Line Generalization in Raster Data Using Zero-Crossings". Photogrammetric Engineering and Remote Sensing, 54(4): 511-517.

ORAL

Session S14-E

Hydrological Extreme Events

Thursday, 29 August, 2013

16:30 - 17:45

14E.1 | **Monitoring hydrological extreme events and their effects using lightweight unmanned aircraft to remote sensing** (#462)

<u>J. Jeziorska</u>, T. Niedzielski, M. Witek

University of Wroclaw, Institute of Geography and Regional Development, Poland

Changes in natural environment caused by extreme meteorological and hydrological events should be monitored with high resolution, both in spatial and temporal domains. Such a monitoring experiment can be carried out using remote sensing techniques, in particular with the modern observation platform that includes a light unmanned aircraft. The Southwestern Poland is an area where extreme flooding occurs frequently, which implies increased dynamics of erosion and accumulation zones and the processes that force river channels to change their spatial settings. The authorities of Kłodzko County commissioned our team to research this flood-risk area. The project will be carried out by organizing flight missions over the studied catchments. If the forecast of extreme events (such as flood) occurs we will organize additional observations from the air, obtaining higher density of measurements. In the project we will use a mini drone swinglet CAM with a high resolution camera, which allows monitoring the environmental changes in real time and receiving very detailed aerial photos of the area (spatial resolution even up to 3 cm). This accuracy will be used to observe changes in land cover and geomorphological forms generated as a consequence of extreme hydrometeorological events. Our project will lead to the production of time series of maps that subsequently allow us to better understand the processes which take place in the environment and – most importantly – help to forecast flood and possible scenarios of fluvial changes in river valleys.

14E.3 | **Proposed interactive maps for informing the population of flood risks: experiment in the City of Saint-Etienne, France** (#126)

E. Chesneau, E. Lieghio

ISTHME-UMR 5600-EVS, Université Jean Monnet de Saint-Etienne, Université de Lyon, Geography, SAINT-ETIENNE cedex 2, France

A full-length version is available and can be opened here:

_extendedAbstract\52_proceeding.*

Preventive information is a key strategic focus in the policy on preventing major risks in France [1]. In fact, one of the main obligations of a mayor is to draw up a DICRIM – a document aimed at the local residents of a commune describing the major risks to which they are exposed, and more specifically the phenomena and their consequences on persons and property, as well as preventive actions for minimizing their impact. The objective of this innovative experimental project is to contribute towards improving the dissemination of preventive information among the population by means of cartography. This is based on the assumption that map interactivity can facilitate the uptake of information on risks among the general public. Indeed, interactivity allows users to explore the map (move around, change view scales, choose what data to display), which can show or hide additional information depending on the reading and zoom level. In 2011, the City of Saint-Etienne, the Major Risks Institute of Grenoble and the ISTHME research centre developed an online DICRIM comprising several interactive maps. This was made available on the City's official website in May 2012 [2], and a set of guidelines was created to serve as an example for other local authorities [3]. Other proposed interactive maps for Saint-Etienne are also being tested using free web mapping technologies in the CEMORAL project (2011-2013) funded by the Loire Public Establishment and the European Regional Development Fund as part of the "Plan Loire Grandeur Nature", an integrated action plan against flooding in the Loire region. Three interactive applications have been developed. In the two first applications, the aim is to guide users in their search for information on a particular risk as they navigate around the map. Each application has unique features relating to the theme being mapped, the interactive options and the selected technology for its development. In the first application, a map on the scale of the city highlights the flood-prone areas and the number of preventive actions (protection, information) carried out in each district. Next, users may zoom in on a district to obtain additional information, such as the water level attained in flood-prone areas or the actions taken according to type, each of which is accompanied by a document (text, picture or video). A map of the surrounding areas of the city, which gives a better understanding of the city's location and the origin of the risk, is also available. Several base maps created on the CloudMade website make it easier for users to find their bearings. Legends and help sheets also contribute to the ease of use. This proposed map has been developed with the Leaflet and Polymaps API. The second application starts with a map of the city in which users may select a district to view flood-prone areas as well as specific elements (public buildings, roads) according to their distance from the risk. The name of each specific element is obtained with a mouse-over action. This proposed map has been developed with the Raphaël Javascript library and is available in both a static and animated version. In a third application that focuses on historical context, an interactive map features a temporal cursor for representing, over time, events that occurred in Saint-Etienne between 1587 and the present day. TimeMap technology, composed of two Javascript libraries (OpenLayers and Timeline), has been used to build the application. As part of future investigations, consultations with local residents and risk managers to identify the map applications that would be most relevant for public communication could be planned. A transposition of these proposed maps to a mobile application may also be considered. [1] http://www.risquesmajeurs.fr/definition-generale-du-risque-majeur [2] http://www.saint-etienne.fr/cadre-vie/dicrim-multimedia/risques-majeurs-a-st-etienne [3] http://www.irma-grenoble.com/05documentation/01publications_index.php

ORAL

Session S14-F

Accessing Historical Maps

Thursday, 29 August, 2013

16:30 - 17:45

14F.1 | **GI Science versus Cartography? Consequences of separating data and visualisation expertise in 21st century mapping processes.** (#1423)

B. Schulte

Beuth Hochschule für Technik Berlin, Germany

A full-length version is available and can be opened here:

_extendedAbstract\167_proceeding.*

Today everybody should be able to create maps by themselves without professional mapping skills or at high expense. All themes related to that objective, such as interoperability of spatial data and open source systems are therefore important and popular topics of the geo-community. By increasingly faster production methods (rapid mapping), beginner-friendly visualisation tools, extremely heterogeneous topics and a downward spiral of prices for geographic products, the human resources for correcting, whether by the map author or editor, are often omitted. During the rationalising of production processes cost savings will done in terms of content expertise. This often means that the thematic expertise and the technical expertise for the visualisation are separated. For map authors who are degraded to simple technicians of visualisation it is difficult to acquire sufficient experience in all thematic fields. However, thematic expertise is the key for spotting errors in the data or avoiding thematically improper visualisations. Particularly in commercial production, fast results are preferred and errors are commonly accepted as long as they do not impede the sale. For many map authors administrative boundaries usually play a minor role in quality management in contrast to numerical data. Although they are unverified, they were considered stable or generally correct. But especially this kind of data has a variety of pitfalls. It is amazing how big the non-interest or a firm belief in the immutability of administrative boundaries is. It is also interesting how superficial developed mental maps are even of some geo-experts, government agencies and the press. On a prominent example for the Federal Republic of Germany, the cartographic misrepresentation of the first-level administrative units of Germany, the federal states of the former German Democratic Republic (GDR), this field will be examined. These representations pervade all media. This misrepresentation cannot be explained by incorrect or excessive generalisation, but solely by the misuse of basic data. The boundaries of the West German states are visualised invariably correct. Although the new East German states are graphically present since 1990, misrepresentations of the boundaries occur on a regular basis. There were no geometrical changes for the western states since 1949 that could be visualise on small scales. Although the eastern states were simultaneously established in the Soviet zone, they were subject to the massive socialist reorganisation and modified to the lowest administrative level. In 1952 they were completely replaced by the ahistorical central governmental districts of the GDR. The reestablishment of these eastern states during the reunification in 1990 no longer based on the boundaries of 1950/52 but on the grouping of the socialistic modified second-level administration units to geographical extends similar to 1952. In order to create more similar boundaries several smaller territorial exchanges of third-level administration units were carried out in 1992 and 1993. Despite these efforts, there are still major differences between the geometric shapes of the 1950, 1990 and the current boundaries. These differences are clearly visible even in smallest scales and allow conclusions on the underlying data bases and the knowledge of the map authors. The examples are drawn from major German newspapers, public administrations, rail and postal companies, large and small internet sites, educational institutions and even geoscientists. These map producers are experts and are the major information sources to the public. This article examines why, despite free-date data can be accessed easily, even in the year 2013 representations of the boundaries of 1950 or 1990 are still visualised and how the change of cartographic production conditions may also have contributed to this fact.

14F.2 | **Journeys through time with the Swiss national map series** (#1452)

M. Rickenbacher

Federal Office of Topography swisstopo, Wabern, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\433_proceeding.*

In 2013, the Swiss Federal Office of Topography swisstopo celebrates its 175th anniversary. Since its foundation as «Bureau topographique fédéral» by general Guillaume-Henri Dufour in 1838, swisstopo has produced three national map series (Topographische Karte der Schweiz 1:100.000, Topographischer Atlas der Schweiz 1:25.000/1:50.000), Landeskarten der Schweiz). They include approximately 7500 first and updated editions of maps in different scales. Therefore all these maps can be regarded as a cultural heritage of national significance. They are called the «topographical landscape memory of Switzerland». The Federal Act on Geoinformation (Geoinformation Act, 2008) commits the producers to make available their geodata in a sustainable way. On this background, swisstopo launched its jubilee year on 17th of January 2013 by publishing the major part of its printed maps on the offices Internet site (www.swisstopo.ch). For any user, it is now possible to navigate at any place in Switzerland covered by the map series 1:25.000, 1:50.000 and 1:100.000. This enables to study very precisely the development of the actual National Map which was established by the «Map Law» of 1935. Everybody can now undertake a journey through time between 1938 to 2011 across the complete territory of Switzerland. From mid-2013 on, all the published maps in the scales mentioned above will be online, which means, that also the establishment of the Dufour- and the Siegfried Map can be visualized. By links to the bibliographical metadata, the user can query the data status of the map shown on his screen. Printing facilities (A4 format) and further advanced functionalities (measure, draw) are supported as well. The launch of this tool was very well accepted in the Swiss media, and within the first four days, the journey through time was visited by more than 70.000 users. In this short time, questions from the user side about the presented maps aroused, which required special historical knowledge to answer. As far as we know, such a web based publication of all printed maps in a georeferenced frame by a national mapping agency is unique in the world. Historically, this cartographic going public is the modern counterpart of the secrecy of maps which was maintained by the governments in former centuries.

14F.3 | **Publishing Old Maps as Dynamic Map Services** (#1206)

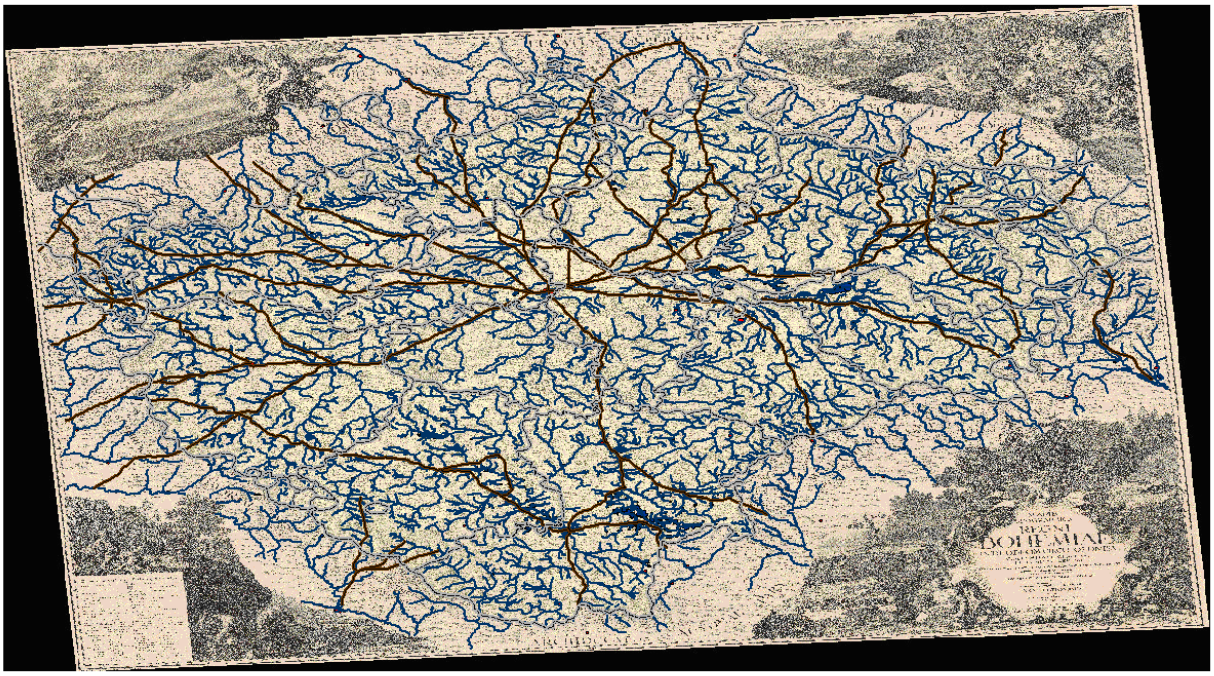
J. Havlicek, A. Muller, T. Janata

CTU in Prague - Faculty of Civilengeneering, Department of mapping and kartography, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\239_proceeding.*

This paper summarizes various resources of old maps which are in digital format on the Internet in the area of today's Czech Republic. The most important old maps providers/owners are either Czech national universities or national institutions. Czech Technical University in Prague belongs to this group as well, since the Department of Mapping and Cartography has published vectorized old maps of the whole area of Czech republic.   Old map in terminology means that the map has been created in the past, but with it work represented the current state. Historical map in terminology indicates that at the time of its inception displayed historic status before creating maps.   Old maps convey much of historically interesting information. Old maps show how individual states were advancing in both, mathematics, as well as cartographic skills. The charts we learn about the boundary of contemporary states, the density of major roads and so on.   Maps were created since prehistoric times, when mankind needed to map their immediate surroundings such as the need to obtain drinking water, important fisheries, etc. Already the ancient Greeks were able to determine approximately the radius of the Earth and represent the known world using primitive cartography system. At the time of discovery cruises cartography recorded huge development. Creation of national, continental, or world maps and atlases always belonged to the prestigious affairs. According to the quality, map series often determined maturity of individual countries. On the territory of today's Czech Republic, many major artographic works originated since the early 16th century.   Maps are published on comercial (ArcGIS Server) and open source (UMN Map Server, Geoserver) software. Among the most famous maps, which are published on map server as WMS and WFS map services, are Muller's map of Bohemia from 1721 and Muller's map of Moravia from 1716. Teachers and students from Department of Mapping and Cartography from Faculty of Civil Engineering of Czech technical University in Prague publish as grand projects many maps from 16th century to 19th century. For example in Bohemia, we can enumerate Bohemia Klaudyan's map of Bohemia from 1518, Criginger's map of Bohemia from 1568, Aretin's map of Bohemia from 1619 and Palacky's map of Bohemia. Other examples from Moravia are Fabricius's map of Moravia from 1569 and Komensky's map of Moravia from 1627.   The focus of this paper is on the new type of map services – dynamic map services. Dynamic map services allow dynamic change of vector data symbology. This paper compares commercial (ArcGIS Server from ESRI) versus open source (UMN Mapserver) tools for publishing dynamic map services. Preparation and testing of new technologies brings to the web map services new knowledge and improvements. The standards of Open Geospatial Consortium (OGC) were rehearsed in this project. Of common standards were described in Czech and rehearsed languages such as XML (Extensible Markup Language) and GML (Geography Marker Language) and Simple Feature. The cartographic standards were described in Czech and rehearsed standards such as WMS (Web Map Service), SLD (Styled Layer Descriptor), SE (Symbology Encoding), WMC (Web Map Context) and WMTS (Web Map Tile Service). Of the standards for the analysis were described in Czech and rehearsed 2.0 standards such as WFS (Web Feature Service 2.0) and Filter Encoding.   Last but not least, this work presents one example of an interactive web map application with dynamic map services, where the user can change the symbology of old maps according to present topographic map and vise versa.



Muller's map of Bohemia:
WMS and WFS of Muller's map od Bohemia

Muller's map of Moravia:
WMS and WFS of Muller's map od Moravia

ORAL

Session S14-G

Mixed Session

Thursday, 29 August, 2013

16:30 - 17:45

14G.1 | **Inspire Directive implementation in the Spanish NSDI** (#751)

A. Rodríguez-Pascual, A. González, C. Sevilla, M. Villalón, E. López, P. Abad, A. Sánchez

National Centre of Geographic Information (National Geographic Institute), SDI Division, Madrid, Spain

Spanish NSDI (IDEE standing for *Infraestructura de Datos Espaciales de España*) opened the national geoportal (www.idee.es) in july 2004 and it has implemented a huge set of web services very early building a community from public sector, academia and private companies. In the first Spanish Inspire monitoring report corresponding to 2009 a list of more than 200 web services were reported and more than 1,000 for 2010. At present the national geoportal supports 13 different geostandards and give visibility to more than 400 SDI nodes at national, regional and local levels. A very open data and services policy has been implemented for the majority of official data producers and services providers. In Spain there is a very good offer of free official geographic data and web services. On the organizational hand, a collegiate body regulated by the Spanish Law which transposes Inspire Directive, the Law 14/2010 called LISIGE, about Geographic Information and Services in Spain, the National Geographic High Council is responsible for the coordination and harmonization of Spanish NSDI. After this first expansive phase of implementation of resources, a second phase of standardization has began from 2011. Inspire regulations has been taken into account and a reengineering process has been accomplished to fulfill Inspire requirements: data specifications, metadata implementing rules, services regulations and quality of services conformance. A new line of work has been initiated to verify and control quality of web services from two points of view: Inspire conformance and services quality parameters. In this communications the following points are covered: a brief summary of Spanish NSDI state of play from technical and organizational point of views; the experience and knowledge gained in Inspire visualization and discovery services implementation; the progress reached in data reengineering; the activities and first results about services monitoring; and a set of conclusions about good practices and lessons learnt.

14G.2 | **GeoVisualisation and Spatio-Temporal Modelling from Satellite Imagery: A Study of Million+ City, Ghaziabad, NCR Region, India.** (#756)

M. Mohan
JMI Central University, Geography Department, New Delhi, India

A full-length version is available and can be opened here:

_extendedAbstract\205_proceeding.*

Urban sprawl has been quantified by considering the built-up area as the key feature of sprawl, which can be obtained either from physical field survey or through remote sensing satellite imagery. A large number of studies are dealing with quantification of the spatial patterns of urban sprawl with the help of remote sensing and GIS. In all these studies, however, concluded with different methodologies in quantifying the urban sprawl. But it is found that there is common approach to consider the behaviour of built-up area and population density over the spatial and temporal changes which has taken place in most of the cases of spatial pattern of urban sprawl. So, the urban sprawl is the process of transformation of rural areas into urban areas due to in-migration, industrial growth and transport network infrastructure development. In the recent past, a lot of attention has been paid to understand and analyze the process of spatial patterns of urban sprawl. The Delhi Metro corridors expansion is one of the significant factors responsible for the urban sprawl in Ghaziabad City in the NCR region. The present study has inquired to answers a number of research questions in detail as what are the spatial patterns of urban sprawl during 2001 to 2010. How is the Delhi Metro network impacting to the spatial patterns of urban sprawl? Which are the suitable strategies for sustainable urban development? However, the present study has considered the urban sprawl as a challenging task therefore, seeks to bring out the noteworthy impacting factor of the Delhi Metro transport infrastructure network development on the process of urban sprawl in the Ghaziabad City of the National Capital Region. In view of this, the present research has made an attempt to help local, regional and state level land use planners and policy makers to better understand and address the issues attributed to urban sprawl. The multi-spectral signatures of remote sensing and entropy model have been applied to scrutinize the geospatial and temporal land transformation and the process of urban sprawl in the Ghaziabad city of the National Capital Region. Over the periods, there has been a continuous process of urban sprawl in the rural-urban fringe of Ghaziabad City due to the extension of Delhi Metro corridors network, liberalization of economy, development plans and policies of the state govt. of Uttar Pradesh and Central Govt. of India. It has resulted into the establishments of number of national and multinational companies, since the inception of Ghaziabad as an industrial city. So, it is noteworthy to mention that there has been occurred a continuous urban sprawl adjacent to the Ghaziabad City. It has largely been responsible in the transformation of physical landscape which is creating socio-economic and environmental concerns. Therefore, the urban expansions are to be planned over the non-fertile land for sustainable urban and environment development which are the most important concerns for the new urban sprawling areas adjoining to the Ghaziabad City at the threshold of the 21st Century.

14G.3 | **3D capabilities of SPOT 6** (#480)

P. Nonin[1], M. Bernard[2]

[1]ASTRIUM GEO Information Services, Sophia Antipolis, France; [2]ASTRIUM GEO Information Services, TOULOUSE, France

A full-length version is available and can be opened here:

_extendedAbstract\280_proceeding.*

On September 9th, 2012 a new optical satellite, SPOT 6, was successfully launched by ASTRIUM. SPOT 6 is the continuation of the SPOT series, operated since 1986. It will be followed in 2013 or early 2014 by SPOT 7 (twin). SPOT 6 provides 60km x 60km images at 1.5 meters. This very agile acquisition system is able to relocate very rapidly and to scan the earth in any direction. The agility of the system offers the ability to acquire multi viewing angle images of the same area during the same orbit. This capacity, from a mere stereoscopic pair up to multiple viewing images, allows to automatically extract 3D information over significant land areas. The aim of the study is to validate and quantify the capacity of the SPOT 6 system to perform 3D extraction, and to derive elevation databases such as DEM or contour lines. The analysis will explore the advantages in terms of quality and automatism of using a triplet rather than 2 stereoscopic images. In the last years, automatic 3D processing of digital images became more popular and efficient. Thanks to aerial images and very high resolution satellite images, new methodologies have been implemented to improve the quality and accuracy of the automatic 3D processing. We propose to experiment the same type of approaches using SPOT 6 images to produce 3D database, always taking care of the cost-vs-performance trend. Different ground-truth sites with very accurate 3D database are used to quantify the quality of the 3D performance from SPOT 6. Our paper will briefly remind the basic characteristics of SPOT 6 imagery, and then expose the performance results we get from it, and the validation and verification methodology we derived from these tests.

14G.4 | **Implementation of an automated generalisation workflow to generalise a 1:50k map from 1:10k data** (#1379)

V. van Altena[1], R. Nijhuis[1], M. Post[1], B. Bruns[1], **J. Stoter**[1,2]

[1]*Kadaster, Innovations, Apeldoorn, Netherlands;* [2]*TU Delft, GIS Technology, OTB, Netherlands*

A full-length version is available and can be opened here:

_extendedAbstract\309_proceeding.*

The prosed paper presents the implementation of an automated generalisation workflow to generalise a 1:50k map from 1:10k data. The implementation of the automated generalisation workflow is carried out by the Dutch Kadaster, which also holds the National Mapping Agency. A driving principle of the workflow is that nowadays users may value up-to-date ness and fitness-for-use of topographic information higher than meeting all existing cartographic guidelines, although the result should still be of acceptable quality. This principle is validated through users-surveys. In addition the implementation acknowledges that the results obtained by an automated process may differ from results obtained by interactive processes. In 2011, an initial workflow implemented with commercial software was refined and improved based on several consultations with users and iterative testing. The optimal implementations, sequences of generalisation operations and parameter settings were experimentally determined. Specific effort was invested to enrich the source data (i.e. TOP10NL) to improve the results. The workflow will be presented in the paper, as well as the results of applying the 100% automated workflow to several study areas. The prototype implementation proofed that it is feasible to replace the current interactive workflow by an automated workflow when accepting that the new map products may (slightly) differ from the old maps. Therefore the results are further developed for implementation in a new production line. The challenge of the implementation of a full production line is solving exceptional cases. While a prototype can be limited to specific study areas, a production line should be able to handle all cases for the whole country. Indeed, our experiments already showed that the difficulty of automated generalisation lies not in the automation of the large part (say 80%) but in solving the exceptions. The paper will therefore pay specific attention to the exceptions in our automated generalisation workflow, including the way they were solved.

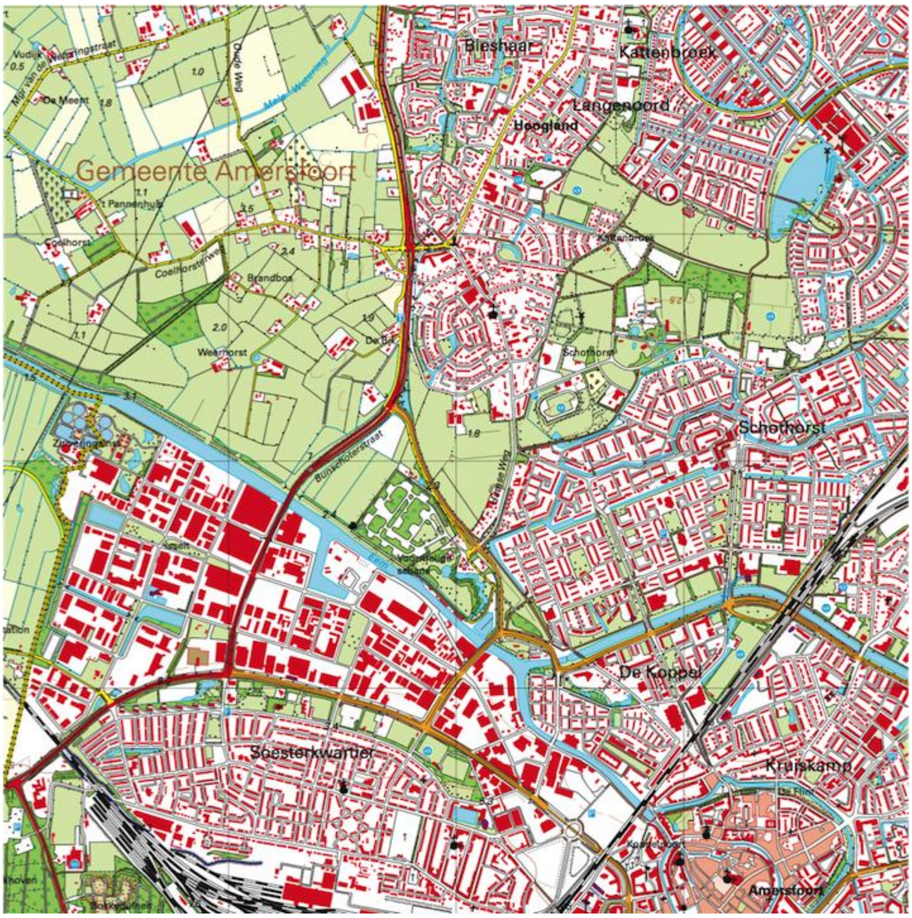


Figure 1:
Source data

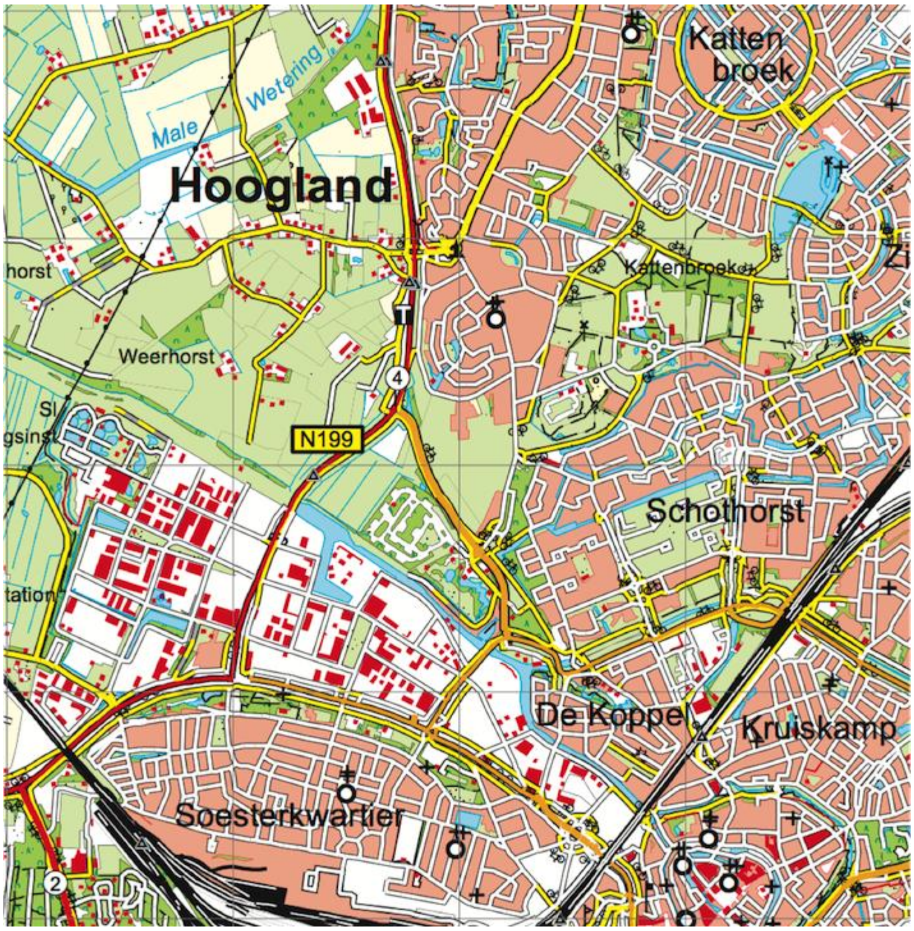


Figure 2:
Generalised map

ORAL

Session S14-H

Sister Cities

Thursday, 29 August, 2013

16:30 - 17:45

14H.1 | **Wroclaw** (#1492)

T. Niedzielski
Wroclaw University, Poland

No abstract or full paper available.

14H.2 | **Cartography and Geoinformatics in Salzburg, Austria** (#1493)

B. Hofer

University of Salzburg, Austria

Geoinformatics has a long tradition in several institutions located in Salzburg, Austria. In these past 30 years or so a strong collaboration across the fields of cartography and geoinformatics was established. This collaboration is reflected in the Geographic Information Systems cluster (GIS-Cluster) of companies in Salzburg, as well as in the collaboration of several research institutions. This talk gives an overview over major projects and achievements of the GIS-Cluster from a cartographic perspective. Milestones include early documentations of demography, land ownership in the cadastre, aerial photography of the city and surroundings, and maps of glaciers and alpine regions. These historical products document the change in and around Salzburg over time as well as the technological developments. Nowadays interactive maps are provided though web technology as a recent example of a cycling map for Salzburg's citizens shows. As a dynamic location for geoinformatics, the University of Salzburg also offers a Master in Applied Geoinformatics in residential as well as distance learning modes for educating future experts. An overview of the studies in geoinformatics concludes this talk.

14H.3 | **Strasbourg** (#1494)

<u>H. Giraud</u>
SERTIT / UNISTRA, University of Strasbourg, France

No abstract or full paper available.

Session S14-I

Business Meeting of the Commissions on Use and User Issues, Geovisualization, Theoretical Cartography

Thursday, 29 August, 2013

16:30 - 17:45

PLENARY

Session KN-7

Digital maps for highly automated driving

Friday, 30 August, 2013

08:30 - 09:15

KN-7 | **Digital Maps for Highly Automated Driving** (#1501)

M. Haueis

Daimler AG, HPC G024-BB, Sindelfingen, Germany

A full-length version is available and can be opened here:

_extendedAbstract\449_proceeding.*

The use of new maps for automated driving applications is presented. Attention is focused on new requirements for maps and their implementation in automated driving functions. New driver assistance systems will gradually path the way towards autonomous driving – a revolution in mobility. According to the WHO, more than 1.2 million people die annually in traffic accidents. The EU plans to reduce the number of deaths in traffic by 50% by 2020. Automated driving will contribute to the reduction in people killed in traffic accidents. Increased computing power of electronic control units, novel sensors and the ability to exchange information in networks are critical enablers for automated driving. The latest examples of driver assistance system provide evidence of this technological progress. Radar sensors detect other vehicles and initiate emergency stops if necessary. Stereo cameras detect pedestrians before a driver can detect them. Those are only a few examples to illustrate the progress made in sensor applications. However, sensors have physical limitations. They are limited in their visibility due to other vehicles and the course of roads, they dependent on weather conditions and their physical detection range has limits. Limited perception of the vehicle's surroundings greatly impacts the trajectory planning of an automated vehicle. Real time situation analysis relates detected objects to the trajectory of the vehicle before the trajectory planning module computes the next move for the vehicle. A reliable understanding of the vehicle environment is key to making decisions about the classification of objects and planning of the vehicle trajectory. Thus, automated driving requires a flawless understanding of the vehicle surroundings, for example, traffic rules, detailed lane information or the course of the path ahead. While sensors have a limited detection range depending on environmental conditions, a digital map offers completely new possibilities to provide environmental information complementing existing sensors. The information in such new digital maps will go behind conventional navigation maps – with respect to accuracy and precision as well as the scope of information they contain. Maps for autonomous driving require accurate information about lanes, their shape, the location of traffic signs and the position of traffic lights. The accuracy and reliability of those maps has to be in the range of ten centimeters to meter. New localization technologies are required to utilize these maps. Because GPS localization accuracy is not sufficient, novel vehicle localization techniques are needed. Recognizing landmarks is one approach to precise vehicle localization. The maps themselves then require new content such as landmark information. A number of questions have to be resolved to permit successful commercialization of new maps for automated driving. New standards, technologies for efficient mapping and update strategies have to be defined. The consideration of a dynamic map layer to include information on, for example, temporary lane closures will add further complexity.

ORAL

Session S15-A

Discussion Forum: Cartography 2013

Friday, 30 August, 2013

09:15 - 10:30

15A.1 | **The State of the Art in Cartography in 2013** (#1188)

A. Buckley[1], G. Gartner[2]

[1]Esri, Inc., Redlands, United States; [2]Vienna University of Technology, Research Group of Cartography, Austria

The state of the art in a field or discipline is “the highest level of general development achieved at a particular time”. This paper explores the state of the art in cartography, the discipline dealing with the art, science, and technology of making and using maps, as of summer 2013. It outlines the newest ideas and most up-to-date knowledge that have contributed to the most important recent advancements in the already existing body of knowledge in the field, and it includes the specific knowledge of the people who provide the framework for advancements. The cutting edge in cartography is examined in relation to five primary themes: the phenomena being mapped, collection of data, map compilation and design, map distribution and dissemination, and map use. We explore what is being mapped and by whom. We discuss “Big Data”, including real-time data feeds and social media data. We review the latest advancements in techniques for mapping spatial and spatial-temporal data. We explore new design approaches and delivery mechanisms. To conclude, we consider the latest advancements that pertain to map use and users. Combining the perspectives of the current ICA president and a leader in the field from the private sector, we offer a unique and comprehensive view on the cutting edge of the discipline.

ORAL

Session S15-B

User Needs

Friday, 30 August, 2013

09:15 - 10:30

15B.1 | **Maps versus its users in the digital era: interpretation, cognition, and memory** (#358)

K. Ooms[1], P. de Maeyer[1], V. Fack[2]

[1]Ghent University, Department of Geography, Belgium; [2]Ghent University, Department of Applied Mathematics and Computer Science, Belgium

A full-length version is available and can be opened here:

_extendedAbstract\241_proceeding.*

Although cartographic products have evolved drastically over time, their main function still remains the same as the one identified in the 1950s: communication of geographic information. However, the possibilities and limitations inherently linked with screen displays have an impact on how maps can be presented to the user, and thus on how the information is perceived and thus used later on. As a consequence, there is a rising need to understand the map user: how does he interpret and process the visual information on the maps, and how is this retrieved and used later on. A user study was conducted that combined several techniques in order to investigate these cognitive processes. In total, 12 participants took part in the study from which six were experts in the cartography and map use. The remaining six participants did not have any cartographic expertise. This distinction is necessary to investigate the influence of expertise on the map users' cognitive processes while interpreting and retrieving the visual information. All participants had to study (learn) the content of four different topographic maps that were depicted on a screen. After studying each map, the participants were instructed to draw this map from memory (retrieve information), using paper and pencils. During the learning phase, the participants' eye movements were registered (using an EyeLink1000, SR Research). This data gives insights in the users' attentive behaviour and the cognitive processes related to map reading and interpretation. Beside the statistical tests, the eye movement metrics (fixation duration, fixation count) were placed in a 2D grid (20 x 32 cells) that was laid over the map image. These 2D gridded visualizations give an excellent overview of the spatial distribution of these metrics. Furthermore, statistical tests (ANOVA) between corresponding grid cells were executed to spatially compare the distribution of the eye movement metrics. While drawing, the users had to say out loud every thought that came into mind. These verbalizations are closely linked to the active content of the participants' working memory and thus to the cognitive processes and strategies needed to retrieve the information from (the long term) memory. The obtained verbal protocols were segmented in two ways to contribute to the validity of the results. First, the number of occurrences of each word was counted, ordered, and compared between the two user groups. Second, the verbalizations were segmented on the criteria of 'full thought' (sentences). A psychological model was developed, based on which a coding scheme constructed that has four levels: map level, item level, confidence level, and actions. Four codes were thus assigned to each of the segments (full thoughts) to obtain the coded protocols. The resulting sketched maps also provided crucial complementary information about how the information is structured in memory and which information could be retrieved. Finally, the participants had to complete a questionnaire after the study, which was used to obtain background information regarding the participants' characteristics. The results indicate that all users focus on the main structuring map elements during the learning phase, which is more pronounced in the expert group. During information retrieval, the same cognitive processes are addressed, but there is a clear difference in what en how much information is retrieved between both user groups. Experts benefit greatly from their extensive collection of background knowledge.

15B.2 | **Evaluating the usefulness of overview visualisations for users with varying levels of domain knowledge** (#374)

S. Bleisch[1], M. Duckham[1], J. Lyon[2]

[1]The University of Melbourne, Infrastructure Engineering, Parkville, Australia; [2]Arthur Rylah Institute, Department of Sustainability & Environment, Heidelberg, Australia

A full-length version is available and can be opened here:

_extendedAbstract\41_proceeding.*

Suitable visualisations are assumed to support exploratory data analysis where the users want to get to know the data, potentially find interesting patterns or outliers and gain ideas for further investigation or formulate hypotheses for detailed analysis. The information seeking mantra suggests starting with an overview before offering filtering or details. Accordingly, this paper presents different overview visualisations of a specific data type exemplified through a selected data set and evaluates the usefulness of these visualisations for users interested in data analysis but with varying levels of domain knowledge. The users participate in focus groups generating qualitative data for comparing the influence of context knowledge on idea and hypotheses generation as a measure for usefulness. The research focuses on spatio-temporal location based movement data. Fish logger data in the Murray River in Australia, collected by the Arthur Rylah Institute for Environmental Research, serve as a test data set. In total more than 1000 fish were radio-tagged and 18 logging towers recorded when fish moved past them on a daily basis between 2006 and 2011. From this data set four different overview visualisations were created. Overview visualisations are defined as showing all the data in a single display. This can be achieved using different techniques for displaying all single data points. It can also be achieved using different aggregations based on the structure of the data, for example, summarising all fish movements from one river zone to another river zone. Two visualisations are adaptations of overview visualisations already in use or suggested by the data owners. Two additional overview visualisations were devised based on the data characteristics what ensures that the same visualisation types could also be used for other location based movement data sets. The visualisations were offered for discussion and hypotheses generation in focus groups comprising 2-4 people. The participants are categorized according to their level of domain knowledge: knowing the data set, knowing the domain the data set comes from and having only lay knowledge of the domain. The collected data was qualitatively analysed to compare the quantities, foci, depth or complexity and relevance, as judged by a data experts, of the generated ideas and hypotheses for further exploration and analysis of the data. Preliminary results suggest similar usefulness but varying preferences for the different visualisations. Additionally, it is hinted that knowledge of the data set itself can help or hinder the evaluation of it while domain knowledge is generally an advantage. Users with lay knowledge of the domain and data collection process only, report a number of ‘interesting’ patterns that can be explained through knowledge of the data collection process. Most participants in this research are not trained in visualisations; however, they suggest a number of additional visualisations or additions to the visualisations they would like to use for further exploring the data sets and following up on ideas and hypotheses.

15B.3 | **User needs analysis for the design of a new campus geodatabase** (#1217)

P. Yuille[1], D. Forrest[2]

[1]Freelance cartographer, Edinburgh, Great Britain; [2]University of Glasgow, School of Geographical & Earth Sciences, Great Britain

The University of Glasgow has over 23,000 students, 6,000 staff and countless visitors, all of whom need to find where they want to go on campus. The University provides a number of maps which aid understanding of the complex campus, including printed maps, posters, web maps and smart-phone applications. Some of the existing maps are dated, others are not optimal for user needs and there is little integration between products. In order to improve the current set of campus maps and locational information, a new comprehensive geodatabase of the University is to be created. The aim is to allow greater flexibility in creating maps for different user groups and also to allow a range of interactive searches for information. Prior to creating this geodatabase, a user needs analysis of the different stakeholders groups was carried out, which is the focus of this study. An institution like a major university is complex and there are many potential needs for information to assist navigation around the campus. The campus has no clear structure, largely due to piecemeal development over the 150 years it has been on the current site. Many buildings have been converted and adapted over the years from other purposes and it is bisected by a busy public road. It is sited on a drumlin, so topography creates further access difficulties, particularly for those with mobility issues. In addition to the groups that may normally be expected to access a University campus, the University of Glasgow is also a significant tourist attraction, with its nineteenth century ‘gothic’ main building dominating the west end of the city, and has several museums open to the public. As the ultimate aim is to produce a flexible, comprehensive database, it was essential to identify the potential users and assess their varying needs. Users were divided into six groupings as follows: students; teaching staff; administrative and support staff; visitors; prospective students; and users with mobility impairments. How data can best be collected from these different groups is considered, given constraints of time and resources. While on-line questionnaires are a common approach to collecting data of the type required, it is University policy not to allow mass e-mails to the university population for such purposes, so consideration of how best to collect the data from each of the user groups is discussed. It was decided that a mixture of semi-structured interviews and focus groups were most appropriate. Data gathered from these were documented and analysed through the use of affinity diagrams. In order to make the data useful in the geodatabase design process and in subsequent product design, some form of synthesis of the data is required. In this case a user persona is created for each of the stakeholder groups. Personas represent a typical user within each group; they can be specified in considerable detail, but may not match the requirements of any one example user. The personas allow the database designer and subsequent map and interface designers to develop products to meet the specific needs of this small number of generic individuals rather than having to consider a wide range of actual users. The second output from analysis of the collected data is a content list of desired features to be included in the database and newly produced campus maps. In combination the content lists and personas answer the questions ‘what is required’ and ‘how will it be used’. With this information available, the significant effort involved in creating and populating the geodatabase can proceed with confidence that data required by users will be included and outputs can be developed that meet their needs.

15B.4 | **DEFINING STANDARD SYMBOLS FOR STREET NETWORK MAPS FOR URBAN PLANNING BASED ON USER REQUIREMENTS** (#533)

C. Robbi Sluter[1,2], M. C. Bonato Brandalize[1], I. Ivánová[3], C. van Elzakker[3]

[1]Federal University of Paraná, Department of Geomatics, Curitiba, Brazil; [2]CAPES - Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior, Brasília, Brazil; [3]University of Twente, ITC - Faculty of Geo-Information Science and Earth Observation, Enschede, Netherlands

A full-length version is available and can be opened here:

_extendedAbstract\291_proceeding.*

This paper describes the first step of a research project that aims to establish a standard set of symbols for the cartographic representation of urban regions. This first step is a case study that focuses on street network symbol design as part of a municipal master plan. In Brazil, the Federal Law 10.257 of 2001 demands that a municipal master plan is the basic instrument for political policies for the development of urban areas. According to the Brazilian Federal Constitution every municipality that has over 20,000 inhabitants is obliged to have a municipal master plan. In the state of Parana, Brazil, 3 groups of professionals are involved in establishing and implementing a master plan: state government technicians, municipality technicians, and urban planners. Commonly, to propose a master plan, the municipal executive government needs to contract a commercial enterprise, which is employing urban planners. Their plan proposal is then analyzed by municipality technicians and sent to the council of representatives to be approved as a set of laws. The state government technicians, who are the users we focus on in this case study, work for an institution called *ParanaCidade* that is responsible to provide knowledge support to municipality technicians who have to review a master plan. According to *ParanaCidade* a municipal master plan is developed in five stages, where three of them are directly dependent on spatial analysis. They are the analysis of the regional, municipal and urban reality; the master plan guidelines and proposal; and the draft of a set of laws. In these stages it is important that every cartographic representation of different aspects of urban reality be perfectly understood by the 3 groups of professionals. However, that is currently not the case in the state of Parana. Today, in different municipalities, urban planners use different classifications for the same phenomena, and those differences are not always based on the specifics of the geographic region. As every classification is depicted by a unique set of symbols, there are also different symbols for representing the same phenomenon. This fact can affect the efficiency of the decision making by state government and municipality technicians in the field of urban planning. Our proposed solution to this problem is a standard for map symbolization which is the result of this case study. The street network was chosen as a research starting point because its design and construction depend on most of the geographic characteristics that must be part of the analysis of the municipal reality. At the same time, the proposals for all of the other aspects of an urban plan, e.g. land use zoning and public transportation, are dependent on the street network. The user requirement analysis is executed through scientific methodology and reference is also made to research into the cartographic design of interactive land use planning maps in the Netherlands. The steps of the methodology are (1) understanding the geographic knowledge based on which users will accomplish tasks for proposing a municipal master plan, (2) defining the street network classification that can be suitable for every map scale necessary for decision making based on spatial analysis, (3) designing a proposed standard symbology for the street system network, (4) designing and implementing qualitative user tests. The tests are based on tasks related to scenarios that represent some actual situations in urban planning. Representatives of the users perform the tasks using maps designed with the proposed standard symbolization. They are also encouraged to 'think aloud' while performing the tasks. And a 'focus group' activity will be prepared based on the results of the user tests in order to improve our proposal for the standard symbolization.

ORAL

Session S15-C

Toponyms 1

Friday, 30 August, 2013

09:15 - 10:30

15C.1 | **Spatial Intelligence and Toponyms** (#718)

Ž. Hecimovic

State Geodetic Administration, NSDI, Zagreb, Croatia

A full-length version is available and can be opened here:

_extendedAbstract\338_proceeding.*

In the past toponyms were the main tool to make spatial relations and spatial reasoning. They are reflecting spatial relations in historical, cultural and other contexts. Toponyms as base of knowledge about spatial relations contain a lot of information. After theory of multiple intelligences proposed by Howard Gardner in 1983, spatial intelligence is one of the more recognized intelligences (bodily-kinesthetic, linguistic, logical-mathematical, musical, interpersonal, intrapersonal, naturalistic and spatial). The most common description of spatial intelligence is the ability to be able to recreate one's visual experience and reasoning about shape, measurement and orientation. In the conceptualization of the spatial relations using geographical names spatial intelligence is not based only on the visual experience. Spatial reasoning using geographical names is the ability to reason about spatial relations using geographical names as objects that are containing spatial information. It is the ability to extract position and orientation from geographical name in everyday life. Geographical names are often not taken as the complete object that is build of information about geographical feature, noun and position in the space. Without any of the element geographical name is not completely defined. For example, spatial reasoning using not completely defined geographical name can lead to cardinal mistakes; noun Berlin can be connected to capital of Germany, but also settlement in Finland and region in France. Spatial intelligence is mostly connected to visual sense and visualization of space features. Because of that is sometimes term visual thinking used. But, blind persons also have spatial intelligence and spatial intelligence is not exclusively tied to the visual sense. Geographical names can be given in narrative way and not only in the written form. They are also not primarily connected to visual effects. Standardization of geographical names and development of Spatial Data Infrastructure (SDI) or spatial Information and Communication Technologies (ICT) systems is using geographical names in semantic approach that is leading to conceptual models. Ontology, as new trend is still not standardized. ISO is writing more standards on ontology to giving more possibilities in connecting different bases of knowledge and that is important for geographical names whose elements are defined in different disciplines. Definitions of geographical names made by United Nations Group of Experts on Geographical Names (UNGEGN) and EU INSPIRE has small differences that are defining different base of knowledge and lead to different developments and practical solutions. That can lead to different spatial reasoning using geographical names. This work is indicating basic relations between geographical names and the spatial intelligence and spatial reasoning.

15C.2 | **Geonames – the Database of Geographical Names of the Czech Republic** (#606)

T. Marek, O. Závodský
Land Survey Office, Praha, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\179_proceeding.*

Presentation will focus on the historical and the contemporary forms of standardization and administration of geographical names carried out by the Land Survey Office in the Czech Republic. Before the standardization of geographical names in 1930`s has begun, information about the geographic location, nomenclature attributes and the cartographic representation of toponyms could be given from the map script only. Change came with the standardization of geographical names for 1:75 000 scale map and especially with the standardization for 1:10 000 scale map commenced in 1950`s. Standardization sheets were then introduced for geographical names and some of their nomenclature attributes, whilst the geographic location and the cartographic representation remained a matter of the map script. Toponyms were administered this way till 1990`s. Since 1996 the digital database Geonames has been developed step by step. It constituted a break in the register of geographical names. Nomenclature attributes were transferred from standardization sheets into the digital form and the geographic location and the cartographic representation of names were administered in the database as well. For the first time in history a data set of geographical names outside the map script was available and could be used without any adjustments for the map printing. Hereby a digital layer for 1:10 000 scale map script was formed. Another changeover came in 2009. The Geonames database was transformed from the system for 1:10 000 map lettering to the system for management of named places in accordance with the INSPIRE policy and recommendations. Simultaneously, Geonames has joined the GIS system of the Land Survey Office called ZABAGED (*Základní báze geografických dat*)), which represents the Fundamental Base of Geographical Data of the Czech Republic. Thenceforth every geographical name has its graphic representation. Some of the names have relation to the features in ZABAGED. Names with no adequate feature in ZABAGED are inserted in the database through simplified graphic representation. Geographical name can be put in the database only once not taking its occurrence on the map script into account. The Geonames database currently provides several nomenclature attributes of geographical names. Geographic location of those names is being preserved in Geonames and partly in ZABAGED. Generalization and cartographic representation of toponyms have been transferred wholly into the Information System of the State Map Series and are not a concern of the Geonames database anymore. Due to those processes Geonames now represents a data set that is independent on the map scale. On the one hand the database is being enhanced with new toponyms up to cadastral map level details, on the other hand includes toponyms from small-scale maps. Geonames data are used for printing of the State Map Series maps and are distributed in web services of the Czech Office for Surveying, Mapping and Cadastre - the searching services, viewing WMS and downloading WFS. The chosen model of the geographical nomenclature administration enables to utilize the same data in various ways.

15C.3 | **Towards a Spatial Analysis of Toponym Endings** (#953)

T. Dahinden

Institut für Kartographie und Geoinformatik, Leibniz Universität Hannover, Germany

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 369-380

The target of this article is to define and use a statistical measure to determine endings of place names. The definition of 'ending' is based on the occurrence of a certain end-string in a gazetteer. Based on this definition a part of the GeoNames-gazetteer is analysed in respect to detect and rank possible endings. The spatial distributions of the most outstanding endings are presented.

15C.4 | **Toponymy and Historical Cartography: the legacy of geographic names on city of Cabo Frio – RJ** (#1144)

B. de Souza, P. de Menezes
Federal University of Rio de Janeiro, Geography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\303_proceeding.*

The study of geographic names includes the comprehension of many aspects directily associated with geographic space, such as: anthropic occupation, natural elements of landscape, cultural identity, disputes for areas control, among others. The toponyms give identity to the space and reveal defined relations on it, they have been used on diversity historic moments as strategy for many objectives of group responsible for naming such spaces. On this approach, the present study search to make a analysis of the geographic names of the city of Cabo Frio-RJ to establish and to sediment their historic-geographical structure, besides to evaluate their cultural origin. Thus, this paper pretends to realize correlations of the distribution of the names with the pattern of anthropic occupation that is observed in the area. Moreover, the organization of the analyzed toponyms for future entering on Geo-Database of Geographic Names of State of Rio de Janeiro, that is a wide collection of information under construction by the Laboratory of Cartography of Federal University of Rio de Janeiro, is also a objective. The city of Cabo Frio is localized on Rio de Janeiro state coast and, currently, stands to be one of the most important touristic pole of the state. In contrast, the choice of this city is justified by the important role of the area in Brazilian history, it received the first portuguese trading post in Brazil, in 1503. For this research, maps and cartographic documents of the XVIII, XIX and XX centuries were analyzed. The results pointed to a historical stability of the geographic names, don't existing significant modifications on them, beyond the prevalence of the names of portuguese origins, that reflects the supremacy of lusitanian spatial occupation in the region and the political legitimation conquered by the group. On this way, it is verified that the toponyms are important cartographic registers which express many local characteristics, extremely significant to the Geography.

ORAL

Session S15-D

Renewable Energies

Friday, 30 August, 2013

09:15 - 10:30

15D.1 | **EnerGeoPlan – Grid-aware Planning of Renewable Energies** (#134)

J. Knies, S. Schütte
OFFIS, Energy, Oldenburg, Germany

A full-length version is available and can be opened here:

_extendedAbstract\128_proceeding.*

These days the electricity system in Germany, Europe and many other countries undergoes a change towards a so called Smart Grid, a power grid that integrates the behaviors an actions of all actors (generators, consumers, storages) in a smart way in order to provide sustainable, economic and secure electricity. This change is mainly driven by the need to increase the number of regenerative energy sources in favor of environmentally harmful fossil and nuclear power sources. Especially in Germany, the number of renewable energy sources increased enormously over the past few years, caused by the subsidies defined in the Renewable Energy Sources Act (EEG). This leads to two major problems. First, the ever growing number of renewable sources requires a careful integration into the landscape to avoid that these adversely impact the eco system as well as to increase acceptance in the broad public. Second, the impact of these sources on to the power grid has to be kept an eye on as, depending on weather and consumption conditions, local over capacities do already arise. The EnerGeoPlan project aims to develop a concept for tackling these problems by combining Smart Grid analysis approaches and Geo-Information Systems (GIS). In a first step, statutory provisions and directives (e.g. rules defined in the EEG, planning directives and acts) are formally captured such that they can be automatically processed by the EnerGeoPlan system. Next, for a region of interest, geographic planning and cadastral data is imported in to the system. In this case, the municipality of Ganderkesee (Lower Saxony) is the project partner, who supports the project with planning data and information. Both, the formalized rules and the geo-data, are the base for the spatial analysis of potential areas of renewable energy plants. The project currently focuses on wind and solar (on buildings and in the field) power plants. Now, from the perspective of the legal planning framework, different scenarios can be analyzed for the area of interest with respect to the potential regenerative power that can be installed. These scenarios may include variations of used technologies as well as different interpretations of the legislative rulings. The results of these scenarios are possible installation positions for the different types of energy sources considered in the scenario. With these positions, a Smart Grid simulation can be parameterized to analyze the effects of the new scenario onto the power grid. For the latter, EnerGeoPlan relies on power system data provided by regional system operators. In a first conceptual implementation, the data provided by the local distribution grid operator EWE Netz GmbH were used. The data contains topology as well as measurement information to approximate the power dissipation and generation along different branches of the medium-voltage grid. Additional, meteorological data is considered within the simulation, in order to increase accuracy. For the simulation part of EnerGeoPlan, the simulation framework “mosaik” is used, which has been developed at the OFFIS specifically for Smart Grid related simulation studies. The scenario result of the geographical analysis extends these up-to-date power grid approximations with potential future renewable energy installations and allows to investigate the impact of these onto the power grid. The project checks the hypothesis, if a joint consideration of power supply and local planning leads to a benefit for the grid.

15D.2 | **ThermoMap – An Open Source Web Mapping Solution for Displaying Superficial Geothermic Resources** (#381)

L. Morper-Busch[1], L. Orosz[2], B. Simó[2], C. Bialas[3], D. Bertermann[3]

[1]*University of Salzburg, Department of Geoinformatics - Z_GIS, Austria;* [2]*MFGI, Geoinformatics, Budapest, Hungary;* [3]*University of Erlangen-Nuremberg, Geo-Center of Northern Bavaria, Germany*

A full-length version is available and can be opened here:

_extendedAbstract\183_proceeding.*

The ThermoMap project is an EC co-funded project (FP7-ICT Policy Support Programme) and focuses on the mapping of very shallow geothermal energy potentials in Europe. Geothermal energy, including horizontal shallow geothermal systems as defined in the directive on renewable energy sources (2009), is the energy in form of heat beneath the surface of the Earth. The visualizing of the superficial geothermal energy potentials is facilitated by using a specially developed interface. 1. Introduction ThermoMap harmonizes, combines and analyses available metadata information (soil, climatological, topographical, geological, groundwater and administrative data) to calculate a value for the geothermal potential in low depths and to create further background information on a large (European Outline Map) to medium (14 Test Areas) scale across Europe. One of the main output of the project is a web-based open-source mapping application. The herein visualized geodata consists of the harmonized, processed and analyzed results of each participant country and 14 detailed test areas of the nine ThermoMap partners from Austria, Belgium, France, Germany, Greece, Hungary, Iceland, Romania and United Kingdom. In the web mapping application itself no spatial analysis is performed, data is not created nor edited, but collected from distributed data sources, visualized and queried in a harmonized and consistent way. 2. Short description of the ThermoMap WebGIS System The system consists of three main components: Client, Server and Data. To visualize and access the different published datasets via Internet, a client application (WebGIS interface or Map-Viewer) was implemented. The application is an HTML website, which integrates the different open source JavaScript libraries – OpenLayers (version 2.11) and ExtJS (version 4.0.2a). OpenLayers is a library for displaying map data in web browsers, for building rich web- based geographic applications similar to Google Maps. It supports map data from any source using Open Geospatial Consortium (OGC) standards as Web Map Services (WMS). ExtJS enhances the interactivity provided by the OpenLayers library with a set of GUI-based (graphical user interface) form controls. The ThermoMap WebGIS follows the principles and concepts of a distributed Spatial Data Infrastructure. The ThermoMap partners provide the test area data only as WMS layers (read-only and not downloadable). For security, copyright and Intellectual Property Rights issues, the data remains with the responsible partner, only an image of the map and some attribute information are shared. Thus, the data sources cannot be directly used or manipulated by third parties. Within the ThermoMap WebGIS all partners installed an own map server on their server. Map servers allow users to share and edit geospatial data and are designed for interoperability. Used map servers are the open source products 'GeoServer', UML MapServer and the proprietary ESRI ArcGIS Server. The Hungarian test areas e.g. were set up using ESRI ArcGIS technology. The databases are located on the several partner servers. For each data set provided to the ThermoMap WebGIS (as WMS layer), the partners have to ensure the project data and naming standards. In the ThermoMap context there are four possible target groups: research, industry, public and agencies. The different target groups which will use the WebGIS interface in the end with quite heterogeneous needs lead to the demand of graduated information levels within the MapViewer application being represented by different 'Info Tools' with differing focus, content as well as data volume and information scope. For the general end user a special query tool was developed that displays interpreted information which can also be printed as a Local Information Sheet enriched with map details and diagrams.

15D.3 | **Wind farms: GIS-based visual impact assessment and visualization tools** (#631)

P. Chias, T. Abad
University of Alcala - School of Architecture, Architecture, Alcala de Henares, Spain

A full-length version of this contribution has been published in: CaGIS (Cartography and Geographic Information Science), Vol. 40, Number 3 (June 2013, Title:"Selected Papers from ICC 2013"), Pages 229-237

Landscape is more and more considered as an essential resource, and therefore as a variable to be included in land planning and protection designations. A structured method of landscape assessment, which links descriptions, classification, analysis, and evaluation, will provide an integrated framework within which the problem of scenic impacts of the renewable energy sources can be debated and solved. Perceptual qualitative data, as well as quantitative data – as the road network, land cover, satellite imagery, and aerial photography- were used either for purposes of site description and analysis, or for the 3D modeling and GIS-based visualization works. A case study of this method demonstrates the impact of wind turbines and wind farms, as well as their cumulative effects in the Sierra de Pela (Soria and Guadalajara, Spain) [1].

ORAL

Session S15-E

Reconstruction of Historical Data

Friday, 30 August, 2013

09:15 - 10:30

15E.1 | **The Way is the Goal - Modelling of historical roads** (#199)

M. Breier

University of Vienna, Department of Geography and Regional Research, Austria

A full-length version is available and can be opened here:

_extendedAbstract\89_proceeding.*

Roads are an important aspect of historical geographies. There are cases in which the courses of historical roads are known, either because maps or archaeological remains exist. However, there are cases in which a road is mentioned in written texts, but there is no further evidence, like archaeological remains or historical maps, of this road. Furthermore, in many cases only fragmentary remains of the road do exist. For these cases, where the exact course of the roads in question is unknown, GIS can provide the tools to model the unknown roads. Wayfinding algorithms, like least cost paths, can calculate routes over a landscape, based on assigned cost values. This is a simple, yet efficient way to calculate historical roads. But which factors are important for the routing of historical roads, besides the relief and rivers? Not just physical factors play an important role, but social, cultural, political and military factors as well. To model historical roads, these factors have to be identified and formalized. Formalization leads to a theoretical model, which can then be implemented in a GIS. The modeling algorithms of a GIS produce sharp results. However, the nature of the research questions allows only fuzzy interpretations. Therefore, visualization of the results has to take this fact into consideration. Furthermore, it is important to think about the epistemological consequences. Can we learn about the past, using GIS? And if so, which aspects of the "historical reality" are discernible? The fuzziness of the visualization and the observation of the observation will help to understand the model of the routes and its restrictions. Furthermore, it allows flexible integration with other historical data. This paper deals with the following questions:

- What epistemological challenges are involved in a historical GIS analysis?
- Which factors are important for road routing?
- How can these factors be formalized as a prerequisite to include them into GIS based models?
- Which methods of visualization are appropriate for the models of historical roads?

Theoretical considerations which will be discussed are based on social geographic approaches, like systems theory, cybernetics and observer theory. Especially the epistemological questions of GIS in historical research will be highlighted. This approach will provide a framework to integrate the considerations and theories from the contributing disciplines like historiography, transport and social geography, cultural history and archaeology. Furthermore, two case studies will be presented. The first one is a medieval Byzantine road in the Former Yugoslavian Republic of Macedonia, which is mentioned in documents from the 13th and 14th Century AD. The second case study deals with historical Buddhist pilgrimage routes from the 10th and 11th Century AD in the Western Himalayans. The various aspects of the two cases will be highlighted and the differences discussed.

15E.2 | **GéoPeuple: The Creation and the Analysis of Topographic and Demographic Data Over 200 Years** (#238)

A. Ruas[1], C. Plumejeaud[2], L. Nahassia[2], E. Grosso[2], M. - C. Vouloir[3], C. Motte[3]
[1]IFSTTAR, MACS, Champs-sur-Marne, France; [2]IGN, COGIT Laboratory, Saint Mandé, France; [3]EHESS, LaDéHis, PARIS, France

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 003-018

The aim of the GeoPeuple project is to analyze the raise of population from the late XVIII to the early XXI century according to the topographic elements that characterize each commune (administrative area conceptually close to municipality): the infrastructure, the equipment, the settlements as well as the natural component such as the relief. We wish to learn more about the history of each commune but also to identify stylized facts if any. In order to understand the evolution of the population at the commune level, a first web interface has been proposed. It allows a better understanding of the aggregation processes. Then we built topographic vector data bases from old maps which required the understanding of the map content as well as a long process of interactive digitalization. To start the analysis step, we developed indices that characterize each commune. At least the analysis is performed: it is based first on the classification of each commune over time. Current study is focusing on the analysis of transitions over time.

15E.3 | **Cartographic Reconstruction of Historic Settlement Development by Means of Modern Geodata** (#483)

L. Hurni, C. Lorenz, L. Oleggini

ETH Zurich, Institute of Cartography and Geoinformation, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\375_proceeding.*

The use of historic maps as well as terrestrial and aerial images is an established method in order to document and analyse the development of landscape and settlements for scientific purposes, but also for landscape and spatial planning. It is quite common to directly depict the original, digitised historic maps in technical reports and other publications in the framework of such projects. Many historic maps are now already available in scanned forms and even as time series: The Swiss Siegfried Map (1:25'000 and 1:50'000) for instance is available in versions between 1870 and 1945, followed by the National Map Series (<= 1:25'000) until today. However, as mentioned, the maps are only available as geo-referenced raster images which make them basically suitable for visual use and comparison. For current mapping and planning projects there is a high demand for GIS-suitable, topologically correct, and if possible cartographically edited vector data. In order to be compatible with the current data types and formats, and to ease combined comparison and analysis, historic data should ideally also meet those structural and technical demands. A number of projects with a similar aim were carried out in the past by various authors. In the "Swiss World Atlas", the official Swiss school atlas, as well as in a so called "time series" (Rickenbacher, 2011), a series of topographical large scale map extracts of specific areas were "retro-mapped". However, the map examples were created using conventional cartographic production technologies, i.e. the maps were manually digitised and symbolised using graphics software like Adobe Illustrator. They make use of symbolised vector data, but topology, fitness for GIS use and a (semi-)automated derivation are not ensured. The aims of the presented project are therefore as follows:

1. Derivation of a map series 1:25'000 depicting 4 situation of the development of the small City of Nidau, Canton of Berne, Switzerland;
2. Use of ArcGIS for geodata preparation, structuring and management; use of OCAD Cartographic software for symbolisation of data;
3. Use of the so-called Pagan-Map (1798), Siegfried-Map and the current Swiss National Map Series;
4. The most innovative core of the project aims at using modern vector-based, generalised GIS data for deriving the historic states by deletion and modification of geo-objects in an efficient way.

Fortunately, a suitable data set was available from the beginning of the project: VECTOR25 was produced by the Swiss Federal Office of Topography swisstopo by vectorising the National Map Series 1:25'000. Based on these vector elements and on the scanned historic maps, the historic situations could be re-established by a stepwise backward deletion of objects. In some cases amendments to buildings needed to be deleted in a more demanding manual editing and also no longer existing objects were re-digitised manually. The developed workflow has led to a series of uniformly symbolised maps 1:25'000 of the City of Nidau which allows for detailed analysis and comparison of its historic developments. Especially the changes due to a regulation of the nearby Lake of Biel can be impressively visualised. During the development of the workflow and the setting up of the various map files, the following major technological and methodological challenges were encountered: Despite the use of the WYSIWYG-based software OCAD, some graphical design problems such as special road forks were symbolised improperly; however the problems could be solved by altering the original GIS-file in ARCGIS without losing topological correctness. Another challenge was the occurrence of local deformations in the historic maps which could be solved by local adaptation/transformations. Currently we are aiming at further improving and automatizing the workflow, e.g. by applying pattern recognition algorithms for detecting historic objects and matching them with todays (vector-based) objects.

Nidau development:
Historical development of City of Nidau

15E.4 | **Georeferencing of the Third Military Survey of Austrian Monarchy** (#1094)

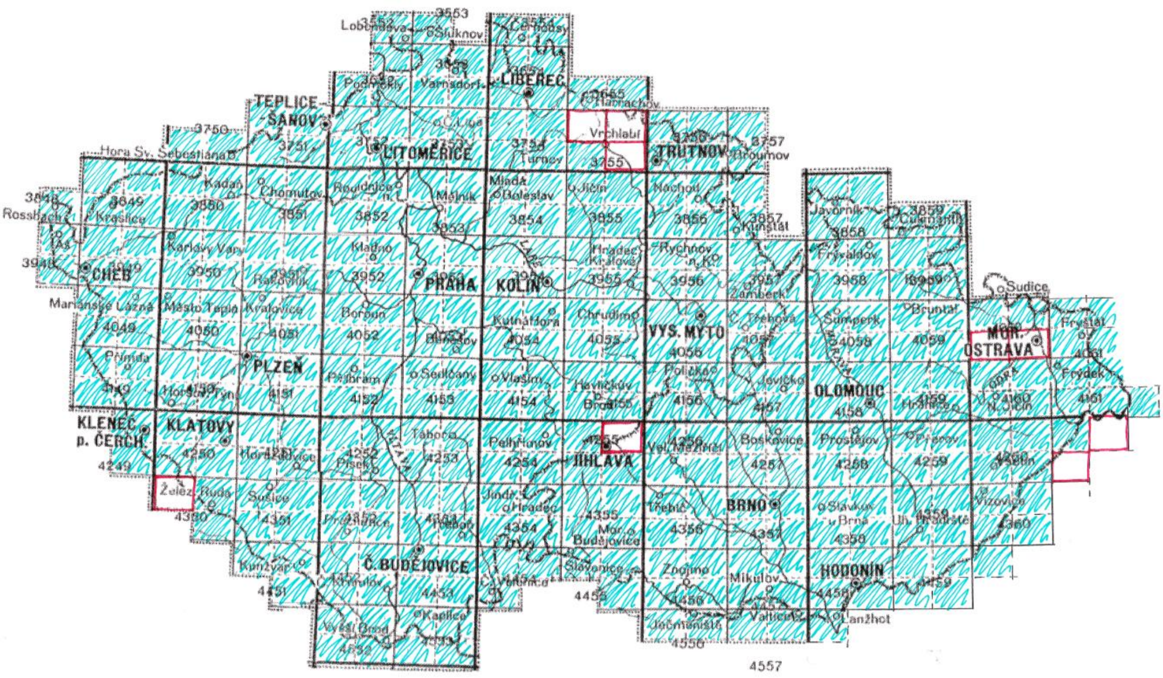
M. Talich, L. Soukup, J. Havrlant, K. Ambrozova, O. Bohm

Research Institute of Geodesy, Topography, and Cartography, ODIS, Zdiby, Czech Republic

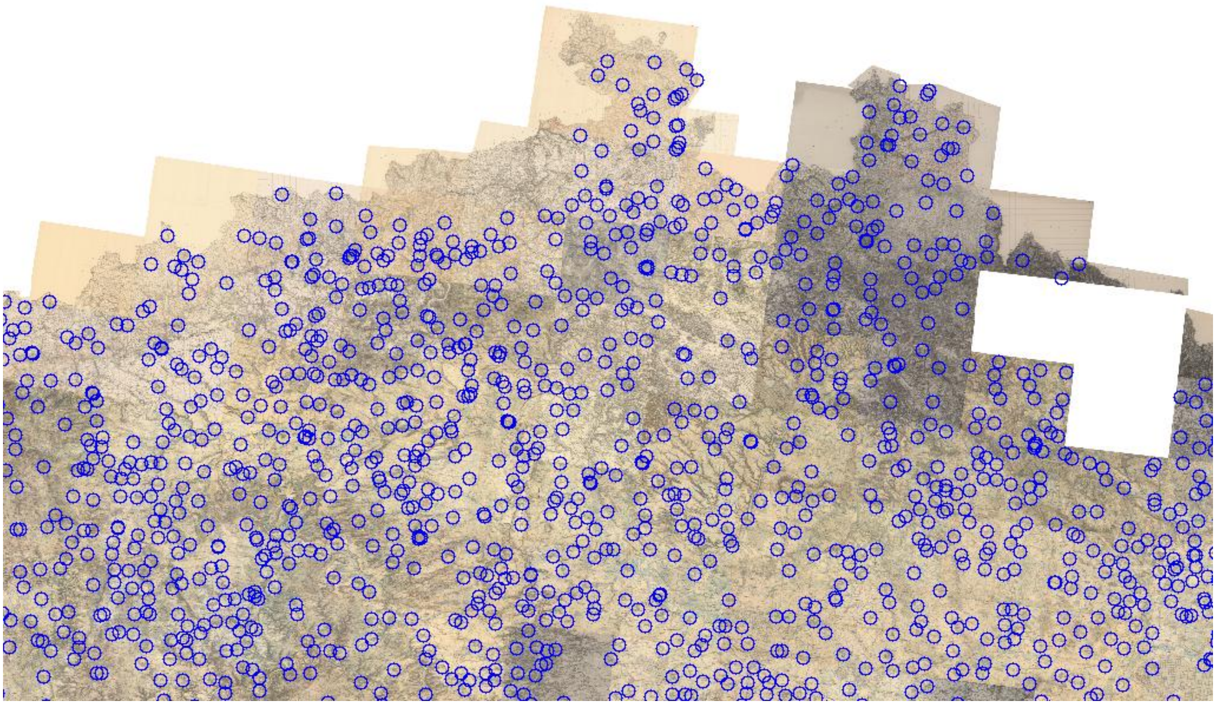
A full-length version is available and can be opened here:

_extendedAbstract\266_proceeding.*

A novel procedure for georeferencing of raster images of the Third Military Survey maps from 19th century (1876-1880) is proposed in the contribution. There were several attempts to design proper transformation model for georeferencing of these maps in recent decade, but none of them have been fully satisfactory due to significant semi-systematic positional distortions. The coincidence of content of these old maps with contemporary maps is even worse than in case of the Second Military Survey that was made earlier (1836-1852) with lower precision. The proposed georeferencing procedure consists of four steps: 1. Rectification of paper shrinkage 2. Projection of a map sheet onto Bessel ellipsoid 3. Cartographic projection from Bessel ellipsoid to plane 4. Elastic transformation in plane 1. Rectification of paper shrinkage In this step, deformation of the paper map sheets were partially eliminated. Affine transformation was applied to rectify the shrinkage, since the paper deformation can be different in different directions. Nonlinear deformations were neglected. Transformation parameters for a single map sheet were estimated with the aid of control points in corners of the map sheet. These points were captured manually on digital image of the map, corresponding true coordinates of the corners were computed from the known geographic coordinates of the corners to preserve the extent of geographical parallelogram on Bessel ellipsoid. Standard least-squares method was applied to estimate parameters of the affine transformation. 2. Projection of a map sheet onto Bessel ellipsoid. It is known, that Sanson-Flamsteed projection was used to transform geographical parallelogram (30' x 15') on ellipsoidal surface to every single planar map sheet. Therefore inverse Sanson-Flamsteed projection was applied to transform the rectified map sheets. Bilinear interpolation among the known map corners was utilized to accomplish the projection of each map sheet. 3. Cartographic projection from Bessel ellipsoid to plane Any cartographic projection of Bessel ellipsoid can be used. We have applied Krovak projection, since this projection is associated with commonly used coordinate system of the Czech Republic (S-JTSK). Result of this step is a seamless planar map of the Czech Republic composed from the separate transformed map sheets. This planar map is irregularly distorted due to semi-systematic positional errors. 4. Elastic transformation in plane Special elastic transformation was designed to correct the semi-systematic non-linear local distortions of the both concerned coordinate systems relationship. The proposed elastic transformation is based on assumption that the local distortions are random. This assumption was statistically tested with the aid of measured coordinates of many control points. Two kinds of random variables are therefore considered: measurement errors of coordinates and corrections of the local distortions. Method of collocation was applied to involve the both mentioned random variables. Huge number of control points (over 4 500) was utilized, namely trigonometric points and church towers. Positional precision of the georeferencing was estimated by error propagation approach through the four separate transformation steps. The precision estimation was verified on additional test set of control points as well. The resulting precision on the control points is about 5-6 meters which corresponds to 0.2-0.24 mm in the scale of the map (1:25 000). Bias on the control points rarely exceeds 10 meters. Resulting seamless mosaic of the Czech Republic is freely available on Internet as a Web Map Service. Content of the old Austrian military maps can therefore be compared to other map sources covering some selected region of interest.



Available map sheets :
Available map sheets covering extent of the Czech Republic. Red blank rectangles stand for missing sheets.



Seamless mosaic of sheets:
Georeferenced map sheets from northern part of the Czech Republic. Blue circles indicate the control points.

ORAL

Session S15-F

Remote Sensing

Friday, 30 August, 2013

09:15 - 10:30

15F.1 | **Land cover trends in Metro Vancouver, Canada over 45 years: mapping, analysis, and visualization** (#1293)

S. Shupe
University of the Fraser Valley, Geography, Abbotsford, Canada

A full-length version is available and can be opened here:

_extendedAbstract\426_proceeding.*

The Metro Vancouver region is one of the fastest growing areas in Canada and has experienced significant land use and land cover change over the past 5 decades, in particular the urbanization of forest and agricultural land. In this study, 45 years of years of historical LULC from 1966-2011 was mapped, analyzed and visualized to examine trends in land cover change and to highlight where sensitive ecosystems are being impacted. Historical land cover data for the years 1966, 1976 and 1986 that had originally been mapped by the Canada Land Use Monitoring Program (CLUMP) using the pioneering Canada Geographic Information System were imported into ArcGIS and linkages created between polygon and attribute data. The CLUMP datasets were originally created using air photo interpretation, field surveys, and census information and contained detailed land information. To efficiently compare changes over the entire time period a land cover rather than land use approach was taken. This was particularly the case because many CLUMP polygons had mixed land use and land cover designations that would be difficult to compare in different years (e.g. 1986 polygons with an improved grass and legumes land cover designation were also attributed with urbanized land uses such as dwelling activities and institutional services). CLUMP polygons for 1966, 1976 and 1986 were thus reclassified into a simplified classification scheme including urban, agriculture, forest, grassland, disturbed/bare, scrub, snow, wetland, and water land cover classes and then covered into a raster format. Land cover maps for 1993, 2000, and 2011 were created by classification of Landsat satellite imagery. Initial classification of these data layers involved an unsupervised classification of 2011 Landsat 5 Thematic Mapper imagery. These classes were manually labeled and merged where appropriate into the classification scheme used for the CLUMP layers. Spatial modeling using NDVI, Tassled Cap layers (brightness, greenness, and wetness), and roads was then used to refine the classification. The classification was then visually inspected for any remaining major errors in ArcGIS using high resolution Bing Maps imagery as a base layer. Major errors were flagged and then edited using a tool that was created to more efficiently handle localized thematic editing of discrete rasters in ArcGIS. The 2011 classification was then accuracy assessed using a stratified random sampling technique. Bing imagery and local knowledge and field checking were used as reference data. The 1993 and 2000 imagery were then classified using unsupervised classification, followed by cluster merging and spatial modeling similar to that done with the 2011 layer. Next, classification changes from 2000 to 2012 were mapped and compared to spectral changes between the 2000 and 2011 Landsat imagery. Land cover changes that did not correspond to spectral change over a given threshold were then visually inspected and manually reclassified where necessary. This procedure was also performed to backclassify the 1993 imagery. Overall land cover change was then visualized and quantified using single date land cover and composite change maps. These map layers were also draped over satellite imagery that had been rendered into 3D using a digital elevation model. To highlight amounts and rates of change in important ecological area, change in a number of watersheds with different topography (flat to mountainous) and different amounts of historical land cover over the time period (from urban to forested in 1966) was also analyzed. Visualization and analysis of change over time provided important information on where and what kind and amounts of change are occurring in Metro Vancouver over time. These data are also being used in ongoing studies evaluating the effects of historical land cover on historical water quality in the lower Fraser River Valley of British Columbia.

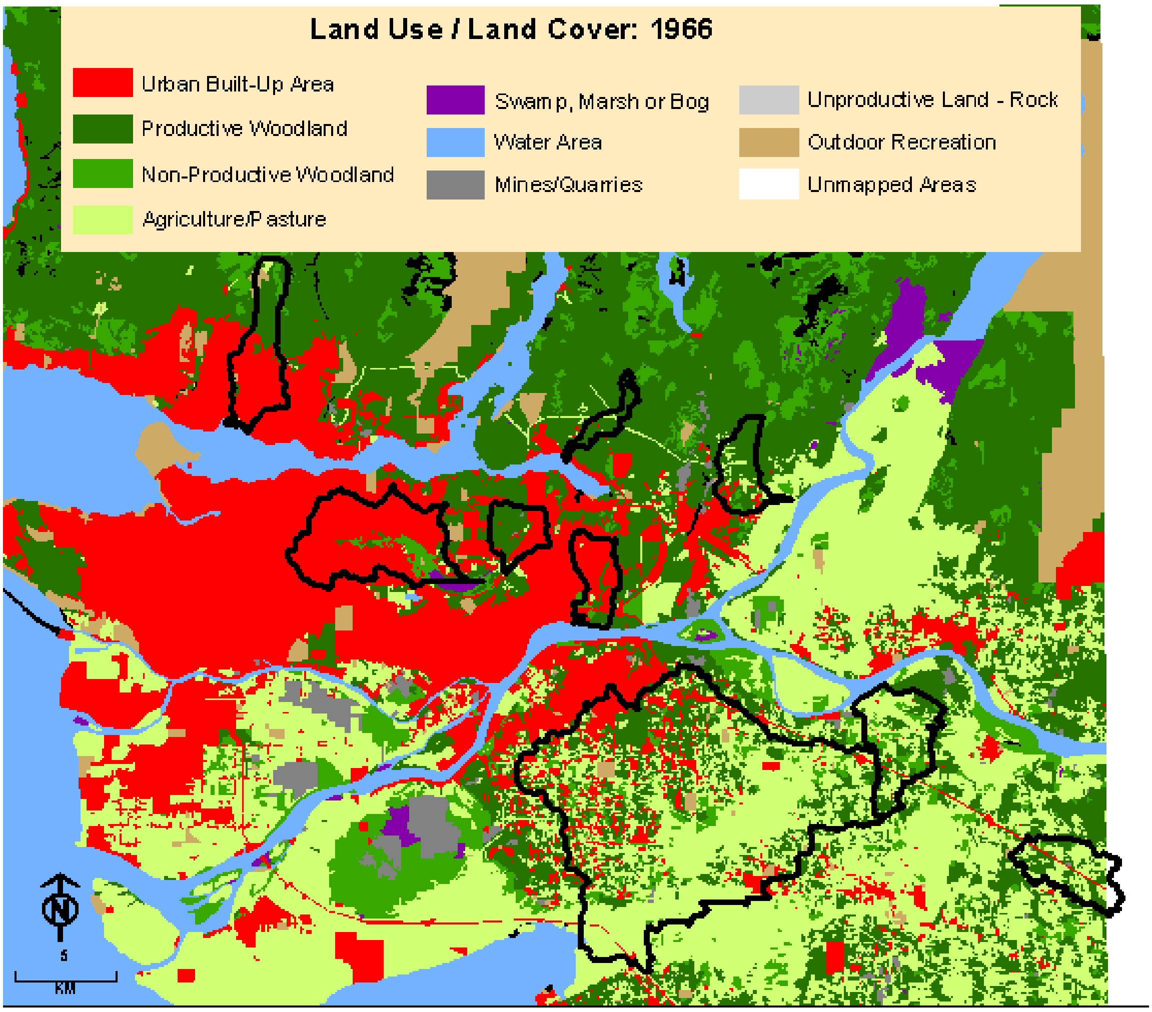


Figure1.png:
Land Use and Land Cover 1966 (before reclassification)

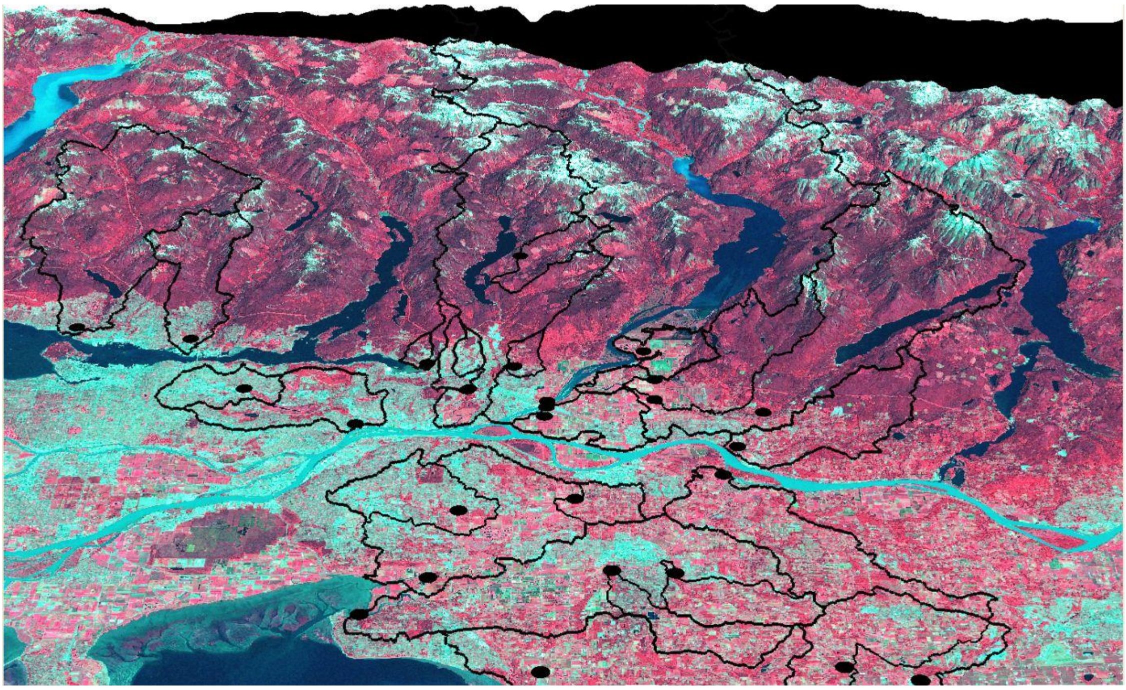


Figure2.JPG:
3D Visualization of the study area with watershed boundaries and temp sample points

15F.2 | **Reservoir Water-Transparency Mapping by Means of Multispectral Ikonos Imagery** (#593)

A. Castreghini de Freitas Pereira

Londrina State University, Geosciences, Brazil

A full-length version of this contribution has been published in: Buchroithner, M., Prechtel, N. and Burghardt, Dirk (eds.): "Cartography from Pole to Pole" - Selected Contributions to the XXVIth International Conference of the ICA, Dresden 2013. Lecture Notes in Geoinformation and Cartography, Subseries Publications of the International Cartographic Association (ICA), 2013, Springer, Berlin Heidelberg, Pages 285-302

In current society, drinkable water has been the subject of in-numerable debates, mainly in scientific groups, in which, through research-es focused on water availability and quality, it is possible to prepare diagno-ses and point out solutions to planners and decision makers. The water- transparency, beyond than being a physical feature easily obtained on field, also represents a correlation with the superficial electromagnetic radiation from the water body, enabling its assessment both by multispectral images taken by sensors from orbiting platforms, as spectral data collected *in situ.* The purpose of this research was to realize the inference of water transpar-ency, using a multispectral IKONOS imagery, at the bands 1 (450 – 520 nm); 2 (520 – 600 nm); 3 (630 – 690 nm); and 4 (760 – 900 nm) and spec-tral data collected *in situ* with FieldSpec UV/VNIR (400-900 nm) spectroradiometer. After initials data analysis and processing, the whole data was submitted to correlation analysis, developing an inference model of water- transparency. In conclusion, the specific objectives was achieved by the inference model of water-transparency through $\left(\frac{B4}{B1}\right)$ band ratio of Ikonos multispectral images, corresponding to 450-520 nm (B1) and 760-900 nm (B4). The spatial distribution of inference model was accomplished and the Secchi Depth results evinced consistency with those obtained *in situ* to central and west regions of the Reservoir. This indicates that the in-ference model of water-transparency was appropriated. This idea is rein-forced on the statistical validation of the model.

15F.3 | **Qualification of Pleiades stereo pairs for updating IGN-France's BD Topo® data base** (#1024)

J. - P. Cantou

Institut Geographique National - France, IGN Espace, Ramonville, France

From early 2103 on the Pleiades constellation shall be operational and shall deliver very high resolution images including stereoscopic pairs. This system made of two satellites designed by CNES is a good compromise for map updating , in the sense that the wide swath and the agility of the platforms allow high revisit performances and both high geometric and radiometric infomation content. IGN's BD Topo® data base describes topographic features with a specified accuracy of 1 m in XYZ. Road infrastructure and individual buildings shall be updated on a continuous basis for the whole territory. This includes change detection, public works follow up, semantic data survey, 3D shape capture by GPS or from aerial photo, last but not least release on the national geographic portal. One of satellite images' trump is their revisit capability of large sites within the 3-year or 4-year aerial systematic coverage cycle, so as to trigger change detection on major new sites, and if possible data capture itself. IGN assessed the visual quality and geometric accuracy of several Pleiades-1A stereo pairs acquired over various sites of the French territory including suburban, rural, forested landscapes. Achieved during the Commissioning phase in 2012 and early 2013 this multi-fold experimentation of Pleiades image content and geometric potential is actually compared and crosschecked with change detection and updating methods presently under operation such as field surveys (i.e. road axis capture from GPS measurements) and photogrammetric data capture from 50 or 25cm aerial photography (i.e. built-up data stereo plotting). The study will include the appraisal of Pleiades image quality under stereo viewing, both in black & white and in colour, and the precision obtained on plotted features in XYZ, confronting then several measurements made by different technicians. Final results shall contribute to the decision making process leading to declare whether Pleiades images can be qualified as input data for the BD Topo® updating process.

Fig 1:
Data stereo plotting from Pleiades imagery over the city of Miquelon (France)

15F.4 | **Laser Scanning Survey in the Pál-völgy Cave, Budapest** (#124)

M. Gede[1], C. Petters[2], G. Nagy[3], A. Nagy[4], J. Mészáros[1], B. Kovács[1], C. Egri[5]

[1]Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary; [2]FARO Europe GmbH, Korntal-Münchingen, Germany; [3]University of West Hungary, Faculty of Geoinformatics, Székesfehérvár, Hungary; [4]GeoLink3D Ltd., Budapest, Hungary; [5]Ministry of Rural Development, Department of National Parks and Protected Landscapes, Budapest, Hungary

The Pál-völgy Cave in Budapest is part of the Szép-völgy Cave System, which is the longest cave system of Hungary. The total length of this system is more than 28 kilometres, of which 19 kilometres belong to the Pál-völgy Cave. Only a small part, about 600 meters is open to the public, where pavements, stairs, handrails and ladders help the visitors. A cooperative project of Eötvös Loránd University, the University of West Hungary, the Technical University of Dresden and a private firm, GeoLink3D joined to carry out a Terrestrial Laser Scanner (TLS) survey of the visitable parts of the cave. The aims of the survey were:

1. to test and compare the functionality of two different laser scanning devices under special conditions,
2. to find a convenient solution to merge the point clouds of different scanners,
3. to create various visualizations (fly-through videos, 3D panoramas) based on the survey,
4. to create a simplified 3D model of the surveyed parts, and
5. to create a traditional 2D cave map based on the acquired data.

The survey was carried out using a Faro Focus^{3D} and a Leica ScanStation C10 instrument in May 2012. The two scanners were working parallel at different parts of the cave, which facilitated the comparison of their speed and usability. The Faro instrument appeared to be more suitable for this kind of survey due to its lighter weight and higher speed. Although the Leica scanner offered higher precision, in the narrow corridors of the cave it could not be utilized. Another disadvantage of the Leica system was that the control point indicator discs had to be identified manually at every station, while the control spheres of the Faro system were automatically recognized and matched by the data processing software. The TLS survey was supplemented by geodetic measurements outside the cave, near the exits, to facilitate placing the point cloud into a geodetic coordinate system. Results of the project by October 2012:

- A website with the 3D scanner panoramas of all scanning stations, supplemented by an overview map.
- Fly-through videos of the cave.

Current tasks in the project:

- The compilation of a new, much more accurate map is in progress, because after merging the separated point clouds of the scanning scenes it turned out that the previous official maps of the cave were rather distorted.
- Creation of a simplified 3D model of the cave, which will be an MSc thesis by a Hungarian student of cartography. The degree thesis is to be completed by May 2013.

Future plans include

- examining the use of control spheres instead of discs for the Leica system (to speed up the surveying)
- scanning additional parts of the Pál-völgy Cave (where the circumstances make it possible, the scanning scenes have to be approachable by considerably wide corridors to ensure that the instruments can be carried in safely)
- scanning other Hungarian caves. The most promising plan is to survey in the Baradla Cave in North-Eastern Hungary, where huge halls follow each other for several kilometres. The wide corridors and the large sizes make this cave an ideal subject for a TLS survey.

ORAL

Session S15-G

Marine and Arctic Data Infrastructure

Friday, 30 August, 2013

09:15 - 10:30

15G.1 | **Representation of coastal and marine environment in spatial data infrastructures to the integrated coastal zone management** (#350)

R. D. Souto, P. Menezes

Federal University of Rio de Janeiro, Geography Department, GeoCart - Laboratory of Cartography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\228_proceeding.*

The Brazilian government has been developing since 2008 the national spatial data infrastructure (NSDI), following a growing worldwide trend to organize, catalog and manage spatial data. The main purpose of this infrastructure is to facilitate sharing and access of spatial data, optimizing the work that uses such data and reducing survey associated costs. In the context of public management, several planning areas require geospatial information, with highlight to the Integrated Coastal Zone Management (ICZM), which needs the support of both terrestrial and marine information. This paper aims to show how coastal and marine environments, particularly in the ecological aspects relevant to the ICZM, have been represented in nine selected NSDIs: Infraestrutura Nacional de Dados Espaciais (INDE) of Brazil, Sistema Nacional de Informação Geográfica (SNIG) of Portugal, Infraestructura Colombiana de Datos Espaciales (ICDE) of Colombia, Canadian Geospatial Data Infrastructure (CGDI), Australian Spatial Data Infrastructure (ASDI), Infraestructure de Datos Espaciales Española (IDEE) of Spain, Infraestructura de Datos Espaciales de la República de Cuba (IDERC) of Cuba, Sistema Nacional de Coordinación de Información Territorial (SNIT) of Chile and the National Spatial Data Infrastructure (NSDI) of United States. The comparative analysis between the Brazilian initiative and other international initiatives was made using as reference the categories of ecological information presented in the "Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Ocean Management," published in 2006 by the Intergovernmental Oceanographic Commission. Almost all observed NSDIs follow the ISO19115 standard as a reference to the metadata themes, except the ICDE Colombian initiative, which differs slightly. The Portuguese SNIG and the Spanish IDEE follow the European directive named Infrastructure for Spatial Information in the European Community (INSPIRE); the CGDI Canadian initiative adopt the North Atlantic Profile (NAP) and the ASDI Australian initiative uses the metadata profile of the Australia New Zealand Land Information Council (ANZLIC). INSPIRE, NAP and ANZLIC are regional directives who adopt thematic categories in conformity with the ISO19115 standard. In Brazil, a committee subordinated to the National Cartographic Commission was formed to structure geospatial metadata. Thematic categories were included in the Brazilian INDE based on ISO19115 standard and according to Brazilian reality. In this sense, geographic names catalogs help the standardization process and facilitate information retrieval. NSDI (EUA), CGDI (Canada) and INDE (Brazil) were initiatives that better provide access to documentation referring to NSDI, as the geospatial metadata profile or a presentation document. Considering the strategic importance of coastal and marine environments to Brazil, the publication of the present study results is expected to contribute to the development of Brazilian INDE.

15G.2 | **Gaining better geospatial knowledge about the marine biodiversity by using harmonized data models, adequate cartographic visualizations and by providing easy access** (#1170)

T. Lübker, P. Hübner, M. Hauswirth, J. Krause

German Federal Agency for Nature Conservation, Marine and Coastal Nature Conservation, Putbus, Germany

A full-length version is available and can be opened here:

_extendedAbstract\269_proceeding.*

Geospatial knowledge about the marine biodiversity is of great importance for the development of successful strategies for protecting the marine biota. While a wide range of detailed geospatial data sets exist for terrestrial ecosystems the data acquisition is significantly more difficult for marine ecosystems, especially in areas beyond the territorial sea, where water depths area higher. Germany's Federal Agency for Nature Protection (BfN) has established several programs to monitor the marine biodiversity focusing on Germany's national Exclusive Economic Zone (EEZ), i.e. the area between 12 sm and 200 sm off the baseline. Species monitoring includes mammals, with a special attention to the protected harbour porpoise (*Phocoena phocoena*), certain sea birds, and benthic communities. In addition, a cadastre on marine habitats is under development. Assessment methods applied include visual surveys from aircrafts and ships, the collection of grab samples, and the use of both stationary and portable acoustic detectors such as porpoise detectors (POD) and side scan sonar (SSS). While the BfN itself conducts between three to four ship surveys annually, most data is collected by different research institutes. Since the commencement of the Marine Strategy Framework Directive (MSFD; 2008/56/EC) in 2008 monitoring activities have been expanded. Currently, coordinated monitoring programmes are being developed for the ongoing assessment of the environmental status of Germany's marine waters. The increasing amount of monitoring data that covers distinct parts of the marine ecosystem and that is collected by different institutes needs to be harmonised in order to be easily comparable. While for data collection in many cases quality measures and standard operating procedures are already operational, data management is usually not harmonised. Therefore, standardised data models are currently being developed that allow for a consistent conversion of the qualified raw data into a data warehouse. Even more importantly, though, adequate cartographic means need to be developed. In case of the distribution and abundance of mammals and sea birds the data is aggregated in time and space with a yearly resolution and by using a pan-European 10x10 km reference grid. A consistent symbolization guarantees the comparability of different time steps. In case of habitat mapping, though, a spatially discrete representation is more meaningful. Additional information on species monitoring is provided such as the monitoring transects and the relative coverage of individual grid cells, here used as an indicator for accuracy. Punctiform information is provided e.g. in order to indicate sights of harbour porpoise mother and child pairs. All this geospatial data is consolidated within a single web-based intranet solution. The application allows for an easy access to the information, an easy comparison of information, to perform geospatial queries in time and space, and an overlay with other marine data sets (via OGC web services). Using the tool, marine ecologists can retrieve tailored information from the monitoring data that they can use to assess the condition and the development of the marine biodiversity. Thus, harmonized data models, adequate cartographic visualizations, and an easy access to monitoring data help to gain thorough geospatial knowledge about the marine biodiversity in the German EEZ.

15G.3 | **Cooperative Mapping of the Arctic: The Creation of the Arctic Spatial Data Infrastructure** (#24)

D. R. F. Taylor

Carleton University, Geomatics & Cartographic Research Centre, Department of Geography and Environmental Studies, Ottawa, Canada

Cartography has always been important in the Arctic. In the digital era it is taking on new forms and functions as location or place becomes increasingly important in the management and use of all kinds of information, not just what is shown on the traditional map. Almost all computer databases, regardless of the type of information they contain, can be accessed using location. Mapping the Arctic is a national priority for countries such as Russian and Canada and a major element in establishing territorial claims over a potentially rich source of strategic minerals, oil and gas. In this sense the cartographies of the countries concerned can be seen as in competition with each other. There is, however, a need for cartographic cooperation in the Arctic and this paper will describe a major effort to create an Arctic Spatial Data Infrastructure (SDI). The Arctic is a shared environment and were environmental disasters to occur these would affect all polar nations, not just one. Effective management of the Arctic region requires combined information from all circumpolar nations in a form which can be easily used. An Arctic SDI would meet this requirement. The idea of an Arctic SDI involving all circumpolar nations was introduced at the International Polar Year GeoNorth 2007 conference. The Yellowknife Declaration, which came out of that conference, called for its establishment. By 2010 all members of the Arctic Council, the main political body for Arctic matters, agreed that such an infrastructure be established and in October of that year the national mapping agencies of the circumpolar nations unanimously agreed to create the Arctic SDI. This paper will describe the many challenges the creation of the Arctic SDI faces. The technical challenges are much more easily resolved than the administrative and political challenges of sharing information. The author is Chair of the Advisory Group to the arctic SDI.

ORAL

Session S15-H

Aktuelle Entwicklung in der Atlaskartographie

Friday, 30 August, 2013

09:15 - 10:30

15H.1 | **Deutsche Atlaskartographie im 21. Jahrhundert: Quo vadis?** (#1468)

A. Wolodtschenko

Technische Universität Dresden, Institut für Kartographie, Germany

Die deutsche Atlaskartographie oder Herstellung hochwertiger und zahlreicher Atlanten in Deutschland hat eine lange Tradition über zwei Jahrhunderte. Ab Ende des 20. Jahrhunderts zeichnet sich diese Tradition durch eine gespaltene Wirkung aus, bedingt durch die digitalen Wenden und Technologien, die sich im 21. Jahrhundert weiter entwickelt haben und gleichzeitig eine dominierende Position in der Herstellung von e-Atlanten einnehmen. Elektronische Atlanten haben analoge Atlanten nicht vollständig ersetzt, aber sie dominieren mehr und mehr in den modernen Gesellschaften und nicht nur in Deutschland. Im Beitrag wird versucht, nur einige ausgewählte Fragen aus atlaskartographischer bzw. atlassemiotischer Sicht zu stellen und zu diskutieren und zwar:

- Welche Zukunft hat die deutsche Atlaskartographie als ein Arbeitsfeld der Kartographie?
- Welche Zukunft haben kartenbezogene Atlanten in Deutschland?
- Wie kann man die Atlasinhalte evolutionieren?
- Ist die Diskussion über nationale/internationale Atlas-Vereinigungen noch zu früh?

15H.2 | **Digitale Atlaskartographie – Herausforderungen, Chancen und Lösungen** (#1469)

R. Sieber

ETH Zürich, Institut für Kartografie und Geoinformation, Switzerland

Um gegenüber frei verfügbaren, kostenlosen Kartendiensten, Geoportalen und Virtuellen Globen konkurrenzfähig zu bleiben, müssen digitale Atlanten neue Wege einschlagen. Gleichzeitig bietet die grosse Popularität von geografischen Daten und Anwendungen digitalen Atlasprodukten die einmalige Chance, neue Nutzergruppen anzusprechen und in die Umsetzung eines Atlasprojektes einzubinden. Eine Analyse über aktuelle Geovisualisierungsprodukte zeigt, dass die Mehrzahl der heute betriebenen Anwendungen primär für den Einsatz im Web konzipiert ist. Die Attraktivität solcher Anwendungen basiert auf dem unmittelbaren Nutzen im Alltag, der Aktualität der Daten und den integrativen Möglichkeiten. Der Beitrag fokussiert in einem ersten Teil auf eine Standortbestimmung für digitale Atlanten, sowie auf Herausforderungen und Chancen, die sich daraus ergeben. Es sollen wesentliche Punkte eines modernen Atlaskonzepts bezüglich Behandlung der Inhalte, Funktionalität und Nutzung von Techniken vorgestellt werden. In einem zweiten Teil wird anhand der aktuellen Entwicklungen beim Projekt Atlas der Schweiz aufgezeigt, wie Lösungen angestrebt werden können. Dabei werden insbesondere die Stärken eines 3D-Visualisierungsansatzes für Atlanten demonstriert.

15H.3 | **Europe-in-Maps – von der Vollständigkeit zur Vielfalt** (#1470)

E. Losang, C. Hanewinkel

Leibniz Institut für Länderkunde Leipzig, Germany

In den letzten 15 Jahren war das Leibniz-Institut für Länderkunde (IfL), Leipzig, an der Realisierung unterschiedlichster Atlasprojekte beteiligt allen voran der Nationalatlas Bundesrepublik Deutschland. Aus diesem wurden seit 2007 zahlreiche Spin-Off Produkte entwickelt, wobei der Focus auf Online-Anwendungen lag. Hierbei wurde immer deutlicher, dass digitale Kartenprodukte für Nutzer dann nur dann attraktiv sind, wenn Sie einen hohes Interaktionspotential aufweisen und den Sehgewohnheiten der „Generation Fernsehen“ und der „Generation Internet“ angepasst dynamische (animierte) Visualisierungsformen favorisieren. Einen Trend der sich durch vielfältige Parallelentwicklungen im Rahmen quelloffener kartographischer Programmbibliotheken (OpenLayers, Leaflet, Mapstraction, deCarta, D3 etc.) und der damit einhergehende (technische) Diversifizierung aber auch Demokratisierung im Bereich der Geovisualisierung bestätigt. Allen gemein sind das Hinterfragen traditioneller kartographischer Konventionen und eine immer stärkere Abwendung von klassischen Publikationsformen. Betrachtet man vor diesem Hintergrund klassische Atlasdefinitionen fällt dabei insbesondere die Forderung nach Vielseitigkeit und Vollständigkeit sich wechselseitig ergänzender Inhalte auf. Einem Streben, dem digitale Atlasprojekte heute mit technisch einfach zu realisierenden, GIS-basierten Workflows entgegenkommen. Auf der Basis der von Ihnen vorgehaltenen digitalen Datenbanken treten sie immer häufiger einzelstaatlichen statistischen Institutionen als Produzenten statistischer Portale und Atlasangebote hervor. Dies führt zu einer immer stärkeren Uniformität hinsichtlich vordefinierter Layouts und daraus resultierender Kartengrößen und Kartenstandards bei kartographischen Darstellungsformen. Um aus diesen datengetriebenen Atlasprojekten auszubrechen, hat das IfL versucht einen neuen Atlastypus zu entwickeln - den „Darstellungsatlas“. Dieser bietet die Möglichkeit plattformübergreifende, technisch voneinander verschiedene Visualisierungsgrundlagen (z. B. Flash, Java, HTML5, Canvas, SVG) in einem Onlinesystem (z. B. Content Management System) zu bündeln und gleichsam als digitale Loseblattsammlung von nicht zwingend thematisch einheitlich gestalteten Kartenanwendungen zu präsentieren. Als solches Instrument versteht sich das Projekt Europe in Maps (europe-in-maps.eu), welches im Rahmen eines Weblog-Systems mit einer ergänzbaren Sammlung von Visualisierungsideen im erweiterten Themen- und Datenumfeld „Europa“ realisiert wurde.

15H.4 | **Der "Island Auto Atlas" - ein plattformübergreifender Reiseführer** (#1471)

A. Gollenstede

geoxxl - Geoinformation Internet Multimedia, Oldenburg, Germany

Ein nun seit fast 40 Jahren publizierter kartenbasierter Reiseführer geht in eine digitale Zukunft. Neben der klassischen Plattform "Print" muss sich der Atlas nun auch den sich rasant entwickelnden modernen Medien anpassen: Web, mobile Plattformen und eBook. Doch neben neuen Marktchancen kommen auch neue Probleme auf den Verlag zu. Es wird aufgezeigt, welche Auswirkungen die neuen Medien auf den Workflow innerhalb des Unternehmens und auf die Qualität der Kartendarstellungen haben.

Session S15-I

Business Meeting of the Commission on Cartography in Early Warning and Crisis Management

Friday, 30 August, 2013

09:15 - 10:30

15I.1 | **GLOFs - Glacier Lake Outburst Floods, a Worldwide Threat for Alpine Areas** (#1495)

M. Buchroithner, J. Peters, T. Bolch

TU Dresden Institute for Cartography, Germany

High mountain areas are exposed to a wide range of natural hazards. Outbursts of glacial lakes belong to the most frequent hazards bearing a serious threat to humans and infrastructure. In times of receding glaciers and thawing permafrost glacial lakes are expected to develop and grow in an even accelerated manner. This development is presumably accompanied by an increase in number and dimension of glacial lake outburst floods. To account for the threatening which emanates from such water bodies several attempts are made worldwide to monitor potentially dangerous glacial lakes. Remote sensing methods offer a convenient tool to investigate lake formations, developments and their respective hazardousness for large areas. A comprehensive approach is set forth to detect and classify potentially dangerous glacial lakes by means of remote sensing which can be adapted to alpine areas worldwide. It is based on the investigation of lakes and their surroundings according to four groups of parameters. These groups comprise lake characteristics, characteristics of adjacent glaciers, characteristics of lake surroundings and the impact in case of glacial lake outbursts. Individual features like lake area or volume, changes in the lake´s area, glacier area changes, glacier dynamics, exposedness to ice avalanches and rock falls and possible outburst paths are combined to a classification scheme. The classification scheme is a numerical approach based on additive ratio scales. The specific hazardousness can be obtained by defining qualitative thresholds resulting in hazard classes from very low to high potential danger. The method allows for the assessment of potentially dangerous glacial lakes over large areas utilizing well-developed remote sensing techniques like the automated detection of water bodies and glaciers with multispectral imagery, glacier velocity measurements using feature tracking, outburst path modeling employing digital terrain models and simple permafrost modeling. However, some essential features which define the potential danger emerging from a glacial lake cannot be addressed by this approach. Dam characteristics such as width and height or the material composition are difficult to investigate sufficiently using remote sensing only. Besides, limitations in image resolution can diminish the reliability of the results. Too coarse digital terrain models, for instance, often lead to an underestimation of modelled outburst paths.

15I.2 | **Mapping for Crises Management Standards** (#1496)

T. Bandrova[1], M. Konečný[2]

[1]*University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria;* [2]*Masaryk University, Laboratory of Geoinformatics and Cartography, Department of Geography, Brno, Czech Republic*

Last big disasters – earthquake in Sechuan, China in 2008, Fukushima tsunami disaster in 2011 and last but not least also hurricane Katrina in..and big tropical storm in East regions of USA in 2012- warn us again that our preparation for such situations is still not enough and has to be innovated by improvement of all individual elements which are parts of disaster management cycle and by efforts to attach disaster risk reduction targets. It is visible and also documented by requests of several world operating organizations (ICA, ISPRS, FIG, IRDR, CODATA etc.) that we should progressively improve also maps created by newest information and communication technologies as a "channel of information" for decision makers but as well as inhabitants. In humankind history maps are repeatedly found as the most convenient and enough understandable products of cartography ensuring interface between maps and people. One of the basic conditions to develop and make effective such ideas is standardization of maps and mapping process for disaster management.

The authors did several experiences about understanding of cartographical information directed to crises management in several European countries. On this base some conclusions are made and proposal for standardization in presentation of geographical information (including phenomena and objects needed in early warning and crises management) are done. In this area specialists use different kind of sources – the most popular are satellite images or traditional topographical maps. The goal is to present the necessary information by the way to be understandable not only for professionals but also for wide range of our users. The necessary data from different sources should be represented on one and the same way independently of base sources. This could be achieved if we use approved standards. Authors propose standardization in data classification and data structuring in the process of preparing all sources for mapping and cartographical visualization. The next proposals are connected to symbol systems, color systems and scales (resolution or level if details) of different kinds of maps already accepted as necessary tools in crises management steps. The development of proposed standards need international cooperation and discussions in national, regional and international levels to be accepted for map productions in crises management together with organizations responsible for standard creations (ISO, OGC).

15I.3 | **Cartography in the Communication of Stakeholders in Risk Situations, Disasters and in Civil Protection** (#1497)

<u>H. Kremers</u>

°, Berlin, Germany

Cartography is used increasingly not only for documenting situations but it is a key element in ensuring decision support communication for all different actors in Risk Situations, Disasters and in Civil Protection. Particular challenges are in the location and time-varying dynamics expected in such situations. Current research deficits especially need to address the special role of cartography (recognition and correct interpretation of the transmitted information), and the use of intermediate results in a consistent manner in the information flows for decision support, action and control of effectiveness of the measures taken by participating institutions, organizations and actors based on standardized geodata-infrastructure and the appropriate application-related web services. Application scenarios for this presentation are based from the authors work as chair of the DGfK (German Cartographic Society) Commission on “Risks, Catastrophe and Public Security”, an Counselor to the DKKV (German Committee for Disaster Prevention), as member of the ICA (International Cartographic Association) Commission on Cartography in Early Warning and Crisis Management, and as Delegate to UN ISDR (United Nations International Strategy on Disaster Reduction) which held its bi-annual Global Platform in Geneva (Switzerland) 2013.

15I.4 | **Cartographic and Geoinformatics Strategies for Early Warning and Crises Management** (#1498)

M. Konečný

Masaryk University, Laboratory of Geoinformatics and Cartography, Department of Geography, Brno, Czech Republic

No abstract or full paper available.

15I.5 | **The Emergency Support System: story of one project** (#1499)

T. Rezník

Masaryk University, Laboratory of Geoinformatics and Cartography, Department of Geography, Brno, Czech Republic

Incident commanders are in crisis and emergency management supported by tools, i.e. command and control systems, to enable and accelerate the planning and decision-making processes and to accomplish the missions. Since these systems cannot cover all data and functionality, we should assume that a command and control system is ‘‘a system of systems’’ in which other systems and sub-systems are used to solve specific functional needs in appropriate detail. Harmonisation of geographic information is one of crucial functionalities for command and control systems. The Emergency Support System (ESS, http://www.ess-project.eu) is a European 7th Framework Programme (7FP) project with funding from 2009 to 2013. The ESS includes a suite of real-time, spatial, data-centric technologies aimed to aid decision-makers during crisis management situations by locating people during crises / emergencies. As such, the ESS may be understood as a sub-system for command and control systems. The presentation aims primarily at issues of the ESS architecture, cell phone localisation based on IMSI catcher concept and four large field tests that were performed between 2011 and 2013.

ORAL

Session S16-A

Geospatial Analytics 3

Friday, 30 August, 2013

11:00 - 12:15

16A.1 | **The Use of GIS Technology for Planning of GNSS Measurement** (#961)

D. Bartoněk, I. Opatřilová
Brno University of Technology, Institute of geodesy, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\961_abstract.*

16A.2 | **Site selection for the next Chinese Antarctic research station** (#925)

X. Pang[1], X. Zhao[1], H. Liu[2]

[1]*Wuhan University, Chinese Antarctic Center of Surveying and Mapping, China;* [2]*Wuhan University, School of Resource and Environmental Science, China*

A full-length version is available and can be opened here:

_extendedAbstract\126_proceeding.*

16A.3 | **Cave Volumetric Studies Based on Archive Maps of the Pál-völgy Cave (Hungary)** (#416)

G. Albert, Z. Ungvári

Eötvös Loránd University, Department of Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\13_proceeding.*

ORAL

Session S16-B

Toponyms 2

Friday, 30 August, 2013

11:00 - 12:15

16B.1 | **Geographic names as a cultural expression: an analysis of the city of Petrópolis – RJ** (#977)

B. de Souza, P. de Menezes, B. Miceli, A. Duque Estrada
Federal University of Rio de Janeiro, Geography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\117_proceeding.*

Geographic names through the comprehension of their origins and motivations allow for multiple relations to the cultural, social , political, economical and natural aspects of a studied area. This type of analysis has a multidisciplinary aspect and shows relevance in Geography, History, Linguistics, Anthropology, Cartography and other fields of study. The toponyms personalize and separate a place from its surroundings. In this matter, this article intends to discuss the geographic names as cultural expression of the groups responsible for naming such places. Therefore, the city of Petrópolis was chosen as it is a special place to be analyzed . Petrópolis is an important cultural and historical legate to Brazil. The Imperial City, as it is known, served as a summer residence of the Imperial family in the second half of the nineteenth century. The city´s urbanization project was led by the German Major Júlio Frederico Köeler who brought German immigrants to work in the plan. It all comes down to the objective of this article that is to search and analize the cultural origins of the current geographic names in the city of Petrópolis with the aim of verifying if is possible to find records of an immigrant group from the past , in this case, the Germanic group. It is intended as well to identify relations between different social groups established by the toponymic motivations.It is relevant to say that this study integrates the project “Geonímia do Rio de Janeiro” sponsored by the Laboratory of Cartography (Geo Cart) from the Geography Department of the Federal University of Rio de Janeiro.

16B.2 | **Enhancing the reading and understanding the toponymic map features by using TIS: a case study from Tunisia** (#1018)

D. Mohsen[1,2]

[1]King Abdulaziz University - Faculty of Environmental Design, Department of Urban and Regional Planning, Jeddah, Saudi Arabia; [2]FLSHS - SYFACTE - ATCIG, Geography, Sfax, Tunisia

Reading and understanding the signification of toponymic features is an essential task for the map users. The way and the context the geographical names are attributed to one territory, region, country or any smaller area or feature reveal often their geographical identity, historical construction and linguistic development. This is particularly the case of countries having multiple linguistic interferences such Tunisia. In this country, different and numerous civilizations and cultures have succeeded and helped in building the toponymic frame of thousands of Tunisian names. For the map user, reading the names transcript on maps by using the rules of one language does not help a lot to understanding the richness and the variety of local toponymy. The various historical, cultural and geopolitical aspects are very often occulted. We think that GIS technology can partly solve the problem in an automatic way. First, while labeling the features, one can use multiple toponymic layers, each one fitting one specific context of use or/and historical period or/and linguistic transcription or/and meaningful signification. Second, by using various graphic hints, we may also superpose in one single layer several toponyms by using various letterings, typestyles, colors and other parameters such as name placements. This is the goal of the Toponymic Information Systems (TIS). In this paper, we discuss the applications of these methods implemented in one Geodatabase to a specific region of Tunisia: *The Cape Bon.* We should advertise the reader about the difficulty of the task. From a partial inquiry addressed to various categories of map users, the results show not only a better understanding of the toponymy, but also a more realistic pronunciation fitting the local ways. The various historical, cultural and linguistic aspects which interfere in the territorial construction are particularly witnessed in this process.

16B.3 | **Toponyms Placement on Web Maps** (#727)

R. Župan, S. Frangeš
Faculty of Geodesy, Cartography, Zagreb, Croatia

A full-length version is available and can be opened here:

_extendedAbstract\181_proceeding.*

The presence and use of Web maps has become a common necessity of a large number of users of various occupations and professions. The problem of toponyms placement on web maps has still not been solved adequately, and remains to be a problem both for users and for cartographers. Specifically, toponyms placement on web maps deviates from the set of cartographic principles, and it is also not in compliance with cartographic visualization and cartographic generalization. The work on practical examples shows the problem and provides solutions to web map toponyms placement. There is a simple method for decision making proposed related to presenting or not presenting a toponym in its possible complex environment with all other cartographic elements and layers, as it is common on web maps.

16B.4 | **Toponymy Evolution of Rio de Janeiro State, Brazil** (#314)

P. Menezes, S. Kairo, P. Dionisio, B. Souza
Federal University of Rio de Janeiro, Geography, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\236_proceeding.*

The State of Rio de Janeiro possesses 92 (ninety two) installed municipal districts and 188 districts. Distributed among those municipal districts there are approximately 850 villages or population nuclei. This geographical space was inhabited at the discovery time, in 1500, by Indians of *Tupi* origin, along the coast, *Jês*, also known as *Goytacases* in Rio Paraíba's mouth and *Puris* in the interior. Seeking to recognize and to map the Brazilian territory, Portugal sent the first exploiting expedition, commanded by Gaspar de Lemos in 1501 and soon afterwards in 1502 with Gonçalo Coelho. In these expeditions were experienced navigators and cartographers, as for instance, Américo Vespúcio. In this way, in spite of place names existed exclusively in local language, began the process of nomination of the new territory, standing out the Cable of San Tome, Cabo Frio, Angra dos Reis and own Rio de Janeiro, using the new Portuguese language. However must be noticed the influence of the local language in place names, on a complete or hybrid way. Since the beginning of the century XVI the toponymy of the State has been going by several historical periods, which in many cases determined changes of some place names in affected areas for the processes. This paper aims to show the connection among the study of the historical maps, the geographical space and the toponymy of the state of Rio de Janeiro, Brazil. Initially the research will present the work on the names of the settlement nuclei, through the analysis on the changes occurred according to each corresponding historical period. The proposed methodology for the study is performed by the extraction of the geographical names (toponymy) from the historical maps, identifying its geographical positioning and associating it to the actual toponymy, according to the geographical names database of Rio de Janeiro state. In this way, the evolution of the name will be studied, as well as the comparison with the current name, seeking for and identifying changes in the name, considering also those derived by orthographic changes. It is still intended to verify and to define the changes motivation in cultural, political or other possible aspects. The final product of the research will be the addition of the place names and their motivations according the historical-cartographic-geographical study, to the geographical names database of Rio de Janeiro state.

ORAL

Session S16-C

National Thematic Data Bases

Friday, 30 August, 2013

11:00 - 12:15

16C.1 | **The Informa of the State Map Series in the Czech Republic** (#1166)

M. Traurig[1], J. Langr[2]

[1]Land Survey Office, Departement of cartography and polygraphy, Praha 8, Czech Republic; [2]T-MAPY Ltd., Hradec Kralove, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\242_proceeding.*

Land Survey Office (LSO) provides (inter alia) administration of the State Map Series of the Czech Republic. In recent years LSO has been developing in cooperation with a private company T-MAPY Ltd. an Information System of the State Map Series (IS SMS). The IS SMS is based on Esri GIS technologies with a cartographic extension made by the company T-Kartor. Spatial data are stored in the Oracle database in the Esri Geodatabase data model. The production line of the IS SMS is managed by the application Workflow Manager developed by T-MAPY Ltd. A file oriented system has been replaced by seamless databases. Data are edited by a multiuser editing in the ArcGIS for Desktop environment. Change proceedings run in on-line mode of long optimistic transactions in a versioned geodatabase. The duplicity of cartographic data is minimized by using cartographic representations in the Esri Geodatabase model. The support of data updating on the strength of changes detection in the source databases is the fundamental benefit. It makes possible to keep the information in databases up-to-date and to generate high quality cartographic outputs within large map series using the CPS Express cartographic extension. Due to the managing system Workflow Manager it is possible to make an efficient planning, monitoring and evaluation of the whole production process, which more than 60 workers participated on. The whole system is well designed and allows to significantly increase the production capacity of Base and Thematic maps in scales 1:10,000 - 1:100,000 on the territory of the Czech Republic.

16C.2 | **New elevation models of the Czech Republic** (#546)

K. Brázdil, I. Skalická

Land Survey Office, Land Survey Department, Prague, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\371_proceeding.*

The presentation provides information about new elevation models of the Czech Republic and their cartographic applications. The project is currently running within collaboration of the Czech Office for Surveying, Mapping and Cadastre, Ministry of Defence and Ministry of Agriculture of the Czech Republic. Airborne laserscanning technology has been chosen as a main data capture method. Basic parameters, workflow and final products – two digital terrain models and digital surface model, their vertical accuracy and application possibilities including hard-cartography application for the production of basic state maps are noted in this presentation.

16C.3 | **Fundamental Base of Topographic Data of Czech Land Survey Office as a source for database cartography and other applications.** (#918)

P. Šidlichovský
Land Survey Office, Database Administration Section, Prague, Czech Republic

A full-length version is available and can be opened here:

_extendedAbstract\412_proceeding.*

The Fundamental Base of Geographic Data of Czech Land Survey Office (ZABAGED) is approaching twenty years of its existence. Today it serves not only as a source for database cartography production of State Map Series, but also for online map visualizations and as a basic data source for information systems containing spatial data in governmental institutions. The presentation describes the shift in requirements on source data with transition of the cartography at Land Survey Office of the Czech Republic from the digital filebased cartography, to the database one, managed by the change detection and processing. The technical aspects of communication interface and data transfer, as well as necessary change of attitude in all workflows concerning creating, updating and modifying relevant data in the source topographical database with impact on the change detection are discussed. Latest developments, including publication of INSPIRE compliant datasets, linking ZABAGED and database of geographical names, relation between ZABAGED and base Registry of Territorial Identification, Addresses and Real Estates, and advances in creation of common watercourse network shared between responsible institutions in the Czech Republic are described as well.

16C.4 | **The Detailed Geological Map of Poland - 60 years of a project, from a traditional cartography to a digital processing** (#395)

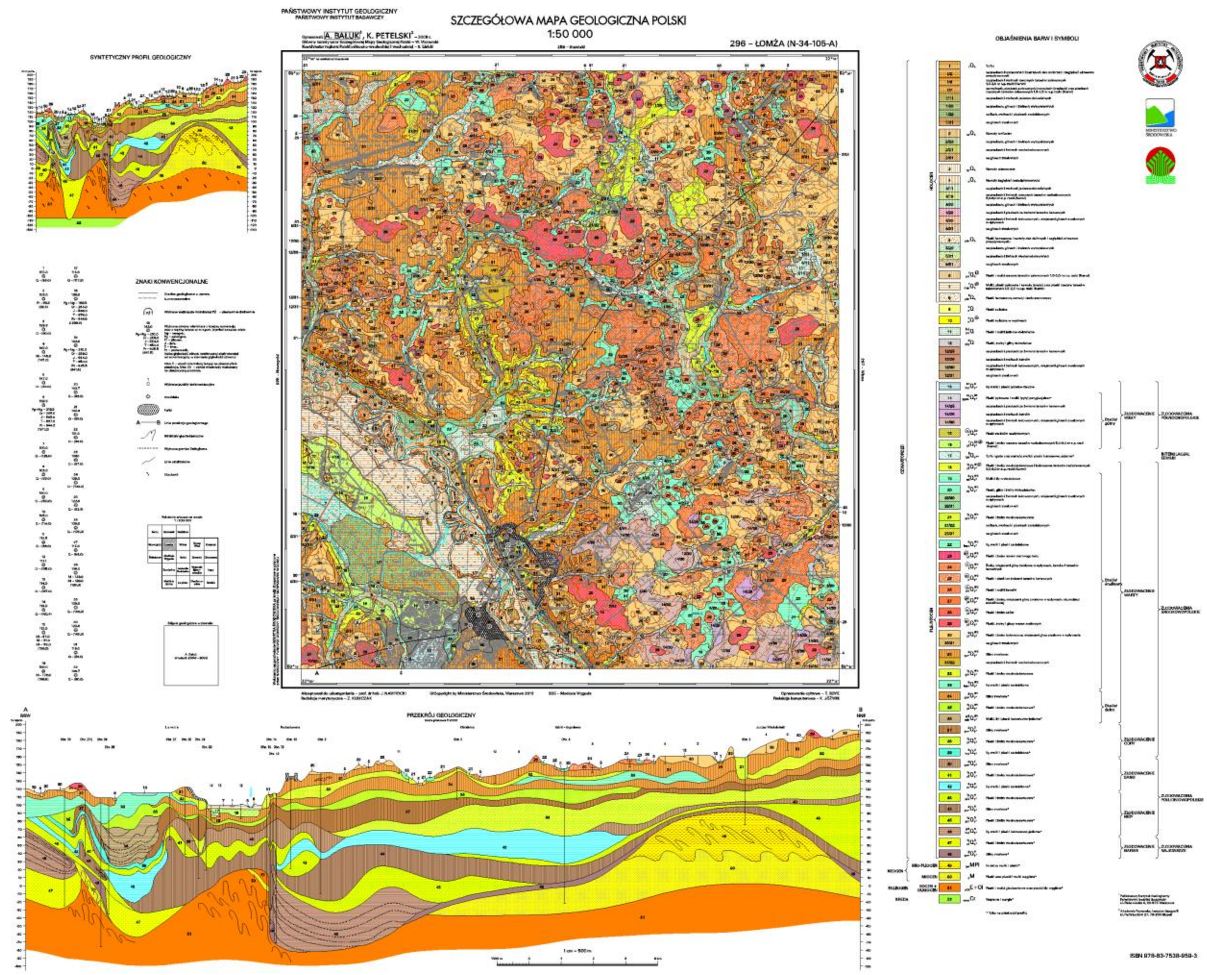
K. Jóźwik

Polish Geological Institute - National Research Institute, Geological Cartography, Warsaw, Poland

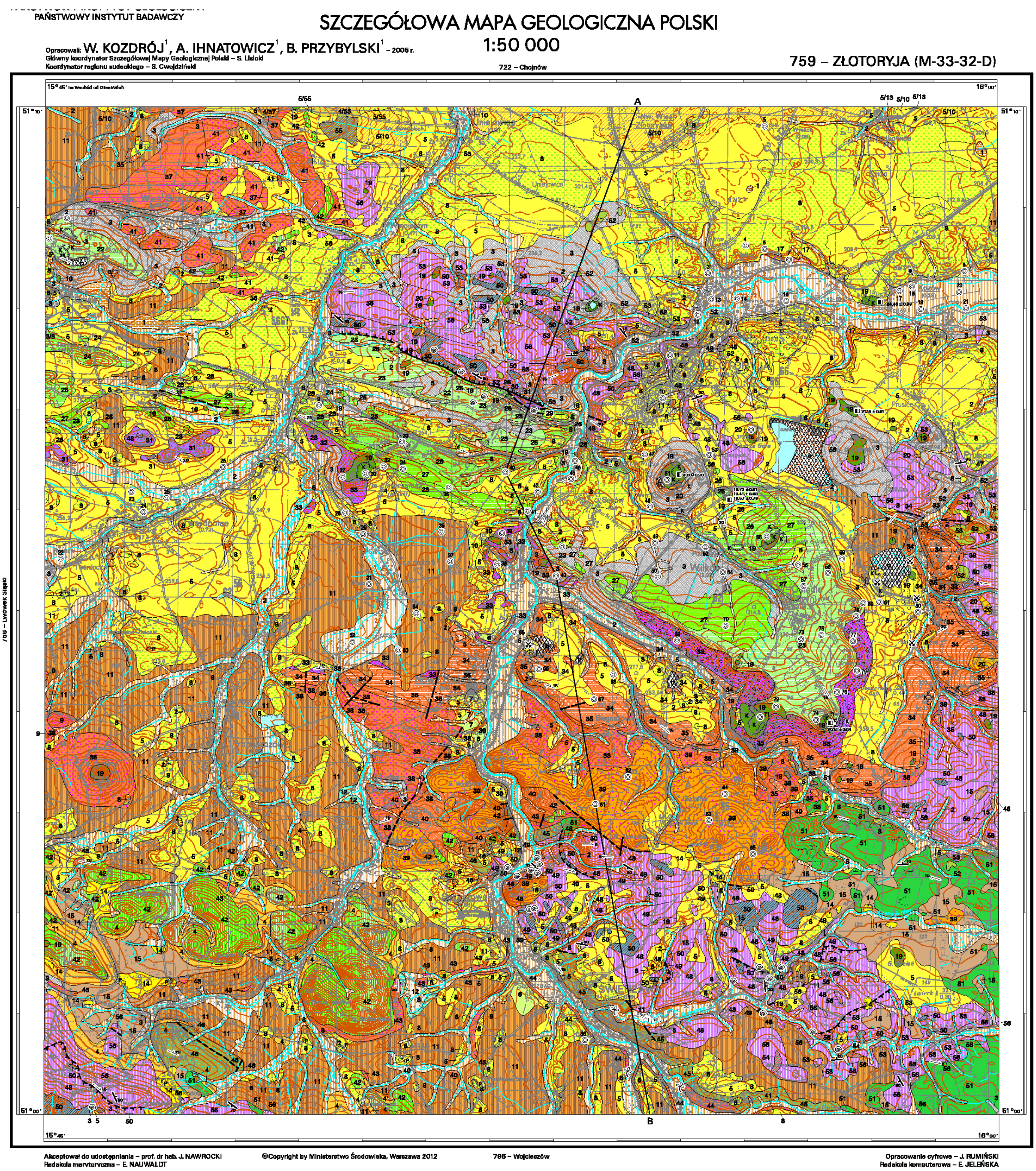
A full-length version is available and can be opened here:

_extendedAbstract\11_proceeding.*

The Detailed Geological Map of Poland (DGMP) in the scale of 1:50 000, being published by the Polish Geological Institute (PGI) since 1954 is one of the most important undertaking of polish geology. Due to the fact that, it combines information gathered during a field geological mapping (performed in scale 1:25 000), exploratory drillings, geophysical surveys, laboratory studies as well as archival results of geological researches, it forms the most complex geological compilation in the country. The whole DGMP edition comprises 1069 sheets. Each of it is a separate study consisting of a geological map in scale 1:50 000, geological cross sections, synthetic geological profiles, explanations of colours and symbols, published together with explanatory text, which describes geology of a given area in detail and includes thematic sketches in the scale of 1:100 000 (geomorphological and geological), results of laboratory analyses and additional attachments. The map is elaborated on the basis of an instruction (published for the first time in 1957, then subsequently updated in the following years), which defines principles of a construction procedure on every single stage, ranging from creating a project of geological works to preparing each map sheet for printing. The whole of the field works (started in 1953) was finished in 2009. It should be stressed that not only did the geologists from PGI take part in the geological mapping project, but also the specialists from the Polish Academy of Science, universities, geological enterprises and other private companies (about 100 authors in total). Until 1994 materials submitted by authors (after an adjustment in merythoric redaction) were delivered to geological publishing companies, where they were being prepared to print using traditional methods. In 1996 the first 10 map sheets were digitally elaborated by the use of the ArcSMGP application. This AML application was created on the basis of ArcInfo Workstation software (by ESRI) and Oracle database and is especially dedicated for the DGMP production. To these days, the same technology is applied for converting author's materials to a digital form as well as for preparing a final map composition. At present, digital and editorial works last – 128 sheets are planned to be published in a current tranche, that is by the end of June 2014. Besides, other 186 sheets will be left to a digital processing and print. Particular sheets, after a digitalization and suitable verification, compose coherent geological database, which enables storing vector data (primary map layers, cross sections and geological profiles in a coverage format) and rasters (hydrography, hypsometry, situation). The database structure is firstly systematized according to a geometry of objects, then to its subject area. Among data gathered in DGMP database and presented on the map, we can enumerate the following thematic layers: geological units, anthropogenic forms, boreholes, documentation points, open pit mines. Additionally, on various layers we find information about: eratic boulders, groundwater seepages, mineral appearance, an accumulation of mineral resources and fossil fuels, fossil flora and fauna findings, prehistoric findings etc. The last stage of works, leading to publishing of a map as a plotter print-out is a technical redaction that includes: checking digitally elaborated data compliance with author's materials in a traditional form, defining colour symbols for geological units (repeatable for entire series – currently over 1500 different symbols), preparing a composition of each DGMP sheet element and finally a composition of the whole map. Currently, works on a new technology usage for an editorial stage of a map production are being implemented. According to this, a map layout will be generated in ArcMap application and data will be stored in ESRI geodatabase format as it is done in case of other cartographical products in PGI.



DGMP sheet:
Example of the DGMP sheet in the scale of 1:50 000



geological map:
Example of a map composition

ORAL

Session S16-D

Glaciers in Mountain Cartography

Friday, 30 August, 2013

11:00 - 12:15

16D.1 | **GEOVISUALISATION OF ALPINE GLACIER ELEVATION CHANGES IN WESTERN CANADA** (#579)

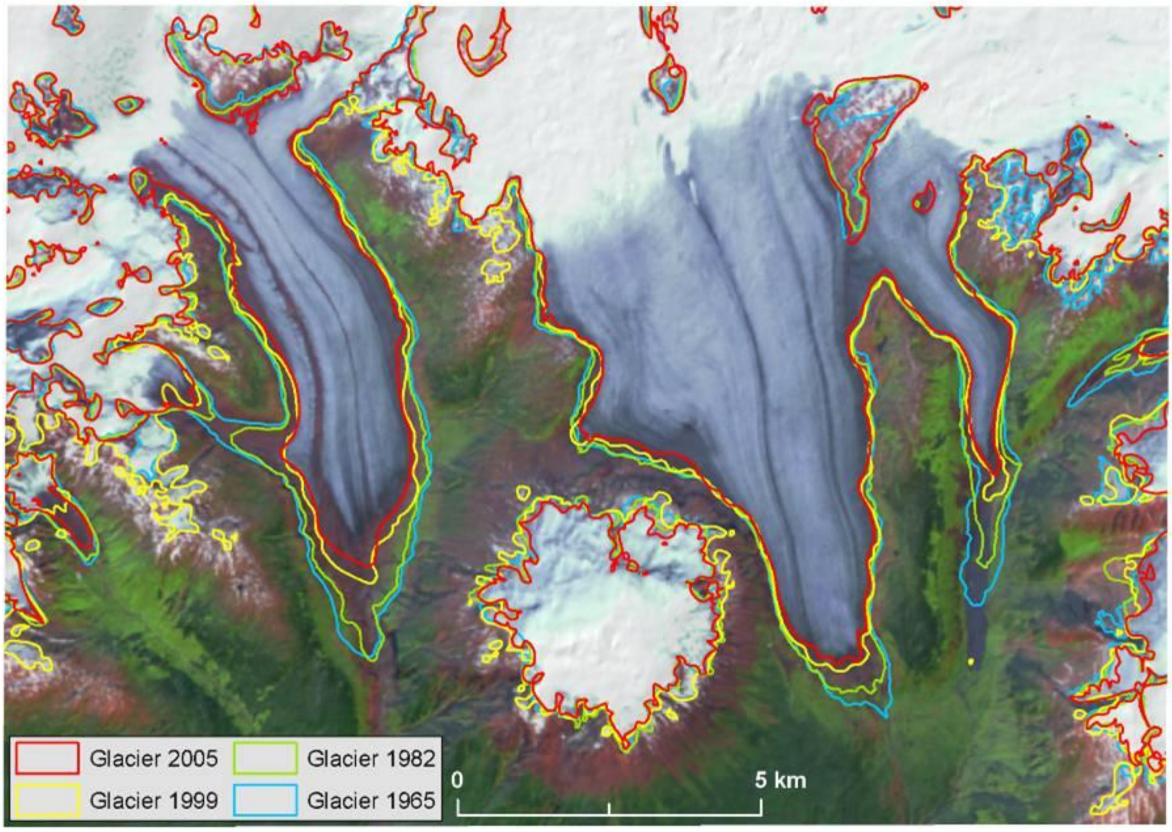
R. Wheate

University of Northern British Columbia, Natural Resources and Environmental Studies, Prince George, Canada

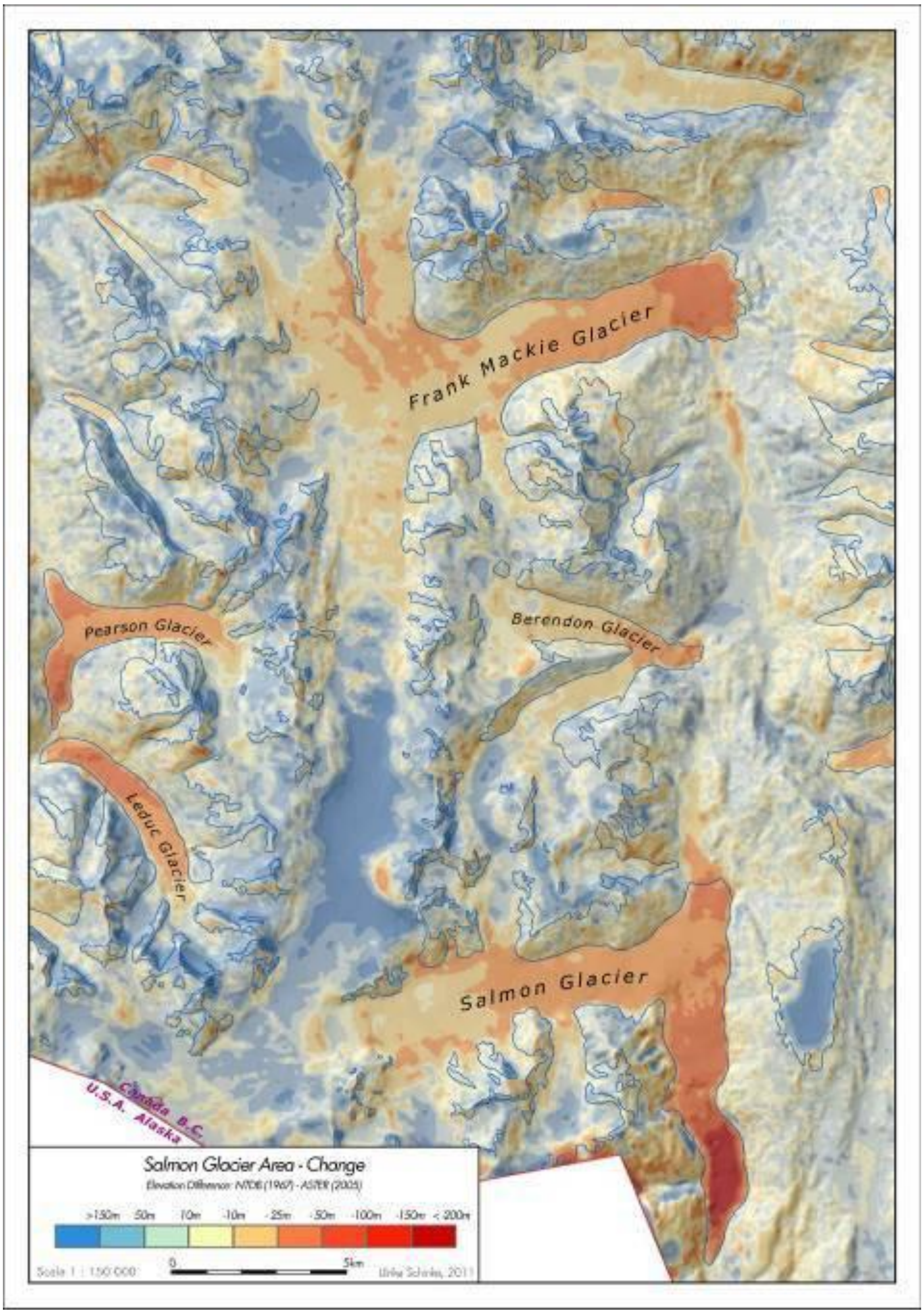
A full-length version is available and can be opened here:

_extendedAbstract\388_proceeding.*

Cartographic representation of glacier extents and elevations were largely considered to be static during much of the twentieth century; that is, mapping was presumed to show a stable environmental record. However continued warming over recent decades has generated the need to visualize past and present glacier configurations in high mountain landscapes. The depiction of retreat and area change is mostly achieved using a sequence of lines or polygons; however this often results in a set of near overlapping 'spaghetti-like' lines near the glacier front, which can only be minimized where individual glaciers are mapped at large scale (fig.1). In contrast glacier thinning or elevation change is widely experienced, and represents a more substantial overall indicator of ice loss and the inferred climate impact. Within a funded project to map and inventory the glaciers of western Canada in the provinces of Alberta and British Columbia (2005-2010), we collected multiple glacier extents and elevation models from sources that include topographic and digital mapping, and satellite imagery. For the whole region, we have a minimum of four digital terrain models (DTM), two of which are photogrammetric from federal (1950-90) and provincial topographic mapping (1980s), and two are satellite derived from the Shuttle Radar Topographic Mission (SRTM) 1999-2000, and the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global (G)DEM (mid-2000s). In select cases, we also have DTMs from historic mapping, further satellite imagery and LiDAR. From the DTM series, four difference maps can be generated using the isarithmic technique: one map for the change between each temporally adjacent pair of DTMs, and one covering the period between the earliest and most recent DTMs (fig.2). For direct comparisons, the mapping unit is converted from total elevation change in metres to annual average change in metres per year; this compensates for variation in the time interval between each pair of elevation data. The isarithmic sequence is optimized using a bichromate scheme with increasing orange-red tints for elevation loss (ablation) and blue tints for gain (accumulation). These are best displayed as a panel of map images. Typically they show a reduced rate of downwasting between 1970-90 to match the lower retreat rate and in some cases glacier advance documented in this period, as a result of cooler summer temperatures. In addition the later difference images reflect the increased rate from global warming since ~1990. The resulting images should be treated with some caution as consideration must be made for both potential bias and data quality. DTMs based on satellite imagery for example include tree canopy height in non-glacier vegetated areas, which infers elevation gains from the photogrammetric DTMs. They include other errors and data gaps due to shadow (SRTM) and clouds (GDEM). The photogrammetric DTMs are subject to lack of data due to high reflectance over icefields and accumulation areas. All DTMs are subject to issues of interpolation especially on steep slopes. Further geovisualisation involves the display of the sequence of four or more DTMs as shaded relief models or enhanced satellite data, both either as registered planimetric images, or as pseudo-3D images draped on their respective DTMs. These can be highly informative in revealing spatial patterns and minor terrain detail changes, involving both retreat and downwasting at frontal and lateral glacier boundaries. Continued warming, glacier retreat and downwasting ensure that this will remain a focus in mountain cartography over the 21^{st} century, along with an ever increasing array of new terrain data available from airborne LiDAR and spaceborne systems, and with improved spatial resolution and accuracy.



Hoodoo Glacier, BC:
Glacier extents 1965-2005 from mapping and satellite imagery, overlain on Landsat image 2010



Salmon Glacier, BC:
Glacier elevation changes 1967-2005: thinning in orange-red tints, thickening in blue (green)

16D.2 | **Interactive 3D-Visualisation of Glacier Changes Based on the Swiss World Atlas Interactive** (#874)

A. Bruengger, W. Samuel, L. Hurni
Institute of Cartography and Geoinformation, ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\175_proceeding.*

Glaciers are sensitive to changes in climate conditions and they react with clearly visible consequences. The observation and reconstruction of glacier changes over time has a long tradition in Switzerland. For more than a hundred years, data on glacier fluctuations in the Swiss Alps have been collected and evaluated. The most common way to map glacier changes is the traditional static 2D map, where several glacier states are drawn with coloured lines or surfaces. But the representations in a 2D map are limited. In this contribution we will present an innovative method for 3D visualisation for glacier changes based on one of the modules of the web-based Swiss World Atlas interactive. This Atlas provides tools to create and display block diagrams for limited territories as one of the main forms of interactive 3D visualisations. Visualisations for two regions in the Swiss Alps have been created, namely the region in the north of the Matterhorn with the Zmuttgletscher and the Bernina region with the Vadret da Tschierva and the Vadret da Roseg. After a short explanation of the functionalities in the Swiss World Atlas interactive we will show the capabilities for visualising glacier changes by means of traditional and interactive 2D maps. The advantages and limitations of different 2D representations will be shown and compared with 3D visualisations. We will detail the creation of a block diagram by presenting an overview of the workflow necessary to obtain a digital elevation model from a traditional 2D map with automatic vectorisation. Through the acquisition and creation of digital elevation models, based on contour lines of old maps, the glacier retreat can be visualised in 3D in a more attractive way. With the comparison of at least two digital elevation models and using 3D visualisation, it is possible to show not only the changes in length, but also in height. Therefore the glacier changes in height can be perceived more extensively in 3D block diagrams. To conclude, we discuss how 3D visualisation can support untrained map readers in better understanding glacier changes or other small scale landscape processes (e.g. volcano eruptions, rock falls, floodings). In an outlook we will propose ideas on future developments and functions, which could be implemented for the interactive 3D visualisation of glacier changes.

16D.3 | **Documentation of the glacier retreat in the eastern part of the Granatspitz Mountains (Austrian Alps) using aerial photographs for the time period 2003-2009** (#184)

V. Kaufmann

Graz University of Technology, Institute of Remote Sensing and Photogrammetry, Austria

A full-length version of this contribution has been published in: The Cartographic Journal, Vol. 50, Number 3 (August 2013), Page 232

This paper documents ongoing glacier retreat in the eastern part of the Granatspitz Mountains (Hohe Tauern Range, Austrian Alps) for the time period 2003-2009 using aerial photogrammetry. Aerial photographs of 2003, 2006, and 2009 were made available by the Hydrological Service of the Regional Government of Salzburg, the Federal Office of Metrology, Surveying and Mapping, Vienna, and the Regional Government of the Tyrol, respectively. High resolution multi-temporal digital elevation models and digital orthophotos of the area of interest were derived using digital photogrammetric methods to provide a sound basis for glaciological research. Glacier outlines of the three glacial stages were mapped interactively. Temporal change in area and surface height of the glaciers mapped clearly document glacier retreat. Glacier mass balance based on the geodetic method was calculated for Stubacher Sonnblickkees (Glacier). Mean annual specific net balance amounts to -656 mm w.e. for the time period 2003-2009, with a mass balance gradient of 324 mm w.e. $(100\ m)^{-1}$ and an equilibrium-line altitude (ELA) of 2995 m a.s.l.. Digital orthophoto maps and other thematic maps, e.g., showing surface height change, were prepared to support further data interpretation. Both the study area and its spatio-temporal change were visualized with special emphasis on the glaciers in a computer generated video film. Another film (exposure 29 August 2011) shows the lower part of Stubacher Sonnblickkees and its surroundings for reasons of comparison.

16D.4 | **The suitability of historical satellite imagery for investigations of the cryosphere** (#1422)

T. Pieczonka[1], N. Holzer[1], J. Peters[1], T. Bolch[1,2], M. Buchroithner[1]

[1]TU Dresden, Institute of Cartography, Germany; [2]University of Zurich, Department of Geography, Zuerich, Switzerland

The cryosphere represented by glaciers, snow, permafrost and seasonally frozen ground forms a large natural storage of fresh water. In combination with non-glacial runoff they are an important water source for sustaining the lives of 1.4 billion people living downstream the large Asian rivers such as the Tarim, Indus, Brahmaputra and Ganges. The climate system and the cryosphere are linked in numerous ways, as an increased annual runoff at several gauges show. Thus, changes in the cryosphere and the local climate may have severe consequences for the future livelihood of local people. Long-term information about the glaciers´ behaviour in such remote mountain areas are however scarce, and field based data collection and research is often hampered by highly inaccessible terrain and harsh climatic conditions. However, remote sensing technologies offer even in such regions the possibility to investigate important characteristics of the glaciers and their variations over the last decades. Satellite missions for scientific purposes dates back to the 1970s; however, the first space images, dedicated to military purposes (e.g. Corona), originate in the early 1960s. The declassification and accessibility of high resolution reconnaissance images such as Corona and Hexagon offer huge potentials for historical research. This long period of recording makes it possible to compare the state of the cryosphere at different time steps and to trace changes. Our investigations aim to detect such changes comprising glacier area and thickness. Here, we want to show the possibilities and potentials of current and historical satellite data to fulfill the expectations in terms of accuracy and reliability. We specify the data used, discuss their benefits and disadvantages and present methods to enhance their usability and accuracy. A central part of these investigations are glacier thickness changes which can be assessed using high-resolution stereo imagery to generate digital terrain models (DTM). The stereo capability of the missions offers possibilities by combining results from stereo Corona and Hexagon with recent remote sensing data as from SPOT-5, ALOS PRISM and Cartosat-1. We were able to generate multi-temporal DTMs for the Mt. Everest Area for 1962, 1970, 1984, 2002 and 2007. For the Central Tien Shan DTMs for 1974/76 and 2009, and for the Mustag Ata / Kongur Shan region DTMs of 1973 and 2009 could be produced. The main challenge of employing Corona imagery is the complex panoramic distortion. It has to be handled by a mathematical approach or empirically using ground control points (GCPs). The KH-9 data of the Hexagon mission do not have such panoramic distortion. Moreover, they contain a Reseau grid, which can be used to remove internal film distortions. Beside these geometrical problems the images feature radiometric errors like vertical stripes probably inserted in the digital scanning process. A bundle of semi-automatic pre-processing methods was used to handle the mentioned drawbacks considering particularly the limitation of ground truth references. In order to obtain accurate results, careful co-registration of multi-temporal DTMs is required. This was obtained by using an analytical approach describing the relation between the measured elevation differences of non-glacial areas and the corresponding slope and aspect values at a certain pixel position. Work is underway to analyse the volume changes more in detail and to extend the investigated glaciers to further areas on the Tibetan Pleateau and the Central Tien Shan within the framework of the Sino-German projects “Aksu-Tarim”, “SuMaRiO”, “TiP”, and “WET”.

ORAL

Session S16-E

Historical Survey and Mapping

Friday, 30 August, 2013

11:00 - 12:15

16E.1 | **"Residentiekaarten", contents and usability of the 19th century topographical maps of Java** (#549)

F. Ormeling

Utrecht University, Faculty of Geosciences, Netherlands

A full-length version is available and can be opened here:

_extendedAbstract\48_proceeding.*

The “Residentiekaart” of Java and Madura islands, produced from 1853-1910 at the scale 1:100 000 received gold medals at a number of world exhibitions because of the advanced reproduction techniques used for its production. Charles Eckstein, master printer and later director of the topographic survey of the Netherlands, had devised a lithographic printing process that allowed for a whole range of tints to be printed from each of the four lithographic stones used for each map sheet, a precursor of the later offset printing really. This reproduction aspect of the fine multi-coloured maps (the contents were differentiated in some 30 colours) overshadowed any discussion of the contents, which was just as unique for a topographic map of a densely settled tropical area in the 1850s. In 1853 the Dutch colonial authorities decided to extend the survey for the production of a 1:100 000 map of Batavia residency (Java was subdivided into 22 administrative districts or residencies) to the whole island. The consecutive survey by indigenous surveyors, overseen by army officers went hand in hand with a trigonometrical and a statistical survey, and the last item made available the detailed land-use information used for the series. The maps were drawn in the ‘Topographische Inrichting’ in Batavia, and sent to the topographical survey in The Hague, Netherlands, for reproduction. Apart from topographic information (wooden or stone buildings, Muslim, Chinese or Christian cemeteries, 6 road categories, roadside accommodation, milestones, post stations, railway and tramway lines, 6 different kinds of bridges, telegraph lines, administrative infrastructure and boundaries, health services, water conduits, fortifications and antiquities (Buddhist and Hindu temples), anchorages, monuments and springs) 30 land use categories can be discerned on the map : various export crop plantations, dry or irrigated rice cultivation, different forest types and wastelands. The emerging agro-industrial infrastructure is shown as well, with factories, hulling mills, brickworks, storehouses and depots, lime kilns, and quarries. To render all this information on a map 1:100 000 is a major feat, and extracting this information from the map as well! The surveys had been done at the scale 1:20 000, and the information collected was then generalized to fit the 1:100 000 scale. Lettering was rather bold and the relief portrayal (modified Lehmann hachures) did not help to get a clear picture of the various land use categories without the use of a magnifying glass. The fact that 19th century newspapers from the Dutch East Indies now are accessible on line, helps in assessing the contemporary reactions to this map series and its use. The paper shows the possibilities for use of this map series, compares the image of these 19th century maps to that of maps produced in the middle of the 20th century, in order to assess the changes in the cultural landscape, in the agrarian infrastructure and in the extension of the settlements. Unfortunately, the base maps 1:20 000 for this map series are lost, and it is now impossible to assess the accuracy of the land use depiction. Even so, the simultaneous statistical survey guarantees that the land use depiction per enumeration unit cannot have been much misrepresented. It is a unique map series because of its contents as well.

Figure 1:
Land use on the Dieng Plateau

16E.2 | **A less known topographic survey: a 1: 50 000 Scale Military Survey of Hungary (1940-1944)** (#1205)

L. Zentai

Eötvös University, Cartography and Geoinformatics, Budapest, Hungary

A full-length version is available and can be opened here:

_extendedAbstract\194_proceeding.*

The 1: 50 000 scale Military Survey is one of the less known and researched surveys of Hungary. The survey was carried out during WWII, so due to the political changes (the first and second Vienna Awards) of that time the mapped area included also parts of the present area of Romania, Slovakia and Serbia. In 1940, Hungary introduced a new scale in its topographic mapping, the 1: 50 000, to replace both the former 1: 25 000 and 1: 75 000 scale maps. The original idea was to publish the new sheets (relief representation with contour lines) in 10-15 years, but due to the WWII the whole survey was carried out till 1944 (the WWII affected Hungarian territories only from autumn 1944). The lack of time caused the mappers to omit the conversion of Lehmann hachures into contour lines on most of the sheets. The 1: 50 000 survey was theoretically based on the 3rd Military Survey of Austria-Hungary. Altogether 403 sheets were published. The overall result cannot be a homogenous set of sheets, but the mapmakers tried to do their best. This was the last survey of Hungary where the relief depiction was a little bit artistic, but the engineering style became more and more dominant and for both military and civil topographic mapping the use of contour lines became the only method for the relief description. There were five different representations:

- Photographically reduced size sheets based on the 1:25 000 scale survey (1927-1940). Colour offset printed with contour lines.
- Photographically enlarged size sheets based on the 1:75 000 scale survey (1927-1940). Most of the sheets were colour offset printed with contour lines.
- Regained territories: photographically reduced size sheets based on the 1:25 000 scale maps of the Third Military Survey updated by using photogrammetry (can be treated as newly surveyed sheets).
- Southern Areas (Voivodina area): Reproduction of the 1:50 000 sheets originally published by the Yugoslavian Military Geographic Institute (partly updated: colour offset printed with contour lines).
- Most of the sheets were published as a photographically enlarged size sheets based on the 1:75 000 scale map sheets of the Third Military Survey. It was mostly a two-colour offset print: black and green for the forested areas (only approximate position). Relief representation is remained Lehmann hachures.

After the WWII (1948–1950) the sheets were republished (for the recent area of Hungary only), practically it was a reprint with the representation of the new borders. Although these sheets were used only for limited period as the first Soviet style Gauss-Krüger military survey was come off between 1950–1952, but this topographic survey is part of the Hungarian cartographic heritage demonstrating that cartographers were managing their job even in special circumstances.

16E.3 | **1:1 Million scale mapping of India and the International Map of the World** (#793)

D. Forrest[1], A. Pearson[2]

[1]University of Glasgow, School of Geographical & Earth Sciences, Great Britain; [2]University of Portsmouth, Department of Geography, Great Britain

By the latter part of the nineteenth century the Survey of India had made significant progress towards surveying the whole of India and publishing topographic maps at a variety of scales including mapping of the provinces at 16 miles to the inch (1:1,013,760). In the early years of the twentieth century, the Survey of India was subject to a major review. The Governor-General in Council appointed the Indian Survey Committee which first met late in 1904 and reported in 1905. One of the key recommendations was that the 16 inch to the mile scale series of Provincial maps should be replace by a new series of engraved maps at 1:1 million-scale. This new series, known as the 'India and Adjacent Countries' series, covered not only India but the surrounding territories mostly under British control. Initially this new series was redrawn from older topographic maps and did not include contours but as new larger scale topographic mapping became available, more detailed relief representation was included and several sheets exist in a variety of versions with contours, layer colours and/or shading. The creation of this new series was significant as apart from serving as a general map series in it own right, it served as the basis for the whole organisation of Indian topographic mapping. Parallel to these developments, the idea of the International Map of the World (IMW) had been conceived and presented by Professor Albrecht Penk at the Fifth International Geographical Congress (IGC) in 1891. Discussion at this and subsequent IGCs culminated in a special conference on the IMW held in London in 1909 at which initial specifications for the map were adopted. The Survey of India was not represented at this conference directly, although in theory it was represented indirectly by the British delegation. This was unfortunate as by this time the Survey of India had gained significant experience of mapping at this scale and had made significant investigations into their design and production. By 1911 the Survey of India received communication from the War Office in London, suggesting that its million-scale mapping should be brought into line with the specification of the International Map. The War Office saw no conflict between the existing mapping of India and this new international series and the Government of India duly accepted the recommendation. As the IMW and the Survey of India Mapping were not compatible in terms of projection, sheet numbering, sheet lines and cartographic design, the IMW was introduced as a separate series and co-existed with the 'India and Adjacent Countries' series until the mid-twentieth century. This paper will examine examples from the 'India and Adjacent Countries' series to illustrate its contribution to developments in topographic map design and production during the early part of the twentieth century. It will also take the opportunity to assess the accuracy of this series, particularly those sheets that cover some of the most challenging environments on earth, the Himalayas.

16E.4 | **The Springboks in East Africa: The role of the SA Survey Company (SAEC) in the East African Campaign of World War II, 1939-1941** (#434)

E. Liebenberg

University of South Africa, Department of Geography, Pretoria, South Africa

A full-length version is available and can be opened here:

_extendedAbstract\116_proceeding.*

When Italy entered the War on the side of Germany in June 1940, the Italian territories in East Africa comprised Abyssinia together with Eritrea, now part of Ethiopia, and Italian Somaliland, now part of the Somali Democratic Republic. Italy's involvement extended the war frontier to north-east Africa, and the Union of South Africa, as a member of the Commonwealth, officially joined Britain's war effort on 11 June 1940. The South African forces (commonly known in the media as "Springboks") played a major role in the fall of Mussolini's East African Empire. Due to the climate, topography and low level of economic development of the area, the war was fought under extreme physical circumstances. With northern Kenya and British Somaliland being dry desert areas and Abyssinia a country of high mountains and deep ravines, it was especially the SAEC (South African Engineering Corps) which rendered an invaluable service in drilling boreholes, constructing roads, building bridges and providing the general infrastructure for military operations. Since 1941 ample literature has been published lauding the contribution of the SAEC as a whole to the Allied victory in East Africa. In contrast, almost nothing has been written on the key role played by one of its units, namely the SA Survey Company (initially named the1st Field Survey Company), for its contribution in mapping parts of the war zone and providing essential military intelligence. By 1940 East Africa was still largely unmapped as the only available maps covering Abyssinia were the standard GSGS 1 : 2 000 000 series of Africa and some 1 : 400 000 Italian maps of which only a few sheets had been secured. As reliable maps are a prerequisite for modern warfare, the task partly fell to the SA Survey Company to map the war frontier on a scale of 1 : 500 000 using data from existing maps supplemented by their own observations. This programme was later extended to also include the production of sheets on a 1 : 250 000 and a 1 : 25 000 scale. To make this possible, valuable support was provided by the No. 60 (Photographic Squadron) of the South African Air Force. This paper deals with the formation and subsequent deployment of the SA Survey Company in Kenya, Abyssinia and Somaliland, and the achievements of its Field Sections, Geodetic Section, Map Production Group, Photo-Topo Group and Map Production Group. The maps which were produced are analysed against the background of the available source material and prevailing circumstances and their quality and style compared to contemporary military maps on the same scale issued during the War by the Union Defence Force in South Africa.

ORAL

Session S16-F

Cartographic Learning Environments

Friday, 30 August, 2013

11:00 - 12:15

16F.1 | **The Web-Based "Swiss World Atlas Interactive": First Evaluation of User Experiences in Modern Geography Education** (#420)

C. Haeberling, L. Hurni

Institute of Cartography and Geoinformation, ETH Zurich, Switzerland

A full-length version is available and can be opened here:

_extendedAbstract\250_proceeding.*

Since its launch in October 2010, the "Swiss World Atlas Interactive" has become a popular teaching tool for geography instructors in Swiss secondary schools. For teachers as well as for students, this web-based and freely accessible atlas is an ideal complement to the most widely used printed school atlas in Switzerland, the "Swiss World Atlas". After two years of further development, many topographic and thematic map representations of the traditional analogue school atlas are now implemented in the electronic version as interactive 2D maps or as block diagrams. Additionally, most global topics are integrated as thematic layers on a virtual globe. All representations are graphically optimized for screen display and enriched with additional interactive functionality. The user-friendly design of the atlas is suited for most teaching purposes. For instance, thematic maps can easily be controlled by switching on and off map layers and navigation tools such as zooming or synchronizing are very intuitive. The available visualization modes can be applied in different teaching situations to manifest the full potential of the interactive atlas. Compared to the static representations in the printed version, the flexible use of the interactive representations as wall maps, as illustrations for presentations, or as a source for worksheets implies a high added value for both teachers and students. The current implementation of the interactive atlas is successful, especially due to the user-friendliness of the graphical user interface and the didactic value of the already integrated representations. We evaluated user feedback from teachers using the atlas in class or for preparing lessons to identify current challenges. Due to the still limited numbers of maps compared to the print version, teachers hesitate to use the electronic version for student assignments. Moreover, the IT equipment in many classrooms or student computer labs is insufficient, so that teachers avoid the laborious operation during the lessons. Further development will focus on improving the day-to-day applicability of the atlas in general, and auxiliary workshops and presentations will be offered to increase awareness and adoption rate. Finally, future development of the "Swiss World Atlas Interactive" will include new thematic content (e.g. desertification, global migration, climate change), adaptation of the atlas architecture to HTML 5 technology, and optimization of digital teaching materials for tablet computers as an alternative to desktop or notebook computers.

16F.2 | **Virtual GIS laboratory for educational needs** (#740)

A. Medvedev

Institute of geography of Russian Academy of Sciences, Department of cartography, Moscow, Russia

Web-laboratory is based on a technology platform UniHUB (http://www.unihub.ru), developed by the Institute of System Programming, and is aimed at the integration of remote sensing data for the Earth sciences. An information system with client-server architecture is focused on the scientific and educational community and is intended for joint research work of its members in a single workspace, providing a search for sources of spatial data, the formation of databases, data access, including external resources, open web services, applications and training materials. Cloud environment of UniHUB is used to solve geographic problems, including the handling of satellite images and digital elevation models using open sources for the methods and techniques of spatial analysis, GIS tools, geomodeling. Collaborate virtual laboratory and its members organized through a single work space and interaction of information-based process portal solutions, and web services. It is universal "point of entry" to the stage of authorized users with access to files and programs, the formation of file storage and document sharing access rights to data, documents and software applications, work control (distribution of tasks and performance control, archives and version control of documents). The user has the ability to find information in the file repository of spatial data - directory of remote sensing data, digital elevation models, GIS projects, etc., and keep the information in the user's workspace, having carried out the selection of thematic data and other cartographic materials of various sizes. The laboratory is based not only on the software applications installed in the workspace, but also training materials and inputs, which allow to use the laboratory for educational purposes. The benefits of this solution are: - Versatility - the application can be easily customized in accordance with the purpose and set of required user functions; - Ease of use - users are able to master their own application in a short time. All the data needed by the user is extracted not only from file storage laboratory, but also of open distributed web services which provide access to remote sensing data. The relevant data is sent to the processing according to specific procedures for analysis or to find new additional data. During his time "GIS-laboratory" was presented to educate students of Geographical Faculty of Moscow State Lomonosov University. The work in the laboratory is introduced in the educational process and is present in the curriculum of third year students. The laboratory also is used by the students of Moscow State University of Geodesy and Cartography (MIIGAiK) through practical training at the Institute of Geography RAS. In the course of practice and training in the Laboratory the students got the skills in using digital elevation models, and in particular obtaining morphometric characteristics of the terrain. The usage of the "GIS-lab" helped to obtain a number of new results in the formation of mating information flow of remote sensing data from different sources, "design" of the new knowledge-based storage arrays, and the organization of the data interface for scientists and students in specific areas of applied research in the sciences ground.

16F.3 | **PaikkaOppi - a virtual learning environment on geographic information for upper secondary school** (#258)

J. Kähkönen[1], L. Lehto[1], J. Riihelä[2]

[1]Finnish Geodetic Insitute, Geoinformatics and Cartography, Masala, Finland; [2]University of Turku, Department of Geography and Geology, Finland

A full-length version is available and can be opened here:

_extendedAbstract\60_proceeding.*

Education related to the cartography and geographic information has a long and interesting history. It goes from traditional map atlases to first cumbersome computer-based applications to more advanced desktop GIS applications and, finally, to computer networks, Web services and advanced browser-based map interfaces. The use of the network infrastructure in geographic information-related education can provide many benefits on the upper secondary school level. Introduction of modern Spatial Data Infrastructures (SDIs) with network-accessible, standardized content services offers a great potential for schools. At the same time the general development towards open service interfaces, Open Source software and open data may greatly benefit schools that struggle with limited budget and personnel resources. PaikkaOppi was a four-year project (2008-2012), funded by the Finnish National Board of Education. Regional Council of Southwest Finland coordinated the project. The consortium included several educational institutions and a private company responsible for the technical development. Finnish Geodetic Institute participated as an expert on geospatial Web services and their standardization. The main result of the PaikkaOppi –project is a Web-based learning environment, designed to support education that somehow relates to geographic information. PaikkaOppi is a Web-based service that integrates geospatial content from several distributed sources and enables its visualization in various ways. It also supports creation and storing of user-generated content. The technical implementation of the PaikkaOppi service is based on Open Geospatial Consortium’s service interface specifications and the use of Open Source applications that support them. The main roles identified in the context of the PaikkaOppi service are the student, teacher, data provider and service provider. In the following the PaikkaOppi service is described from the viewpoint of each of these roles. For the student PaikkaOppi is a Web browser-based learning environment. The main component of the user interface is a map view that integrates geospatial content from various different providers. The user interface is designed to be intuitive and easy to use. The student is completely relieved from the complicated issues related to spatial data acquisition, harmonization and integration and can fully focus on using and understanding spatial data in visual form. The student can draw on the map to create new spatial content, add attribute information, images and video content, and share the result with his fellow students. For the teacher PaikkaOppi is a tool that facilitates introduction of spatial viewpoint to the curriculum in context of various subjects. The teacher does not need to acquire and install applications or geospatial data sets. All components of the system are kept up-to-date automatically and the teacher can just focus on the core issue: helping the student to understand spatial information and its use in different problems. From the data provider’s viewpoint the use of Web services makes it easier to deliver content. Standardized service interfaces and content encodings simplify the provision of geospatial data to schools. There is no need to support various file formats, as the only requirement is to set up a service implementation that follows standardized access protocols. The PaikkaOppi service provider maintains the user rights information, data storage for user-generated content and a data cache for improved performance. The service provider maintains the PaikkaOppi user interface too. The future improvements of the PaikkaOppi service include better sharing of user-generated content between schools, introduction to crowd-sourced data sets and campaigns for countrywide co-operative data collection. A good example could be observations of bird migrations.

16F.4 | **THE ROLE OF UNIVERSITIES IN THE BRAZILIAN NSDI CAPACITY BUILDING PLAN – THE CASE OF THE OPEN GEOSPATIAL LABORATORY AT UFPR** (#767)

S. Camboim, M. C. B. Brandalize
Federal University of Paraná - UFPR, Geomatics, Curitiba, Brazil

A full-length version is available and can be opened here:

_extendedAbstract\430_proceeding.*

ORAL

Session S16-G

Mixed Session

Friday, 30 August, 2013

11:00 - 12:15

16G.1 | **Impact of Spot6/7 data in the constitution and update of Spatial Data Infrastructures over Africa** (#942)

K. Guerin[1], T. Rousselin[1], M. Bernard[2]

[1]Geo212, Paris, France; [2]Astrium GEO-Information Services, Customer Services, Toulouse Cedex 4, France

A full-length version is available and can be opened here:

_extendedAbstract\299_proceeding.*

Over the past ten years, *Spot 5* has been the cornerstone of large Spatial Data Infrastructures (SDI) all over the world. Its main assets were the very large coverage offered by its 60 km swath and a spatial resolution fitted for 1:50 000 to 1:100 000 projects. Our team has been in charge of choosing imagery for defense and oil & gas cartographic projects over large parts of Africa and Asia and Spot 5 proved to be very effective for those requirements. Spot 6 and 7 launches allow maintaining and extending those efforts through the next decade. Stakeholders of large cartographic projects obviously need continuity. The development of a modern SDI is a lengthy process which requires multiple investments: in capital expenses but also in the building of a complex production ecosystem (with image providers & producers) and in the development of a shared knowledge basis. These investments being done, the capability to offer data continuity for change detection or for updating is a strong requirement. *Spot 6/7* maintain key characteristics (both in terms of satellite performances and service) which guarantee the continuity of a High Resolution (HR) offer fitted for medium scale cartographic projects. But new distribution services like streaming are suited to a new way to monitor change, assess the SDI obsolescence and give stakeholder objective elements to decide on the need for update (where, when and how?). *Spot 6/7* also propose multiple improvements which potentially overcome some traditional collection and production bottlenecks. First the new agility of the two satellites allows a much easier collection, especially over large surfaces. Furthermore, this coverage capacity is reinforced by an efficient tasking system, based upon 6 tasking plans per day and finer weather forecast. This increases both reactivity and quality of acquisitions in terms of cloud coverage. This really matters when seasonal constraints impact the quality of the end product. For instance, an efficient data collection process over the river Niger needs to adjust to the seasonal flooding of surrounding areas, progressively moving downstream. Second, the availability of a blue spectral band will enhance product relevance and interpretation over shorelines, and enable the production (and screen display) of really true colors. Last, the spatial resolution improvement has a decisive impact for the analysis of small to medium cities where *Spot 5* resolution was inadequate and Very High Resolution (VHR) data too expensive. *Spot 6/7* take part in a satellite constellation which also includes *Pleiades 1A* and *1B*. The phased orbit and synergies (same operator and provider, coherent tasking system) are essential for data access and collection optimization. Having led a lot of multiscale projects optimizing (technically and financially) HR and VHR data, we clearly will benefit from an integrated solution, using the same geometric reference and provided in the same format. If continuity as aforementioned is a key factor, *Spot 6/7* nevertheless is a source for evolving requirements. Ten years ago, geospatial expectations in developing countries where linked to the production of base maps. Today large areas are available at 1:50 000. Hence, there is a shift in expectations from base maps to value added geospatial products, performing operational functions, associating geospatial and other data, to provide user with HSEC risks analysis (Health, Security, Environment, human Communities …). To conduct those analysis at a country or regional level, complete, detailed and regular coverage is mandatory and *Spot 6/7* provide a unique combination. The paper will present our results performed from *Spot 6* and *Pléiades* data coverages tasked for case studies for SDI needs in Cameroon, Senegal and Chad. We will illustrate the benefits in spatial analysis, which could fulfill the needs of SDI projects (either building a new SDI or updating an existing one), both technically and economically.

16G.2 | **GIS Data within a Seamlessly Integrated 3D Environment** (#745)

R. Gammon, V. Smith, B. Westcott
Intergraph, Huntsville, United States

A full-length version is available and can be opened here:

_extendedAbstract\435_proceeding.*

For decades, users of GIS technologies have been investing in the compilation, maintenance, and deployment of GIS databases. Today's GIS databases tend to be extremely large and robust, accurately reflecting historical changes and the plethora of assets within the real world. These databases have typically been collected and stored using both 2D and 2.5D features, and as a result, they do not lend themselves well to display within a 3D environment. With 3D becoming a commonly used method of geospatial processing, there is a growing need for a system that unites a corporation's GIS data and 3D visualization. Specifically, a system that someone with little to no training can use to connect to a wide variety of GIS databases and rapidly visualize and interact with them in a 3D environment. During this presentation, we will illustrate how GeoMedia can be used in tandem with GeoMedia 3D to meet this need. Specifically, we will investigate how GeoMedia technologies can be used to quickly connect to a collection of disparate GIS databases and easily render their data inside a 3D environment as realistic representations and thematic 3D maps. Realistic renditions of our world are important because they can provide situational awareness; however, additional power lies in coupling the realistic representations of the world with a robust collection of thematic 3D mapping capabilities. Thematic 3D maps augment our understanding of spatial phenomena as they distill complex spatial phenomena into simple, easy-to-interpret representations. More specifically, 3D thematic maps allow the reader to better understand relationships within seemingly unconnected, unrelated data. Therefore, 3D thematic maps can be used to facilitate the decision-making process and lead to quicker and more confident decisions.

16G.3 | **Research and Application of Two-peak Changing Law of Electronic Map Load** (#409)

N. Jiang, Q. Sun, Y. Cao, H. Zhang, Y. Gu
Information Engineering University, map and gis, Zhengzhou, China

A full-length version is available and can be opened here:

_extendedAbstract\16_proceeding.*

Session S16-H

Business Meeting of the Commission on Digital Technologies in Cartographic Heritage

Friday, 30 August, 2013

11:00 - 12:15

Session S16-I

Business Meeting of the Commission on Cartography in Early Warning and Crisis Management

Friday, 30 August, 2013

11:00 - 12:15