1 Abstract

This full paper reflects my diploma work. It inquires into defining and definitions of the interactive maps. It is also investigating the change of paradigm in cartography. Focus is in the concept and content of interactive maps, as like as examples from the micro-region of Letovice. There is a attempt of pronouncing general rules for interactive maps on the basis of my own practices. The end of this work is SWOT analysis.

2 Key words

Interactivity, Internet, content of maps, technical requirements, use.

3 Introduction

Peterson et al. (2003) says: before describing the elements of interactive maps it is appropriate to briefly outline their predecessors – Hypermaps and Interactive Multimedia maps, delivered on stand-alone computers from hard disk or CD-ROM.

The term Hypermap was coined by Laurini and Miller-Raffort in 1990. They saw Hypermaps as an unique of using multimedia with GIS. The Hypermap was described as an interactive, digitized multimedia map that allowed users to zoom and find locations using a hyperlinked gazetteer (Cotton and Oliver, 1994). Geographic access is provided via
coordinate-based access in which by clicking a point or a region on a map retrieves all information relating to that point (similar functionality to today’s ArcGIS “Identify” button). Many hypermapping products were developed using HyperCard “stacks” on Macintosh platforms. Examples of hypermap atlases produced using HyperCard are La Francophonie nord-américaine à la carte (North American French-speaking communities á la carte) and Mines et minéraux à la carte (Mines and Minerals á la carte), (Raveneau et al., 1991).

Interactive multimedia maps became popular with the introduction of the CD-ROM. Initial products on this medium, like the Digital Chart of the World (DCW) and the World Vector Shoreline (Lauer, 1991), exploited the storage capacity of the medium (approx. 640 MB initially). Once the CD-ROM readers became a “standard” personal computer accessory, the potential for provision of interactive “rich media” geospatial products was realized. Many products were developed, including atlases, street directories, and historical map collections.

The internet, and more particularly the use of the World Wide Web, has meant that the cartographers are now able to deliver their products directly to the consumer. With the general acceptance of this technology this meant that the delivery mechanism was in-place and cartographers now could concentrate on designing and producing innovative geospatial products. These include collections of images made through scanned paper maps, data files that can be downloaded to a client’s computer and then re-drawn locally, information services that include maps, Web atlases, online Geographic Information Systems (GIS) that enable users to log into databases maintained by spatial information resource providers, and multimedia mapping packages that work as well on-line as similar products (Cartwright, 2002).

4 Definitions and the paradigm of the Interactive maps

Interactive maps are defined by the list of terms and definitions in Strategical ICA plan 2003 – 2011. There is written:

“Maps have additional functionalities, e.g.: can be:

... Interactive ... Containing hyperlinks to connect with additional information within the related database, thus offering sources well beyond their visible content. Acting as hyperlinked interfaces to help users navigate through geospace. Via associated network-linked databases of geospatially-related information. Designed with new variables such as sound.”
According to this I have created following categories of interactive maps:

1) **in compliance with used transfer media:**
   - Internet: interactive map is located on the internet server and is connected to various databases on the internet
   - Intranet: interactive map is located on a LAN (Local Area Network) and does not contain hyperlinks to databases on the internet
   - Local: map nad the database is located on the same computer
   - Hybrid: map is located on the internet, intranet or local computer and is connected to various databases on the internet, intranet or local databases

2) **in compliance with used multimedia (hypermedia):**
   - Textual: providing additional textual information, e.g. in form of the www page
   - Pictorial: after some event (click, etc.) will show e.g. photography of the object
   - Animated: with animations, including videos = dynamic interactive maps
   - Acoustical: with sound as a new functionality to selected elements in the map
   - Reciprocal combinations

3) **in compliance with space representations:**
   - 2D interactive maps
   - 3D interactive maps

With start of Interactive maps comes also the change of paradigm. Paradigm of the information transfer is shown in Figure 1.

![Figure 1: Paradigm of the information transfer (for paper and non-interactive maps).](Kolacny, 1967)
I didn’t find any paradigm of interactive maps in literature so I made my own example. It is shown in Figure 2. Commission on Maps and the internet says that the Internet has redefined how maps are used. No longer restricted to paper, maps are now transmitted almost instantly and delivered to the user in a fraction of the time required to distribute maps on paper. They are viewed in a more timely fashion. Weather maps, for example, are updated continuously throughout the day. Most importantly, maps on the Internet are more interactive. They are accessed through a hyperlinking structure that makes it possible to engage the map user on a higher-level than is possible with a map on paper. Finally, the Internet is making it possible to more easily distribute different kinds of cartographic displays such as animations. The Internet presents the map user with both a faster method of map distribution and different forms of mapping.

Figure 2: Two-channels example of the paradigm of interactive maps.
5 Examples of use in micro-region Letovice, Czech Republic

Self-evident, there are examples of interactive maps in my diploma work. Studied area is micro-region Letovice (aprox. 110 km²). Interactive map serves here as a “multi-medial cross-road”. For example, visitor of the area wants to spent his holiday near water and forests. So he just turn on corresponding layers and besides that the layer of accommodation. If he wants to know more about that place, he will just click on the object and get additional information (e.g. address, phone number, e-mail, www page – if exists,...).

This example serves also to the citizens of micro-region Letovice. If somebody wants to know actual program of cinema, wants to pass request to town hall, post office, etc. then he or she just click at symbol in the map. Appearance of this interactive map is shown in Figure 3.

![Interactive map of micro-region Letovice (Czech Republic)](image)

Figure 2: Interactive map of micro-region Letovice (Czech Republic)

6 Steps for production of interactive maps

I wrote those steps after my knowledges, experiences and mistakes with production of interactive map of micro-region Letovice. Those steps are not strict rules. Order of steps will be different in dependence on particular purpose of created interactive map.
1) It is necessary to have basic **project considerations** first. This step can be the longest, but it is one of the most important. Mistakes in this step can cause failure of the whole interactive map. Our project considerations have to be particularly about:

- **What is the purpose** of our map? *This basic question will influence all other steps; according to the purpose will look like scale, symbolism, way of display,...*

- **aspects of end user** *There are server-side, client-side or combined solution, we can (or cannot) use plug-ins,...This consideration will influence both, hardware and software of producer and user. Aspects of end user will of course change the price of our map.*

- **What’s my hardware?** *Hardware of our computer will adjudicate in complicated tasks (e.g. generalisation). Layers production, editing and conversion does not have to be (in compare with generalisation) so exacting. I think that for user is the most important his access to the internet. That’s why we have to consider hardware of end user, although we know almost nothing about it.*

- **What’s my software?** *Except software itself is important in this step if we will offer map stand-alone or if we will offer also another type of services (e.g. WMS). We have to keep in mind this question: ”How will our software influence the end user?”*

- **What are my knowledges?** *With best software and hardware we cannot do good interactive map. I also need some knowledges. Without it I won’t be able to create, for example, map symbolism.*

- **What are my financial possibilities?** *They will play very important role in all another mentioned aspects except for particular purpose and the user.*

- **Creation the first design of the map** *(with considering of all foregoing steps)*

> There should be included necessary data, symbolism, colours,... I recommend to analyse previous published maps and also analyse the classification method of all features of the content (contemporary with method of their cartographic displays)

2) **acquiring or creation** *(vectorise, spatial analysis and operations, etc.) appropriate data for interactive map*  
*When you think about creation and/or acquiring*
necessary data, it is presentable if you think contemporary with Step 8. We have to ask: “What type of data can we acquire. Will we have to edit them?”

3) **generalisation** of acquired (created) data  
   I consider the generalisation as a “necessity” in the field of vector interactive maps. With regard to we have no information about hardware of end user, the best choice is to minimalise our requirements. This in practise means we have to create data as small as possible (of course with regard to particular purpose). This will make relatively quickly access to our data.

4) **control (correction)** – **not only** – of the topological consistence of data  
   There can be breaked some topological rules after generalisation. That’s why it is neccessary to control and correct data. Of course errors can arise in other ways.

5) **Top up** data with **attributes**  
   It is not necessary to have this step here. But I think it is “more comfortable” solution (in comparison with filling attributes for example in XML file). It is not also neccessary have any attributes in our map at all (except links; without links it is not interactive map).

6) **export (conversion)** of data to Web readable format  
   Nowadays exists very wide range of solutions. There is need to choose the best – which most of all depends on particular purpose, software and the financial possibilities.

7) **editing (creating)** user’s interface  
   Software packages of firms mostly have default user’s interface. But sometimes there’s nothing and you have to create user’s interface; for example in some Open Source projects. However it is better to adapt user’s interface in according to particular purpose (and from that resulting sphere of users).

8) **Connection with WMS / ArcIMS servers**  
   This part is not mandatory. Only on designer of the map depends if he choose this choice or not. But try to consider why you should create some layers if you can download it from another server. So you can save your time, money and have better quality of data. Furthermore you are not creating data which were once created. There’s no redundancy, instead of it there are effectively attached existing data sources.

9) **Functionality testing**  
   After creation of interactive map I regard as important to test it. We can upload map into Web only if we think that the map is finished. I wilfully wrote map about we think it is finished. If it really is or not will show it’s use on the Web.
10) **Uploading completed maps to your server**  
This is basic step on the way to offering finished map to users. I know, on the basis of my own practices, that the map well running on a local computer is not always running on the Web.

11) **Top up metadata**  
Only with metadata is for user easy to find if your map containes informations which he/she needs. Simultaneously is it possible to retrieve additional informations (not only) about that map.

12) **Functionality testing of interactive map on the Web**  
Testing plays very important feedback for cartographer. Only testing can show you your mistakes that you made in process of work.

13) **Studying user’s needs and prospective change of interactive map**  
I strongly recommend to create (or mention existing) e-mail address where users can send their remarks and initiative. This will make good communication between cartographer and user. After that you can optimize your “finished” map.

## 7 SWOT analysis

Although SWOT analysis is widely used in Human Geography, I think, it has it’s (very effective) place also in the field of cartography. This kind of analysis in tabular form presents main features of this phenomenon (see Table 1) which are lost in width of context.

**Table 1: SWOT analysis of Interactive maps (for the conditions in 2005)**

<table>
<thead>
<tr>
<th><strong>S (STRONG)</strong></th>
<th><strong>W (WEAK)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>possibility of distributed databases</td>
<td>not uniformed composition of users</td>
</tr>
<tr>
<td>interactivity</td>
<td>bad for data with higher memory requirements</td>
</tr>
<tr>
<td>commericalism</td>
<td>installation of support for some formats (e.g. Adobe SVG plug-in)</td>
</tr>
<tr>
<td>no restriction for connecting with another data sources by links</td>
<td>different appearance according to the user’s hardware configuration</td>
</tr>
<tr>
<td>transfer speed of geographical information</td>
<td>lower quality of maps due to requirement of time minimalisation</td>
</tr>
<tr>
<td>actuality of data (in most cases)</td>
<td>constricted usage of high-resolution</td>
</tr>
<tr>
<td>higher number of users (in compare to the paper maps)</td>
<td></td>
</tr>
</tbody>
</table>
- new forms of visualisation
- including of animations
- support of 3D visualisation
- paradigm changed to 2 channels
- usage in mobile cartography
- high functionality
- platform independence
- use in risk management
- effective and cheap solution of many activities (in compare with Geographical Information Systems)
- connecting (into) geoportals

<table>
<thead>
<tr>
<th><strong>O (OPPORTUNITY)</strong></th>
<th><strong>T (THREATS)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>chance speak to higher number of users</td>
<td>design maps with errors which can be included (e.g. by WMS) in some other maps</td>
</tr>
<tr>
<td>possibility to add sound to the map</td>
<td>too much of animations can confuse user or can cause no applicability</td>
</tr>
<tr>
<td>work out 3D space in better representations (better formats)</td>
<td>we can forget to some optical-fysiological atributes of map elements in design of interactive map</td>
</tr>
<tr>
<td>nearly fully adaption of the user’s interface</td>
<td>degradation cartography as the science (tool for everyday practices)</td>
</tr>
<tr>
<td>use interactive maps in creating of spatial data infrastructures</td>
<td>user’s none adaptability towards main cartographical rules</td>
</tr>
<tr>
<td>creation of automated cartographical procedures</td>
<td></td>
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<tr>
<td>design of interactive atlases</td>
<td></td>
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<tr>
<td>possibility to adapt funcionality for particular purpose</td>
<td></td>
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<tr>
<td>bigger development in the field of mobile cartography</td>
<td></td>
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<tr>
<td>higher effectivity due to GUI (e.g. connection with GIS software)</td>
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</table>
8 CONCLUSIONS

Interactive maps are relatively new method of cartographic displays. Thanks to interactivity and internet are possible to connecting (geo)databases accross the world. This also brings new possibilities for users. Internet itself does not allow extended funcionality (as the interactivity is). However there are many solutions to solve this problem (server-side, client-side, combinations).

Biggest advantages of this technology are accessibility, actuality, geospatial data access. Disadvantages are above all lower quality of interactive maps, user’s speed of data transfer and different appearance according to the user’s hardware configuration. For me is the main opportunity map adaption for particular purpose of user.

Interactive maps have their possible use in the first place in fields of tourism, transport, spatial data infrastructures, education, environment, demography, risk management, atlases, weather forecast, crime, mobile cartography and 3D visualisation. This type of maps are nowadays the tool of almost everyday practices.

It is almost impossible to discuss “next” – at least – in longer term (progress in field of geoinformatics and the World Wide Web is very quickly). My opinion is that there will be the most important those aspects in future: minimalisation of neccessary time to retrieve information, better visualisation, more intuitive control over map and more individualised solutions.

9 REFERENCES