ICA Commission Renewal: Cognitive Issues in Geographic Information Visualization (CogVis)

Nomination
The Mapping Sciences Institute of Australia is proposing the renewal of the Commission and nominates Dr. Amy Griffin (UNSW Canberra) as its Chair. The Comité Français de Cartographie (CFC, the French representative to the ICC) also supports this application and nominates Dr. Sidonie Christophe as its Vice-Chair.

Proposed Leadership
Dr. Amy Griffin, Senior Lecturer, School of Physical, Environmental and Mathematical Sciences Research, UNSW Canberra, Australia. (Proposed Chair)

Amy Griffin was co-chair of the CogVis commission from 2011-2015, and has been an active member of the Geoviz commission since 2003, focusing on understanding how map readers use geovisualizations to think about spatial problems. Her research interests lie in the areas of understanding the cognitive and perceptual processes that geovisualization use draws upon, the human-centered design of geovisualization systems, and developing understandings of how people move through space and time, often with the help of geovisualization tools. She has published in a wide range of cartography and geography journals and currently a member of the Cartographica, Cartographic Perspectives, and Cartographic Journal editorial boards. She is also the vice-president of the North American Cartographic Information Society (NACIS).

Dr. Sidonie Christophe, Researcher, COGIT Laboratory, IGN, Paris, France. (proposed Vice-Chair, eventually to become Chair in the following term)

Sidonie Christophe has been involved in the Cognitive Visualization Commission, and is currently co-chair of the French research group about Cognition & Cartography (GDR MAGIS) from 2013-2016. Her research interests lie in the formalization of knowledge and processes underlying geovisualization design, users/geovisualization interactions and users perception/cognition of stylized visualizations. She has published in cartography journals and is a reviewer for the main cartography and geographic information science journals and conferences.

Proposed Terms of Reference: 2015-2019
The overall goals CogVis from 2015-2019 will be to:

- Promote the awareness of cognitive issues in cartography, developing human-centered cartographic theory and practice based on sound empirical findings on the use of cartographic displays for spatio-temporal inference and decision-making.

- In conjunction with the Commission on Geovisualization, Commission on Use and User Issues, and Commission on Map Design, develop and publish a research agenda for that outlines major research challenges for interactive cartography that we should work towards addressing as a community. The beginnings of this work will occur at a joint pre-ICC 2015 meeting of the four commissions in Curitiba, Brazil.

- Define short and medium term research goals that fall within the scope of this research agenda and that address key issues associated with building a sound theoretical base to support the construction and use of cognitively adequate and perceptually salient visual displays of geographic information.

- Encourage interdisciplinary and international collaboration with cognate disciplines and relevant stakeholders, including other ICA commissions and working groups.

- Actively seek to encourage more participation in the Commission from researchers in the Asia-Pacific region, which is currently underrepresented among our membership.

Information supporting this nomination (the Commission’s rationale, past achievements, and current membership) can be found below.
Commission Rationale:

In recent years *geovisualization* has morphed into the field of *geovisual analytics*, emphasizing human exploration of geographic information through highly interactive visual interfaces, taking advantage of *perceptual* and *cognitive* abilities to recognize and process patterns and outliers in visual displays, linking these patterns and outliers to existing mental schemata and knowledge bases, and eventually arriving at an appropriate spatially relevant course of action or decision given the visual input (Chen et al., 2008). Visual analytics is based on the intuition that highly interactive and dynamic depictions of complex and multivariate databases amplify human capabilities for inference and decision making, as they facilitate cognitive tasks such as pattern recognition, imagination, association, and analytical reasoning (Thomas and Cook, 2005).

Along those lines a pervasive theme underlying many current (geo-) visualization research challenges is the difficulty of effectively evaluating highly interactive visualization tools and complex displays and identifying their potentially positive influence on exploratory data analysis, knowledge extraction, and learning. While research within the visual analytics and geovisual analytics communities has focused predominantly on building tools and respective highly interactive computer-human interfaces, *fundamental* investigations based on empirical evidence of the *who, what, how, when and why* of human inference, analytical reasoning, and spatio-temporal decision making with visual displays work have received considerably less attention. To this day we still know little about the effectiveness of graphic displays for space-time problem solving and behavior, exploratory data analysis, knowledge exploration, learning, and decision-making. This lack of understanding is particularly noteworthy, as the predecessor of the current International Cartographic Association (ICA) Commission on *Geovisualization* (then called *Visualization and Virtual Environments*) had already identified this problem at the turn of the century as one of the key challenges for geovisualization research, namely the need to focus on cognitive issues and usability (MacEachren and Kraak 2001). Specifically, these authors point to the need for developing a theoretical framework based on cognitive principles in order to support a human-centered approach to geovisualization. We contend, that less has been achieved today than was anticipated, and cognitive issues should still be of utmost concern to designers and developers of useful and usable map displays. More generally, this is also true for the ICA Commission landscape at large, where fundamental cartographic design theories, map use and spatio-temporal behavior, etc. have rarely been tested empirically and validated by cartographers or other cognate disciplines.

Other related fields of research, for example, information visualization, have also recently identified the need for developing a sound theoretical framework based upon cognitive principles. In 2010, at the *VisWeek* meeting in Salt Lake City, there were a number of events to support this research direction: an InfoVis Theory Workshop, a Visualization Theory Panel, a Birds-of-a-Feather meeting focusing on how evaluation and theory are connected, and a paper session entitled *Theoretical Foundations of Visualization*. In psychology, for example within the large US NSF funded *Spatial Intelligence and Learning Center*, spatial cognition scientists and psychologists have become interested in the effect of studying visuo-spatial displays on spatial thinking and behavior.

This proposal for the renewal of the ICA Commission on *Cognitive Issues in Geographic Information Visualization (CogVis)* complements and extends the ongoing work of the GeoVisualization Commission, which has been key in establishing the emergent discipline of *Geovisualization* since 1995; the more recent *Use and User Issues Commission*, which since 2005 has been focusing on usability issues and users of cartographic products; and the new *Map Design Commission*, which was formed at the 2011 ICC in Paris, France.

The vision of the proposed *CogVis* Commission co-Chairs is that this commission will continue to work to provide the empirical basis for developing a cognition and perception-informed theoretical framework on which the design of successful static, dynamic and interactive maps; geovisual analytics displays and systems; and effective human-computer interaction should rest. We are also committed to building linkages with cognate disciplines from which the other mentioned three Commissions might benefit such as like-minded researchers in psychology, cognitive science, vision science, human-computer interaction, and the design sciences. Thereby, the *CogVis* Commission’s work would support that of other existing ICA Commissions, while in turn our own work will be informed by map, geovisualization and human-computer interaction design problems identified by the above-mentioned ICA Commissions and others. For example, while the *Map Design Commission* aims to identify examples of good cartographic practice that underpin...
high quality, effective map design (i.e., what), our Commission would empirically assess the identified examples to understand why, how and for whom the employed practices lead to a good quality design. Similarly, while the Geovis Commission aims to identify novel methods and develop new tools for the analysis of spatio-temporal information through interactive visual interfaces (i.e., what & how), our commission would empirically assess the developed examples to understand why and for whom human inference, analytical reasoning, and spatio-temporal decision making with visual displays work more effectively and efficiently. Finally, while the Use and User Issues Commission aims to study map use context including users, use cases, and usability (i.e., who and how), our commission would provide the empirically ground theoretical framework to understand identified use and user issues (i.e., why and for whom).

**Past Achievements of the Commission during the Prior Term (2011-2015)**

The CogVis commission was initiated in 2011 at the Paris ICC. We have been an active commission and have worked hard to achieve the goals set in our terms of reference. We report briefly below on the achievements of our Commission to date. Please see our commission webpage for additional detail: https://www.geo.uzh.ch/microsite/icacogvis/mission.html.

Organized sessions/events at the following meetings:

- **AAG, New York, USA, February 2012:** 11 short papers, 30 long papers (in conjunction with ICA Commission on Map Design); led to the publication of a special issue in *Cartographic Journal*
- **AutoCarto 2012, Columbus, Ohio, USA, September 2012:** Pre-conference workshop on Experimental Methods (in conjunction with ICA Commission on Use & User Issues); directed particularly to young researchers & researchers new to empirical user studies
- **Workshop GeoViz: Interactive Maps that Help People Think, Hamburg, Germany, March 2013** (in conjunction with ICA Commission on Geovisualization); led to the publication of a special issue in the *International Journal of Geographic Information Science*
- **AAG, Los Angeles, USA, April 2013:** 20 papers across 4 sessions
- **Pre-conference workshop on Eye Tracking at ICC 2013 in Dresden, Germany, August 2013** (in conjunction with the ICA Commissions on Geovisualization and Use and User Issues). This 1.5 day workshop included 15 presentations, an analysis software demo, and participation from all of the major eye tracking equipment vendors.
- **We had many members who participated in Cartocon 2014 in Olomouc, Czech Republic, February 2014, and several commission members served on the programme committee (abstract and paper review), and provided keynotes for the conference.**
- **AAG, Tampa, FL, USA, April 2014:** 20 papers across 4 sessions; two of our Commission members (Rob Roth and Anthony Robinson) co-edited a special issue of *Cartographic Perspectives* based on papers submitted from these sessions; co-organized with the AAG Cartography Specialty Group, the ICA Commissions on Use and User Issues and Geovisualization, and with the support of the North American Cartographic Information Society (NACIS).
- **AAG, Chicago, IL, USA, April 2015:** 20 papers across 4 sessions, plus an additional session of 5 papers and a panel on Current Issues in Cartography Education, co-organized with *Cartographic Perspectives* Editorial Board and the ICA Commissions on Map Design and Education & Training.
- **Two days of pre-conference ICC 2015 activities in Curitiba, Brazil, in conjunction with the ICA Commissions on Geovisualization and Use and User Issues. Day one will be a workshop on Experimental Methods directed towards PhD students and early career researchers. Day two will be activities in support of the first steps towards developing a new research agenda for interactive cartography.**
- **One or two days of workshop during the ISPRS GeoSpatial Week 2015, La Grande Motte, France, in conjunction with the ISPRS working group WGII/6 about geovisualization and augmented reality. The purpose is jointly focus attention of people from the ICA and ISPRS communities on cognition and decision-making challenges with hybrid visualizations (vector/raster, 2D/3D/4D, imagery, points of interest, etc.).**
Scientific publications facilitated as a result of Commission-organized activities:


Current Commission Members (in alphabetical order)

At the time of writing, the commission has 202 members, representing 31 countries. A full list of current members can be found below:

Kaddour Djebbar Abdelghani | National Institute of Cartography and Remote Sensing - Algeria
Dr. Pragya Agarwal | Lancaster University
Dr. Paula Ahonen-Rainio | Aalto University
Ramathan Ali | giCentre, City University London
Dr. Suchith Anand | University of Nottingham
Dr. Gennady Andrienko | Fraunhofer IAIS
Dr. Natalia Andrienko | Fraunhofer IAIS
Behnam Atazadeh | Department of GIS, K.N.Toosi University of Technology

Andrius Balciunas | Centre for Cartography, Vilnius University
Raffaella Balzarini | Laboratoire d’Informatique de Grenoble
Dr. Sarah Battersby | Department of Geography, University of South Carolina
Kenan Bektas | Department of Geography, University of Zurich
Dr. Miguel-Angel Bernabé-Poveda | Dep. of Land Surveying and Cartography, Universidad Politénica de Madrid
Dr. Enrico Bertini | University of Konstanz
Rahul Bhosle | Center for Earth Observation
Raechel Bianchetti | The Pennsylvania State University
Dr. Jan D. Blaha | J.E.Purkyne University in Usti nad Labem
Dr. Susanne Bleisch | Institute of Geomatics Engineering, University of Applied Sciences Northwestern Switzerland
Dr. Connie Blok | University of Twente
Dr. Rita Borgo | Computer Science, Swansea University, Swansea, UK
Jan Brus | Department of Geoinformatics, Palacký University in Olomouc
Alžběta Brychtová | Department of Geoinformatics, Palacký University in Olomouc
Tommy Burke | National Centre for Geocomputation

Dr. Yongxiang Cai | School of Geosciences, Yangtze University
Jiří Cajthaml | Czech Technical University in Prague
Nairne Cameron | Algoma University
Seyed Hossein Chavoshi | University of Ghent
Prof. Dr. Yufen Chen | Department of Cartography and GIS, Zhengzhou Institute of Surveying and Mapping
Dr. Elisabeth Chesneau | Université Jean Monnet of Saint-Etienne
Dr. Zachary Christman | Department of Geography, Middlebury College
Dr. Sidonie Christophe | COGIT Laboratory IGN-France
Dr. Agata Ciolkosz-Styk | Institute of Geodesy and Cartography
Dr. Cheryl Ann Cohen | Northwestern University
Prof. Dr. Nico Van de Weghe | UGent
Dr. IR. Stefan van der Spek | Delft University of Technology / Faculty of Architecture / Department of Urbanism
Dr. Corné van Elzakker | University of Twente, Faculty ITC
Prof. Luc Van Gool | ETH, D-ITET, CVL - Computer Vision Lab
Dr. Elizabeth Vaughan | Ball State University
Dr. Brian Verdine | University of Delaware
Dr. Marlene Villanova | Laboratoire d'Informatique de Grenoble
Alena Vondráková | Department of Geoinformatics, Palacký University in Olomouc

Dr. Jue Wang | Department of Earth and Planetary Sciences, Washington University in St. Louis
Prof. Colin Ware | Center for Coastal and Ocean Mapping, University of New Hampshire
Prof. Chris Weaver | School of Computer Science and Center for Spatial Analysis, University of Oklahoma
Carolyn Weiss | Statistics Canada (retired)
Beate Weninger | HafenCity University Hamburg
Dr. Jan Wilkening | ESRI Germany
Paul Wilson | GE Energy
Associate Professor Stephan Winter | The University of Melbourne

Jinlong Yang | The Human Factors in GIScience Lab, Department of Geography, The Pennsylvania State University
Asli Yilmaz | Middle East Technical University/ Geodetic and Geographic Information Technologies

Doctor/Maître de conférences Christine Zanin | University Paris 7 Paris Diderot
Pengdong Zhang | Department of Geography, Ghent University
Yueqin Zhu | Department of Cartography, Technology University of Munich

Contact:
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Dr. Sidonie Christophe, IGN/COGIT Laboratory, Université Paris-Est, 73 Avenue de Paris, 94160 Saint Mandé Cedex. Tel +33 1 43 98 84 32, Email: sidonie.christophe@ign.fr
Curriculum Vitae

Dr. Amy L. Griffin

1. Personal

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Mobile

Email a.griffin@adfa.edu.au
Webpage https://research.unsw.edu.au/people/dr-amy-l-griffin

2. Education

2006 GrCrt. University of New South Wales, Graduate Certificate in University Teaching and Learning
2004 Ph.D. The Pennsylvania State University, University Park, PA, USA. Geography
2000 M.S. The Pennsylvania State University, University Park, PA, USA. Geography
1997 B.A. Macalester College, St. Paul, MN, USA, Geography, Chemistry, Art & B.S. (History Emphasis), Cum Laude

3. Theses

2004 Understanding how scientists use data-display devices for interactive visual computing with geographical models
2000 Feeling it out: The use of haptic visualization for exploratory geographical analysis
1997 Alternative methods of organic chemistry instruction using animation and visualization technologies

4. Honours, Awards, and Recognition

2008 Rector’s Commendation for Excellence in Classroom Teaching
2005 Estelle Canning Memorial Prize for the best paper presented at the Annual Meeting of the Australian Map Circle
2003 Penn State Alumni Association Dissertation Award
2000 E. Willard Miller Award in Geography, Best Student Paper—M.S. level, Department of Geography, The Pennsylvania State University
1999-2002 National Defense Science and Engineering Graduate Fellow
1999 Jacob K. Javitz Graduate Fellowship (declined)
1998-1999 University Graduate Fellow, The Pennsylvania State University
1997-1998 Fulbright Fellowship, Geographiches Institut, Rühr Universität, Bochum, Germany

5. Employment

2014-2011 Instructor, MGIS program, The Pennsylvania State University
Senior Lecturer, School of Physical, Environmental and Mathematical Sciences, University of New South Wales, Canberra, Australia
Teaching responsibilities: undergraduate courses in environmental hazards and sports geography; postgraduate courses in GIScience
2007 Professeur invitée, Laboratoire Image et Ville, Universite Louis-Pasteur, Strasbourg, France
2004-2011 Lecturer, School of Physical, Environmental and Mathematical Sciences, University of New South Wales, Canberra, Australia
2003 Instructor, Department of Geography, The Pennsylvania State University, University Park, PA, USA
Teaching responsibilities: undergraduate cartography course (2 semesters)
2003 Research Assistant, GeoVISTA Center, Department of Geography, The Pennsylvania State University, University Park, PA, USA
2002 Teaching Assistant, Department of Geography, The Pennsylvania State University, University Park, PA, USA
Teaching responsibilities: undergraduate cartography practical exercises (1 semester)
1999 Teaching Assistant, Department of Geography, The Pennsylvania State University, University Park, PA, USA
Teaching responsibilities: undergraduate Computing for the Earth Sciences practical exercises (1 semester)

6. Publications

Refereed Monographs


Refereed Papers or Book Chapters


**Book Chapters**


**Special Issues Edited**


**Book Reviews**


**Other Publications:**


**7. Recent Research Grants**

<table>
<thead>
<tr>
<th>Year</th>
<th>Agency</th>
<th>Amount $</th>
<th>Title of Project</th>
</tr>
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<tbody>
<tr>
<td>2013-2015</td>
<td>US National Science Foundation</td>
<td>275,000</td>
<td>A user study of techniques for geovisualizing uncertainty in survey data (with Seth Spielman, Nicholas Nagle)</td>
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<tr>
<td>2011</td>
<td>UNSW Major Equipment and Infrastructure Investment Scheme</td>
<td>81,900</td>
<td>Set-up and maintenance of a mobile eye-tracking laboratory (with Frances Miley and Lynn Grigg, co-CIs)</td>
</tr>
<tr>
<td>2010-2013</td>
<td>ARC Linkage</td>
<td>325,000</td>
<td>Time scarcity in Australian families: another inequity? (co-CI with Lyndall Strazdins*, Dorothy Broom, John Glover, Cathy Banwell, Jane Dixon, Rosemary Korda, Megan Shipley, Francesco Paoloucci, Marian Esler and Stephen</td>
</tr>
<tr>
<td>Year</td>
<td>Project Description</td>
<td>Budget</td>
<td>Details</td>
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<tr>
<td>2009</td>
<td>UNSW Major Equipment and Infrastructure Investment Scheme</td>
<td>76,000</td>
<td>Setup and maintenance of an eye-tracking laboratory (with Hussein Abbass, Michael Barlow, Sameer Alam and Martin Copeland, co-CIs)</td>
</tr>
<tr>
<td>2009-11</td>
<td>DSA Scholarship Fund</td>
<td>60,000</td>
<td>Social-Ecological Intersections: A Spatial Approach to Understanding Bushfire Risk and Community Capacity for Resilience and Adaptation in the Sydney Metropolitan Area</td>
</tr>
</tbody>
</table>

### 8. Post-Graduate Research Student Supervision

**Completed Students (supervisor)**
- Shibani Mishra (2006-2010), PhD
- Daminda Solangaarachchi, (2008-2012), PhD
- Solomon Gbanie (2011-2015), PhD

**Students in Progress (supervisor)**
- Julia McQuoid (2012- ), PhD
- Ahmed El-Sergany (2012- ), MPhil, part-time
- Van Anh Le (2015- ), PhD
- Dyah Panuju (2015- ), PhD

**PhD Committees (committee member)**
- William Buckingham, University of Wisconsin, Madison (PhD, completed 2012)

### 9. Service and Professional Membership

**Service Activities**
- 2013-2017 Vice-President Elect/Vice President/President/Past-President, North American Cartographic Information Society
- 2012 Human Research Ethics Panel (HREA), UNSW-Canberra
- 2011- Co-Chair, Cognitive Visualization Commission, International Cartography Association
- 2009-2012 Business Manager, Australia and New Zealand Map Society
- 2008-2012 Board Member, North American Cartographic Information Society
- 2006 Convenor, 34th Annual Conference of the Australian Map Circle
- 2004-2010 Secretary, GIScience, Spatial Analysis and Modelling Study Group, Institute of Australian Geographers.
- 2009-2011 Member, UNSW-ADFA research committee
- 2008-2009 Member, School of PEMS research committee
- 2005-2006 Member, UNSW-ADFA postgraduate coursework education committee
- 2004-2006 Member, School of PEMS undergraduate education committee.
- 2006 Member, School of PEMS postgraduate coursework working party
Amy L. Griffin

2005-2006 PEMS postgraduate coursework coordinator; Member, PEMS research Committee; Member, UNSW-ADFA postgraduate coursework advisory committee

1999 Graduate Student Representative, Department of Geography, Pennsylvania State University, University Park, PA, USA

Editorial Board Membership:


Grant Application Reviewer:
Australian Research Council (Discovery Project Scheme, DECRA Scheme), Swiss National Science Foundation, Wellcome Trust (UK), Belgian National Science Foundation (FWO), South African National Science Foundation

Society Memberships
North American Cartographic Information Society (NACIS)
Association of American Geographers (AAG)
  Specialty Groups: GIS, Remote Sensing, Cartography, Medical Geography, Hazards
American Congress of Surveying and Mapping (ACSM)
American Society for Photogrammetry and Remote Sensing (ASPRS)
Canadian Cartographic Association (CCA)
British Cartographic Society (BCS)
ICA Commission on Visualization and Virtual Environments, Corresponding Member
ICA Commission on Cognitive Visualization, co-Chair
Institute of Australian Geographers (IAG)
Australian and New Zealand Map Society (ANZMS)
Higher Education Research and Development Society of Australasia (HERDSA)

10. References

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