

ICA Geovis Commission ICC2011 Workshop, Paris, France:
**Persistent problem in geographic visualization:
Evidence of geovis(ual analytics) utility and usefulness¹**

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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). While research within the visual analytics and geovisual analytics communities has focused predominantly on building impressive tools and respective highly interactive computer-human interfaces, a fundamental unsolved challenge has persisted to this day: providing ***systematic empirical evidence of the what, how, when human inference, analytical reasoning, and spatio-temporal decision making with visual displays works, and for whom and why.*** 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 *Geovisualization Commission* (then called *Visualization and Virtual Environments*) has 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. I contend, that less has been achieved today than was anticipated then, but could have been possible, and I believe that 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*,

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spatial cognition scientists and psychologists have become interested in the effect of studying visuo-spatial displays on spatial thinking and behavior.

As a result of these latest development outside of our field and the persistent research problem on systematic evaluation and validation within the ICA Geovis Commission and the ICA at large, Amy Griffin (UNSW ADFA) and myself submitted a proposal for a new Commission of the International Cartographic Association (ICA) on *Cognitive Issues in Geographic Information Visualization (CogVis)*² intended to complement and extend the ongoing work of the *GeoVisualization* Commission, which has been key in establishing the emergent discipline of *Geovisualization* since 1995 and the more recent *Use and User Issues* Commission, which since 2005 has been focusing on usability issues.

The vision of the proposed *CogVis* Commission Chairs is that this commission will 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 proposed *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 *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*), this new *CogVis* 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*), the *CogVis* commission would provide the empirically grounded theoretical framework to understand identified use and user issues (i.e., *why* and for *whom*).

In summary:

My contribution at this ICA workshop is to inform the Geovis Commission attendees on these new developments initiated by a subset of current Geovis members, and get first feedback from the audience on how to develop a fruitful future collaboration strategy, should the new *CogVis* commission be accepted by the ICA at the general assembly. Specifically, I would like to get the audience's views on what the specific

² The proposed commission on *Cognitive Issues in Geographic Information Visualization (CogVis)* has been accepted by the ICA General Assembly in Paris, France 2011.

needs and current challenges of the Geovis commission members are in geovisual analytics research and tool development related to:

- human factors and tool use,
- systematic tool and display evaluations,
- visual analytics method validations