

## GeoVisual analytics: interactivity, dynamics, and scale

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## EDITORIAL

### GeoVisual analytics: interactivity, dynamics, and scale

This issue of CaGIS showcases research activities related to Geospatial Visual Analytics. It represents a selection of the contributions made during a dedicated scientific workshop organized by the International Cartographic Association Commission on Geovisualization. Since 2007, the Commission has been chaired by Gennady Andrienko (Fraunhofer Institute IAIS) and Jason Dykes (City University London) to continue the work of the highly successful Commission on Visualization and Virtual Environments, which was key in establishing the emergent discipline of “Geovisualization” since 1995. The main focus for the period 2007–2015 was on the use of interactive maps and cartographic techniques to support interactive visual analysis of complex, voluminous and heterogeneous information involving measurements made in space and time.

Twenty years ago, interactive maps were predominantly used by scientists involved in analysis and hypothesis generation in their professional activities. More recently, interactive maps are being widely used for research, education, and information consumption through a range of accessible media and technologies in a variety of disciplines and application scenarios on all types of computers in all sorts of places. In this broad and evolving context, there is a clear need for the cartographic community to contribute to and learn from the development and use of interactive maps and cartographic techniques that are designed specifically to support visual analysis and analytical reasoning. These interactive maps are being used as flexible spatial interfaces and are being applied to massive data sets that are often collected in real time by advanced sensors, and which may include elements that are not necessarily spatial. These interactive interfaces are being used increasingly in GIScience and beyond for knowledge creation and theory generation, decision support, disaster management, information communication, and education.

During the eight-year period, the commission has organized workshops on a regular basis as a focus and forum for research activity in which possibilities for geovisualization are explored and knowledge about geovisualization is established. Most of the workshops have been attached to major conferences (e.g. ICC, GIScience, AGILE), whilst several others have been

organized as a successful stand-alone conference at HafenCity Universität Hamburg organized by Jochen Schiewe and his team at the g2Lab. From these workshops and conferences, 11 special issues of established journals have been published. The commission also prepared four strategic papers associated with these activities and publications (Andrienko and others 2007, 2008, 2010, 2011).

This special section continues the efforts of the commission towards shaping the research area of geospatial visual analytics. The special section is based on contributions presented at the workshop ‘GeoVisual Analytics: Interactivity, Dynamics, and Scale’ held on 23 September 2014 at the GIScience conference in Vienna, Austria. This specialist workshop brought together more than 40 researchers working on the design, implementation and evaluation of interactive analytical cartographic representations. The workshop program included 15 presentations grouped into 4 sessions of regular talks presenting mature research, mini-talks presenting works in progress and discussions about emerging topics. All workshop materials are available online (GeoVA 2014). Based on the reviews of submitted extended abstracts and presentations at the workshop, the guest editors invited authors of the nine most highly ranked regular presentations to submit full papers to this special section. After several rounds of reviewing of six submissions, three papers have been accepted for the special section. These papers exemplify current research directions in geovisual analytics.

We are very grateful to the reviewers and the authors for their diligent and extremely efficient work. It is notable that the reviewers not only critiqued the papers, but also gave concrete recommendations to the authors for their improvement through revision.

The 1<sup>st</sup> paper, “Exploring mass variations in the Earth system”, reports about results of close collaboration of visual analytics researchers with domain scientists. Based on user- and task-centred design, the authors identified important analytical requirements and provided tailored support for them. Thus, visual displays are combined with appropriate user-controlled spatial filters. Explicit comparison of results of different observations and simulations is supported. The implemented tool provides means of navigation in space and time to identify

and focus on prominent variations as well as the interactive modification of data sets on demand. The proposed visual analytics approach provides a valuable extension of the Earth system modeller's toolbox.

The 2<sup>nd</sup> paper, "Enabling geovisual analytics of health data using server side approach", describes a software implementation that enables a user to explore multivariate spatio-temporal health data sets and to understand spatial distribution of diseases especially in relation to external factors that may influence outbreaks. The paper proposes a server side approach for designing a geovisual analytics environment that allows user-driven geovisual analytics based on Web services. Since the framework builds on the existing OGC web mapping standards, it integrates the existing geo web services as well as stand-alone health data repositories into an infrastructure that allows combination and interactive exploration of these heterogeneous data sets in a visual environment.


The 3<sup>rd</sup> paper, "Geovisual analytics and the science of interaction: an empirical interaction study", reports on a controlled interaction study to learn how variation in interaction primitive combinations impacts broader interaction strategies. A visual analytics platform called GeoVISTA CrimeViz, developed in collaboration with a police organization in the United States, was used as a living lab for examining the nature of interaction strategies. Experimental results revealed several noteworthy characteristics of the relationship between interaction primitives and interaction strategies. Consistently successful and suboptimal interaction strategies were characterized in terms of their constituent interaction primitives and articulated as user personas, allowing for the establishment of interface design and use recommendations.

The three selected papers are united because they are based on advanced implementations of the state-of-the-art visual analytics techniques, are applied to real-world data, and are used for solving real domain problems in close collaboration with domain experts.

In summary, we believe that this selection of papers exemplifies current efforts in contemporary analytical cartography, and that these contributions will be interesting and useful not only for people primarily occupied with analysis and/or visualization of spatial data, but also for more general readers as they search for effective technical and graphical means of representing, analyzing, and adding meaning to their spatial and temporal datasets. Doing so should be beneficial as they make maps that help people think in a range of important applied contexts.

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