Self-Portrayals of GI Junior Fellows

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Interaction with geospatial data

Abstract: My research interest lies at the interaction between human-computer interaction (HCI) and geoinformatics. I am interested in developing new methods and novel user interfaces to navigate through spatial information. This article will give a brief overview on my past and current research topics and streams. Generally speaking, geography is playing an increasingly important role in computer science and also in the field of HCI ranging from social computing to natural user interfaces (NUIs). At the same time, research in geography has focused more and more on technology-mediated interaction with spatiotemporal phenomena. By bridging the two fields, my aim is to exploit this fruitful intersection between those two and develop, design and evaluate user interfaces that help people to solve their daily tasks more enjoyable and effectively.

Keywords: Geoinformatics, HCI, GeoHCI, Mobile Devices.

ACM CCS: Human-centered computing → Human computer interaction (HCI), Human-centered-computing → Visualization → Visualization application domains → Geographic visualization

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1 Research area & motivation

Humans have used maps as abstract representations of the real world for more than 8000 years, mainly to facilitate orientation and navigation [9, 14]. With the onset of mobile computing, there has been a perceived sea change in how humans interact with maps. The assumption is that since mobile map applications are becoming the predominant means through which many people experience cartography, existing cartographic principles developed on older media are not as useful as they once were. More generally, despite the fact that mobile maps are extensively rooted in a long history of cartography, popular mobile map services have been designed with limited input from cartographic experts. This sea change has also led those in social computing [16], ubiquitous computing (e. g. [8]), natural user interfaces (e. g. [10]) and other areas of HCI to increasingly leverage geographic methods [6, 7], adopt geographic use cases and ask geographic research questions. When it comes to interaction with spatial information, my research lies on the geographic user experience/traditional cartography boundary. I am particularly enthusiastic about developing intelligent user interfaces that help people complete daily tasks more effectively and enjoyably. In this short abstract I highlight three different exemplary research projects of my own within this field.

2 Interacting with spatial information

In one of my research streams, I am interested in improving the way people interact with spatial data. In our research on how people interact with virtual globes [11] back in 2008, we found that the use is restricted to a small set of tasks so simple that they do not involve any spatial thinking. Spatial thinking requires that users ask "what is where" and "why"; the most common virtual globe tasks only include the "what". To overcome this restriction in the interaction and allow users to ask "what is where" and "why", when interacting with virtual globes, we designed and developed a novel prototype of a virtual globe [11]. We introduced a new type of new simple spatial thinking-oriented virtual globe data type called Explicitly Explanatory Spatial Data (EESD). This kind of spatial data contains both a standard spatial layer and a new explicitly explanatory layer designed specifically to answer "why" questions and it was automatically mined from Wikipedia data. As such, interacting with the layer of the spatial references of Wikipedia articles, the narratives form an explicitly explanatory layer for the relationships between the points in the spatial layer. Looking at the spatial layer, a user can ask "Why are these two spatial entities related?" and the system can easily respond with an answer. With tens of millions of spatial articles in the English Wikipedia, users are able to ask this very simple and general spatial thinking question about almost anywhere in

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the world. This simplicity and generality fits in with other typical virtual globe data layers (i. e. satellite photography), but also allows for the explicit answering of "why" questions. In addition a user can define a region and he can select one or more different "themes" (which represent different Wikipedia articles a as input) for that region. By dragging a theme into the region, users can explore semantic relatedness values for that "theme" in the region they selected. Clicking on a single symbol will provide the text-based explanation of the "why" of each value as described in the data section. EESD was based on previous research within the WikEar [12] and Minotour [5] projects, which use Wikipedia to generate narratives between geotagged Wikipedia articles. The development and evaluation of this prototype was presented at the ACM IUI conference [11]. Building on our work on improving the interaction with virtual globes we also have been active in the use of cartography in non-geographic spatial reference systems such as the periodic table and anatomical charts, primarily for the purposes of exploratory search [2] in general. Exploratory search, in which a user investigates complex concepts, is cumbersome with today's search engines. We present a new exploratory search approach that generates interactive visualizations of query concepts using thematic cartography (e. g. choropleth maps, heat maps). The approach can be applied broadly across both geographic and non-geographic contexts through explicit spatialization, a novel method that leverages any figure or diagram – from a periodic table, to a parliamentary seating chart, to a world map – as a spatial search environment. We enable this capability by introducing explanatory semantic relatedness measures. These measures extend frequently used semantic relatedness measures to not only estimate the degree of relatedness between two concepts, but also generate human-readable explanations for their estimates by mining Wikipedia's text, hyperlinks, and category structure. We implement our approach in a system called Atlasify, evaluate its key components, and present several use cases. Again, more information can be found in the full conference paper presented at SigIR [4]. A third prototype focuses on mobile aspects of the user when interacting with spatial information. With our PhotoMaps project [13] users get the cartographic benefits of custom-designed "you are here" maps when navigating on their mobile phones through on-the-fly georeferencing of photographed maps. We show and demonstrate this with a prototype how users can walk up to such situated maps and use their smartphones to "take away" the map. This happens by taking a photo of it, in order to use it to assist their on-going navigation activity. The contributions presented in the paper, awarded with the best paper award at ACM MobileHCI [13], are the analysis of the design and characteristics of public maps we collected, a description of different approaches and implementations for georeferencing photos of maps on-the-fly, and a proof-of-concept evaluation, providing validation of the feasibility of the concept using images of public maps in the context of pedestrian navigation tasks.

3 Discussion & outlook

While interest in mobile map applications and related domains like location sharing and volunteered geographic information is growing in HCI, still few papers are utilising the relevant cartographic literature and best practices in geography. As a result, important research questions, methodologies, and datasets are missed. Academic cartography has had more cartographically-informed engagement with mobile maps, but it suffers limited understanding of the state-of-the-art and best practices in HCI, and computer science more generally. In my research I try to slowly bridge and close that gap. This article gives the reader a brief introduction on my research in the geo domain and shows the various aspects and multiple research challenges in that area. I am also active in the area of mobile HCI in general [1] and advancing user interfaces for interactive surfaces and tabletops [3, 15].

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Bionotes

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Johannes Schöning is a professor of computer science with a focus on HCI at Hasselt University, working within the Expertise centre for Digital Media (EDM) – the ICT research Institute of Hasselt University. In addition, he is a visiting lecturer at UCL London within the Intel Collaborative Research Institute for Sustainable Cities. In this series, we portray the seven computer scientists who are first to receive a GI Junior Fellowship. In this part of the series, Johannes Schöning summarises his work in the field of interaction with geospatial information. His research interests are new methods and novel mobile interfaces to navigate through spatial information. In general, he develops, designs and tests user interfaces that help people to solve daily tasks more enjoyable and/ or effectively. This includes the development of mobile augmented reality applications, interactive surfaces and tabletops and other "post desktop" interfaces. His research and work was awarded with several prices and awards, such as the ACM Eugene Lawler Award or the Vodafone Research Award for his PhD. In addition, Johannes serve as a junior fellow of *Gesellschaft für Informatik*.