

# What is geographic expertise? Does it matter?

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## ABSTRACT

In this paper we argue for new investigations into the nature and value of geographic expertise in users recruited to take part in GeoHCI studies. Distinct from spatial ability, geographic expertise (GE) refers to the geospatial competencies that a user possesses. Our GeoHCI experiences suggest several research goals for characterizing GE and judging its value in GeoHCI studies.

## Author Keywords

Geovisualization; GIS; expertise; evaluation, GeoHCI

## ACM Classification Keywords

H.5.2 User Interfaces: User-centered design.

## INTRODUCTION

Eliciting expert feedback is a central focus for many user-centered design and evaluation activities of geospatial information systems (GeoHCI). While the use of non-experts in GeoHCI studies remains common, most authors will highlight the fact that such studies would benefit from experts. It is taken for granted in the GeoHCI community that this is true. Here, our intention is to explore the nature of geographic expertise (GE) and to identify key questions that must be answered in order to better understand when having expert users is important, and the ideal ways in which we can measure or characterize their GE.

## DEFINING GEOGRAPHIC EXPERTISE

The geospatial profession is growing rapidly in every way. In the U.S. alone, the Department of Labor estimates that more than 300,000 jobs in the geospatial technology sector will need to be filled over the next decade [4]. At the same time, what constitutes the geospatial profession continues to diversify. Remote sensing, cartography, spatial analysis, spatial software development, and location intelligence are just a handful of the sub-domains that constitute the larger geospatial profession. Recent efforts by the University Consortium for GIScience to define a body of knowledge for Geographic Information Systems and Technology (GIS&T) for use in education have yielded a compendium [2] that identifies over 1600 educational goals that are important for aspiring geospatial professionals to learn. Other recent efforts by the U.S. Department of Labor to

define core competencies for geospatial professionals have resulted in complex, comprehensive models of geospatial industry [1] and geospatial management [3] skills.

Amidst this broad range of forms of GE, the GeoHCI research community is faced with a fresh challenge to better define, disambiguate, and understand such expertise. In addition, we should explore its relative impact on the user-centered design activities we wish to pursue. We need to know what GE is, and whether or not it matters.

Here we define geographic expertise as the set of geospatial technology and methodology competencies that a user possesses. GE is distinct from cognitive spatial ability, recognizing the fact that a wide range of measures already exist for eliciting and understanding aspects of a person's overall spatial ability, and the fact that spatially-able people are not necessarily involved in a geospatial profession.

## EXPERIENCES FROM GEOHCI STUDIES

Geographic experts have played prominent roles in a wide range of recent GeoHCI studies. Typical goals for such studies are to elicit design requirements for new geospatial systems, to evaluate current/prototype systems to suggest future refinements, or to explore cognitive and perceptual processes that relate to geographic knowledge or systems. At Penn State, we have experience with these major types of studies; employing experts and non-experts to achieve these goals. Anecdotally, our most valuable GeoHCI experiences with experts have been projects that attempted to develop and iteratively refine systems designed to be used by experts [10]. Our studies on perception [6], and cognitive processes [11] seem not to suffer from a lack of expert involvement, compared to non-expert student participants. However, we have not completed the research necessary to draw clear distinctions regarding the value of expertise for different types of GeoHCI studies.

## RESEARCH PRIORITIES

Here we present four research priorities for elaborating upon the nature and value of GE in GeoHCI. There are certainly other important questions beyond these.

### Can we categorize users based on types of geographic expertise?

The aforementioned efforts to define a body of knowledge for GIS&T and core industry and management

competencies for professionals provide a range of potential mechanisms by which we could categorize GeoHCI study participants. We need to develop best practices for categorizing participants by expertise. We do not know if efforts to define discipline competencies fit well with real-world user populations that we wish to engage for GeoHCI studies, and we lack the means to easily assess these competencies through pre-tests or other mechanisms.

#### **How does spatial ability relate to geographic expertise?**

A wide range of measures of spatial ability are available to characterize participant aptitude for spatial proficiencies. Future efforts should identify whether or not spatial ability relates in any manner to particular types and/or amounts of GE. One recent study found no relationship between spatial ability and expertise [5], although the study did not stratify expertise, relying instead on years of work experience alone. Furthermore, we need to know if it is possible that one or the other may better explain variation among user performance in GeoHCI cognitive and perceptual experiments where speed and precision can be measured.

#### **How much geographic expertise makes a difference?**

It remains an open question as to what extent a long career in a geospatial profession adds value to participant pools for GeoHCI studies. We need to understand how many years of experience, types of geospatial competencies, and types of geospatial professions a particular user may need to have in order to make a noticeable impact on our ability to conduct meaningful GeoHCI science. For example, previous HCI work has focused on understanding how many users it takes to identify most usability problems [8], and we argue here to explore the extent to which we can identify sweet-spots for recruiting experts (both in terms of numbers and professional diversity) for GeoHCI studies.

#### **Does geographic expertise explain perceptual and cognitive differences?**

Recent research has focused on exploring potential perceptual and cognitive differences between those who have GE and those who do not [9]. Much more needs to be known regarding the types of GE that may cause differences to appear in visual and cognitive processes as pertains to interacting with geospatial information. Advances in eye-tracking technology make new forms of perceptual studies more approachable than ever, while rich methods such as the long-term case study approach [7] may reveal deeper cognitive processes among experts.

#### **CONCLUSION**

While a great deal of progress has been made on understanding user's spatial abilities and their impact, much less progress has been made on understanding geographic expertise. Such progress is essential to support the further development of efficient and effective GeoHCI methods. Given the time and capital associated with recruiting expert

users, we need to know how to best utilize those participants. The nature of GE is already complicated, and the rapid growth of the geospatial profession will increase that complexity over time, thereby calling for a more nuanced understanding of GE's impact on GeoHCI studies.

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