

# Challenges for Human Subjects Research in Cartography

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## ABSTRACT

In this position paper, I outline a set of challenges for human subjects research in cartography. My opinions presented here are preliminary and partial, and are drawn from notable trends in cartographic research since the 2001 ICA special issue as well as my own experience conducting both qualitative and quantitative human subjects research.

## Author Keywords

Methodology; user studies; user-centered design

## HUMAN SUBJECTS RESEARCH IN CARTOGRAPHY

In the 2001 ICA special issue of *CaGIS*, MacEachren & Kraak [1] identify development of a “human-centered approach to geovisualization” as their final, crosscutting research challenge. Centering on the human requires an understanding of how people see (perception), understand (cognition), interact with (motor skills), and derive meaning from (culture) maps. Accordingly, each research agenda in the ICA special issue includes a call for assessments, evaluations, or studies of cartographic concepts, tools, and techniques that involve human subjects.

How well have we answered these calls? I retrieved 351 scholarly articles published across 15 volumes and 60 issues of *CaGIS* since the 2001 special issue, excluding editorials, responses, book reviews, and other brief notes or reports. My preliminary review of these 351 articles found only 57 (16.2%) that describe the collection of primary data from human subjects either in the article abstract or in the methods section (Fig 1). Instead, most articles propose a novel design or analytical technique without an empirical evaluation, or describe a technical application or case study without consulting users or stakeholders. Clearly, empirical evidence from human subjects is not required to do cartographic research, so when is it valuable? We need to:

- Summarize results from human subjects research in cartography since the ICA special issue, identifying remaining gaps and appending recent developments;
- Affirm the role of human subjects research in cartography, and do so in a manner that is chiefly aware of its historical limitations and broader politics [2] so as to complement, and not combat, non-empirical epistemologies in cartography.

## CHOOSING AND MIXING HUMAN SUBJECTS METHODS

There is a wide array of methods available for conducting human subjects research, and pairing research methods with research questions can be a challenge. I counted 89 unique

studies reported in the 57 *CaGIS* articles since 2001 that involve human subjects. Most of these studies make use of an experimental or quasi-experimental protocol ranging in formality in which participants complete tasks with a series of map designs or a single, multi-functional cartographic tool. On my count, 46 such studies were completed in a lab setting, 9 were conducted online, and 6 were conducted in the field (61 in total). In addition, the survey method was used 14 times (not including surveys containing maps to mimic a quasi-experimental design), interviews 10 times, focus groups 3 times, and participant observation 1 time. Notably, I did not mark the 12 studies using volunteered geographic information in the *CaGIS* sample as human subjects research—given its common treatment as a secondary source—but there are strong ethical arguments for treating VGI analyses as human subjects research.

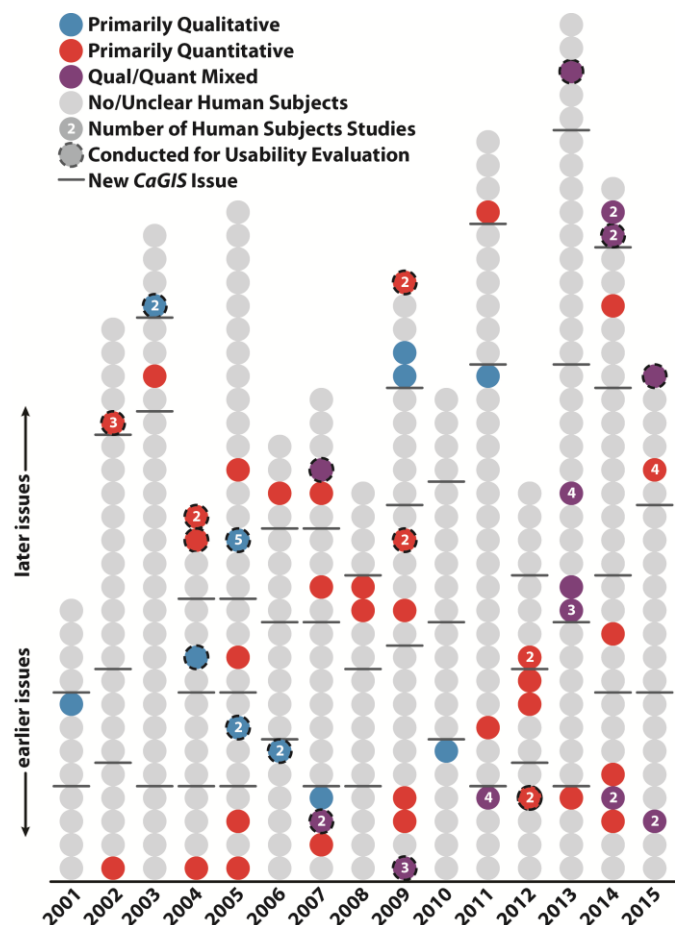


Figure 1. Human subjects research in *CaGIS* since the 2001 ICA special issue. The ICA special issue is not included in the 2001 review. At the time of this writing, three issues of *CaGIS* have been published in 2015.

A useful, albeit limited, way to organize different methods that involve human subjects is by the type of primary data collected through the procedure: quantitative or qualitative. There is a bias towards quantitative research in the reviewed sample of *CaGIS* articles: 33 articles primarily report quantitative data, while only 11 articles primarily report qualitative data. However, 13 articles explicitly collect both quantitative and qualitative data, and there has been a notable spike in *CaGIS* of mixed method research over the past ~5 years. To further clarify how to choose and mix human subjects research methods, we need to:

- Construct a unifying framework for organizing methods that use human subjects, exposing relative advantages and disadvantages specific to cartography;
- Increase our attention on qualitative and mixed methods for cartographic research.

### DESIGNING A HUMAN SUBJECTS STUDY

When doing human subjects research—qualitative or quantitative—I find it useful to organize the study design by four topics: (1) participants (e.g., sample size, expert/non-expert), (2) materials (e.g., real/synthetic maps, visualization tools), (3) procedure (e.g., tasks/questions, randomized/structured order), and (4) analysis (e.g., coding, statistics). While the expectations across these topics justifiably vary across methods, I also found quite a large amount of variation in study design within a single method in my review of *CaGIS* articles. Further, methodology textbooks in geography are invaluable resources for designing map-based studies, but do not cover many study design decisions specific to cartographic research, particularly regarding emerging technological trends in interactive, online, and mobile mapping.

However, my *CaGIS* review did yield several potentially viable strategies for developing best practices in cartographic research involving human subjects, including a historical synthesis of cognitive experiments [3], “methods” articles providing extended discussion for applying a novel human subjects method or analysis technique for cartographic research [e.g. 4, 5], and a “reanalysis” article applying new techniques to a compilation of previously published studies [6]. To move beyond the minimum publishable unit and towards reliable, valid, and relevant human subjects research, we need to:

- Undertake a coordinated effort to produce an edited volume on methodology that outlines best practices for studying human subjects in cartography;
- Update methodological procedures and analysis techniques to study interactive, online, & mobile maps.

### USER-CENTERED DESIGN WITH HUMAN SUBJECTS

In their ICA agenda article, Slocum et al. [7] make a distinction in human subjects research between theory-driven experiments and usability evaluations. Since the 2001 special issue, there has been a marked increase in the application of user-centered design and usability

engineering techniques in cartography, particularly for interactive, online, and mobile maps [8]. Of the 57 reviewed *CaGIS* articles, 17 used human subjects research explicitly for usability evaluation as part of a broader user-centered design process. What excites me about user-centered design for cartography (aside from making better maps) is that it shifts the human from an object of study and to an active member of the design and development team.

User-centered design has different standards for human subjects testing than traditional cartographic research [9]. User-based evaluations are conducted in a discount manner and emphasize rapid, qualitative feedback. User-centered design processes often mix multiple methods across the length of a project—triangulating insights across evaluations—and make use of novel or non-traditional participant procedures (e.g., card sorting, cognitive walkthrough, think aloud). Finally, user-centered design pairs user input with expert- and theory-based evaluations to make efficient use of project resources. As cartographers increasingly take on the role of UI/UX designer on large mapping and GIS projects, we need to:

- Develop recommendations for adapting human subjects methods for discount, user-centered cartographic design; we present an initial framework in [10];
- Encourage publication of case studies that apply user-based evaluation, expanding positive examples of user-centered design in cartography to inform other projects;
- Integrate user-based evaluation methods into cartographic education to prepare students to fill UI/UX designer positions.

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