Research Approaches in Cartography: A Preliminary Review

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In this presentation, we report on a preliminary review of research approaches recently published in the International Cartographic Association's (ICA) affiliate journals. Arguably, a strength of cartography as an academic discipline is its range of accepted epistemological, ontological, and methodological approaches for making a publishable research contribution. As both an art and science, cartography welcomes humanistic, feminist, semiotic, and other critical approaches as well as draws from qualitative and quantitative empirical methods developed in geography, psychology, and other social sciences. Further, cartography also is a professional design craft, and therefore novel practical, applied, and technical approaches from fields such as graphic design, user interface and user interaction (UI/UX) design, mathematics, computer science, and software engineering have also been relevant. Despite this diversity of approaches, most methods and techniques employed in cartography are from outside the discipline. Accordingly, it can be daunting to keep track of the numerous approaches researchers use to study maps and mappings, and further to assess if the methods used match larger research objectives and disciplinary goals. Here, we ask: *How do researchers contribute to cartography*?

Research methodology has drawn intermittent attention within cartography since the turn of the century. For instance, Montello (2002) took a historical approach to evaluating cartographic research and traces the roots of American cognitive cartography to the use of the "scientific approach" set forth by Robinson in the Look of Maps (1952). He argued that while the goal of cognitive cartography in the second half of the 20th century was ostensibly to improve maps, as a whole the discipline still has many questions to answer; one of which was "to what degree, and how, will map-design research affect map production and education in the twenty-first century?" (Montello 2002, 299). Suchan and Brewer (2000) complement Montello's primarily quantitative focus with discussion of the array of qualitative methods growing in popularity in geography and other social sciences, arguing such qualitative methods bring "research closer to the problem-solving realms of mapmakers and map users" (Suchan & Brewer 2000, 145). Finally, MacEachren & Kraak (2001), Robinson et al. (2005), and others have called for the adaptation of usability evaluation methods for interactive cartography and geovisualization, with insights from the evaluations included as part of a user-centered design case study about a specific mapping application.

More recently, the ICA hosted a series of joint commission workshops to develop a collective research agenda for the future of cartography as a research discipline (Griffin et al. 2017), with one of the resulting special issue papers directly focusing on user studies. An explicit need identified was for a "comparative and critical meta-analyses of prior user studies on maps and visualizations, with a focus on similarities and differences of empirical results when evaluating print/static versus interactive maps" (Roth et al. 2017, 78). In perhaps the most robust analysis to date, White (2017) evaluated how participants were recruited for human-subjects user studies, what and how information about the participants was collected by the researcher(s), and what was reported in publications. His research showed a high level of variability across user studies in how this was reported and some assumptions that can be made about what data was collected. The result of his research was the creation of a database of user studies for the discipline to use, however it has not been widely-distributed or maintained. Finally, little of this work has integrated emerging community-engaged, collaborative, and feminist methods, processes, and workflows available for cartographic research (e.g. Boll-Bosse and Hankins, 2018). Such approaches center reflexivity, offering a toolkit for "pressing pause" during the research and design process to "become accountable to intersections of power that are both foreclosed and enabled by their own positionality" (Kelly & Bosse, 410).

As an entrypoint to understand how researchers currently are contributing to cartography, we used quantitative content analysis (QCA) to evaluate the research approaches published in 2002–2022 across the ICA affiliate journals: *Cartographica: The International Journal for Geographic Information and Geovisualization, Cartography and Geographic Information Science (CaGIS), The Cartographic Journal*, and *The International Journal of Cartography*

(IJC). Specifically, our coding expanded on Roth's (2015) scheme applied to user studies published in 2001–2014 *CaGIS* articles to encapsulate a more diverse range of contribution types and methodological decisions within these different approaches. In this way, we expand upon Roth's work but provide a new way of looking at the methodological contributions of cartographers in these journals. Our selection of journals is intended to capture the research supported and published under the affiliation of the ICA and results and suggestions will directly support future research calls. The research we will present in this presentation will be a first pass at documenting and coding the main contribution of each study and the methods used. Our goal is to take note of the gaps in the types of methods published in the ICA journals and identify potential opportunities for methods and contributions of researchers going forward.

Preliminary results from this initial review of the articles published in ICA affiliate journals show a general shift in research methods between 2002–2022. First, we observed a diversification of methods from the quantitative controlled experimental methods of the "Robinson" era of cognitive cartography including qualitative and user-centered design studies to more computational and technical non-empirical approaches. Second, we observed a subset of new approaches and methods specifically tailored to evaluation of interactive, animated, web and mobile maps. Third, we observed that critical cartographic approaches hold a relatively small space within ICA affiliate journals. Finally, we observed possible evidence of a growing disconnect from the practical and professional side of the discipline; based on this preliminary work, we expect that the questions the *entire* discipline wants to answer do not track with the research questions and methods published in these ICA journals.

There are many future opportunities for cartographic research particularly through calls for research that represents the wider discipline in three key ways. First, the past decade has seen a greater crossover between traditional cartographic research and critical cartography, but the latter of which primarily has been published outside the ICA affiliate journals. This is despite the general agreement that the human user is no longer viewed as "an object of study [and is now viewed as] an active member of the design and development team" (Roth 2015, 2). Second, scholarship on practical cartography has also not been a focus in the ICA journals. Indeed, connecting with professional cartographers can be a challenge, but it is also an important opportunity for the discipline. Finally, while the ICA (and thus ICC) has a goal of being the place which brings together cartographers from across the globe, we hope new and renewed calls can be made to encourage the publication of scholarship from outside the Global North. Identifying the current state of contributions is an important first step to broadening the authorship and thus contributions of researchers across the worldwide field.

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