

Vis For All:
Studying and Designing for Underrepresented Groups in Data Visualization

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Intellectual Merit: The development of information visualization tools and platforms have transformed data visualization into a powerful reasoning tool that is broadly accessible on the web. However, most design recommendations in the field of information visualization make two critical assumptions that do not hold in web environments: 1) people have a baseline familiarity with charts and quantitative reasoning software, and 2) people will dedicate sustained attention to a particular design. A recent assessment of computer skills of 215,000 people in 33 countries by the *Organization for Economic Co-operation and Development* found that only 32% of the population (aged 16-65) is able to solve problems using tools such as sorts or filters, mechanisms that are common in data visualizations. In addition, *The New York Times* has recently decided to make *fewer* interactive visualizations, concluding that the level of engagement and attention did not match the time investment. The failure of these assumptions (and resulting designs) have severe implications for the public understanding of critical decisions we face in the 21st century (e.g. reducing the impact of climate change, combating poverty, the efficacy of vaccinations). This research renews the focus on underrepresented populations that is necessary to improve the public's trust and understanding of complex data.

The principal investigator's research will address these challenges by examining and designing for demographic groups that have been historically underrepresented in the visualization literature. Leveraging the rural geographical location of the PI's home institution, the PI plans to 1. conduct **field studies** of rural, low socioeconomic populations reexamining visualization design guidelines 2. **develop tools** to improve the access of researchers to more diverse populations, and 3. **disseminate design guidelines** interaction mechanisms that improve accessibility to data visualization.

The principal investigator has a background in examining the effect of individual differences in information visualization, as well as designing technology that personalizes interaction with an interface. The PI has proposed a framework to describe the effects of individual differences in data visualization, investigated the effect of cognitive traits on understanding medical data visualizations, and designed interactive mechanisms to encourage data exploration on web visualizations. In addition, the PI has a history of using physiological sensors to provide a unique objective, in-situ perspective on visualization evaluation that will be necessary to capture ethereal measures such as engagement.

Broader Impacts: The results of this research will improve the accessibility of data understanding and reasoning to the majority of Americans who lack the skillset to use existing visualization designs. In addition, the tools the PI develops will lower the barrier for other researchers seeking access to more diverse populations.

In addition, the PI is a faculty member at Bucknell University, a 4-year undergraduate liberal arts school in central Pennsylvania. Following the PI's standard research processes, work funded by this project will heavily involve undergraduate students as both collaborators and co-authors. It will also fund undergraduate travel to Human-Computer Interaction conferences, which due to their diverse composition (in comparison to many technical conferences) have traditionally encouraged students from underrepresented backgrounds in Bucknell's Computer Science department. Finally, the PI is involved with the development of new curriculum that focuses on students approaching Computer Science from outside traditional STEM backgrounds. Findings from this work will be directly translated to pedagogical techniques designed to improve the accessibility (and ultimately, diversity) of the computer science classroom. The results of any course modules will be made publicly accessible and widely disseminated for other computer science departments.