HCC: Medium: Collaborative Research:
Scaling Collaboration over Data and People

Project Summary

Many vital organizations—police departments, intelligence agencies, disease control centers, science and engineering projects, and others—are forming collaborations to investigate complex problems. Tracking down criminal networks, prosecuting corruption, studying earthquakes, and identifying the source of disease outbreaks are examples of investigative tasks that often require collaboration. Collaborations in quasi-decentralized teams allow experts not only to specialize but also to share information and collaborate to make sense of this information. These collaborations depend on analysts' professionalism and skill, and on their joint ability to organize and manage information, build schemas, and integrate hypotheses. Recent advances in information aggregation and data visualization have the potential to revolutionize information sharing and collaboration, but analysts still confront problems of information overload, coordination costs, and social disincentives, at a high cost of missed opportunities and error. These challenges increase markedly when data are multitudinous and analysts are many in number and accountable to different organizations.

Research plan
The goals of this research are (1) to understand how the process and results of collaborative analysis change as the scale of data and people increase, (2) to identify optimal cognitive and social conditions for collaborative investigative analysis, and (3) to design and test visualization tools that support collaborative sensemaking through a sharing of the analysis process. These tools can make it possible for analysts to create joint categorizations, compare their hypotheses, and observe traces of one another's analysis paths. The research encompasses two main activities—developing tools and conducting behavioral studies that address questions such as how the tools scale to larger collaborations and massive amounts of data, which tools can reduce cognitive tunneling, and how to minimize the social costs of information sharing.

Intellectual merit
This research will improve our understanding of the complex cognitive and social coordination activities required in collaborative investigative analysis, and lead to new tools supporting this coordination. Our theoretical framework based on cognitive limitations and biases and social processes, exacerbated by scaling data and people, will guide new research on analysis and the potential of visualization tools. The research involves undergraduate, graduate, and professional students, and will result in their further training and education in interdisciplinary research. We propose interesting new educational activities, and have had experience in doing so in the past.

Broader impacts
This project has the potential to improve collaborative investigative analysis in many fields of critical importance to society, including criminal justice, intelligence, science, and epidemiology. Our results will provide new visualization tools for analysts in these areas, recommendations for organizational practices to improve the quality of collaborative analysis, new methods for training professional analysts to solve complex, interconnected problems, and new learning tools for graduate programs in fields such as epidemiological analysis and criminal justice.

Key Words. Collaboration; information visualization; computer-supported collaborative work; investigative analysis; sensemaking; problem solving; visual analytics