Combining Usability Techniques to Design Geovisualization Tools for Epidemiology

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Designing usable geovisualization tools is an emerging problem in GIScience software development. We are often satisfied that a new method works well and provides an innovative window on our data, but functionality alone is insufficient assurance that the tool is applicable to a problem in situ. As an extension of the static methods they evolved from, geovisualization tools are bound to enable new knowledge creation. What we have yet to learn is how to adapt techniques from interaction designers and usability experts toward our tools in order to maximize this ability.

ESTAT (Exploratory Spatio-Temporal Analysis Toolkit), a geovisualization toolkit developed by the GeoVISTA Center at The Pennsylvania State University, is one attempt at facilitating geospatial data exploration and knowledge creation. ESTAT features four geovisualization tools linked together via a dynamic selection, indication, and brushing mechanism. These four elements include: a scatterplot, a bivariate map, a parallel coordinate plot (PCP), and a time series plot (Figure 1). ESTAT was designed from the onset as a geovisualization toolkit for cancer epidemiologists at the National Cancer Institute (NCI). In recent years, the GeoVISTA Center has collaborated with NCI to develop a number of geovisualization tools to support epidemiology.
Our colleagues at NCI anticipate that geovisualization tools will provide epidemiologists with the ability to abduct new hypotheses more effectively and more often by enabling them to uncover structure in increasingly massive and complicated data. Geovisualization tools are not inherently accessible, however, and they need to be designed with as much care for usability as any other software. This is especially challenging because there is limited knowledge regarding the development of usable geovisualization tools. Those who have focused attention on user issues have often relied on quantitative measures of user performance and preference, and usability assessments have generally been employed after tool design has finished. The design of geovisualization tools requires knowledge about the context of work within which they will be used, and should involve user input at all stages, as is the practice in any human-centered design effort. Toward that goal, we have employed a wide range of techniques in the design of ESTAT to date, including: protocol analysis, card-sorting, focus groups, and an in-depth case study.
This paper presents the design history of the ESTAT application, specifically reporting on our efforts to make geovisualization tools usable for epidemiology. ESTAT is the result of a user-centered design effort, and the series of assessments we have employed are described and discussed. Particular attention is targeted toward the results gathered from a case study application using ESTAT for a specific problem in cancer epidemiology. Additionally, the process of usability research that led up to the decision to embark in a long-term case study and collaboration is described. The results of the case-study analysis are discussed, but the primary focus is on the insight we gathered during the case-study that was beneficial to the usability of our geovisualization tools.

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