

Grounding Geovisualization Interface Design: A Study of Interactive Map Use

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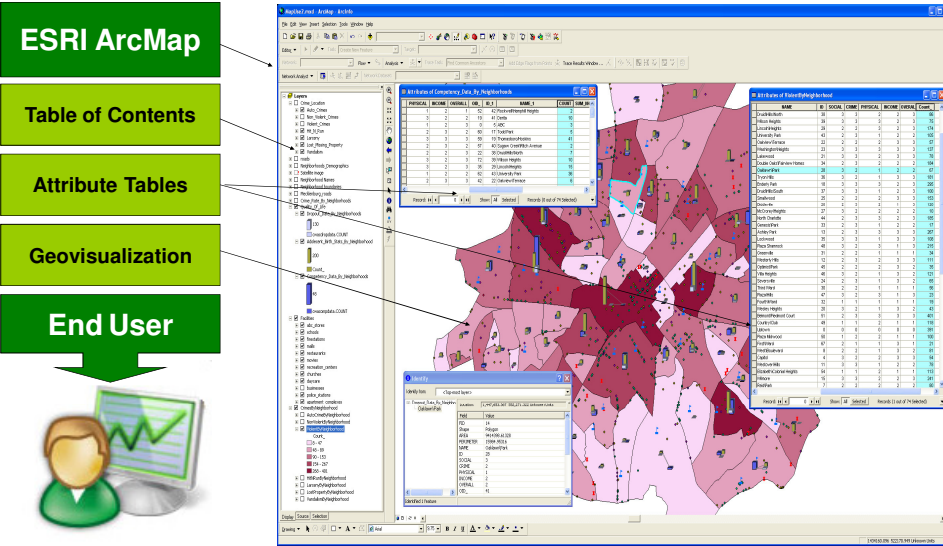
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BACKGROUND

- Geographic maps are one of the most traditional, familiar, and important visualizations in widespread use today
- Building the most effective tools to support user-centered geographic visualization faces a significant challenge: very little is known about how people interact with maps

GOALS

- Understand how the visual interface supports or hinders analysis
- Develop an interaction framework describing users' behaviors



METHODOLOGY

Overview

- ArcMap from ESRI (above), was selected to create a interactive map
- Created a geovisualization with a variety of layers representing crime data, demographics, and quality of life statistics for different neighborhoods
- Conducted an exploratory user study, where users were asked to perform various analysis tasks with a complex map visualization

Participants/Procedure

- Participant backgrounds varied from being novice to expert.
- Fifteen volunteers, 7 males and 8 females, with various GIS backgrounds
- Participants were provided with an explanation of each of the data layers and invited them to explore the layers and the map before beginning the tasks
- Participants completed eight tasks. Participants were asked to think aloud during this process.
- Computer screen, audio, and video for the participant were recorded

Analysis

- Created a textual timeline of each participant's behavior. Open coding was used to analyze the timelines of each participant
- Categorized each participant as a novice, intermediate, or expert based on their experience with ArcMap
- Focused on general patterns of interaction with the map and usability issues

RESULTS

Geovisual Analysis



- Participants with different GIS expertise (shown above) used different combination of approaches (quantitative, visual or mixed)
- Strategies used for comparisons and judgments included (1) visually overlaying values next to or on top of each other at the same time, (2) toggling between two layers to see visual changes, (3) lining up attribute tables next to each other on the screen, and (4) using the Identify tool to view data values of individual objects for data point comparison

Map Interactivity

- Map interaction tools (zoom, pan, etc.) were used infrequently

Conceptualizing Layering

- Layer ordering have created problems for participants. Layer hierarchy and ordering strategy was rarely used even though it would help with the problem solving

IMPLICATIONS

- The high cognitive demand of the interaction impacts more than the efficiency and usability of the map visualization, but can impact the decision making process and analysis results
- Understanding user behavior provides grounded basis for automated personalization / tool support
- Ways to improve geovisual map interactions include
 - (1) Reducing complexity
 - (2) Encouraging Interactivity
 - (3) Supporting Customizations

CONCLUSION /FUTURE WORK

- Lack of interactivity:
 - Adds cognitive load to an already complex environment
 - Impacts users' ability to explore the visual representation
 - Reduces the use and effectiveness of the visualization
- Users need support for basic interaction and analysis behaviors to simplify useful approaches and further reduce complexity
- We are continuing to analyze our results and develop a more formal model of the analysis goals of our users, and a framework describing the interaction behaviors that support those goals
- Based upon the context of the user, we will develop a model of users' behaviors and interactions