Beyond the Bezel: Utilizing Multiple Monitor High-Resolution Displays for Viewing Geospatial Data

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Abstract

Computers have vastly expanded capabilities for storing, creating, and manipulating spatial data, yet viewing area is still generally constrained to a single monitor. With this viewing window limitation, panning and zooming are required to view the full details of a map or image and, because of the large sizes of typical database, usually only in small portions. Multiple monitor configurations provide an attainable, low cost way for individuals to create large, high-resolution desktop displays. This increased screen real estate is particularly useful for viewing and interpreting rich and complex geospatial datasets because both context and amount of detail can be simultaneously increased, reducing reliance on virtual navigation to obtain the desired balance between context and scale. To evaluate the utility of multiple monitor displays for geospatial data, this experiment involved a variety of map and image reading tasks using both raster and vector data under three different monitor conditions: one monitor (1280 x 1024 pixels), four monitors (2560 x 2048 pixels), and nine monitors (3840 x 3072 pixels). Fifty-seven subjects took the test on one of the three display configurations. A computer program captured each subject's performance by recording answers, mouse click locations, viewing areas, tool usage, and elapsed time. A post-experiment questionnaire obtained additional qualitative feedback about subjects' experience with the tasks and display configuration. Overall, subjects did perform more efficiently on the larger display configurations as evidenced by a reduction in test completion time and in the amount of virtual navigation (mouse clicks) used to finish the test. Tool usage also differed among monitor conditions with navigation tools (zooming and panning) dominating on the single monitor while selecting tools (tools used to provide answers) predominated on the nine monitor display. While overall test results indicated the effectiveness of the larger displays, task-level analyses showed that specific performance varied considerably from task to task. The larger displays were the most efficient on some tasks, while other tasks showed similar results among all displays or even the single monitor as the most efficient. The best performance improvements occurred between the one and four monitor conditions, with the

nine monitor condition mostly providing only modest additional improvement. Subjects rated the four monitor display size as the most ideal.

Attribution

Dr. Carstensen is my primary advisor for this research study and is Co-PI of the grant that funded this work. He helped design and implement the testing program, supervised experiment development, and oversaw data analysis.

Dr. Campbell is a member of my thesis committee. With his experience with geospatial data, he helped to design the data visualizations and tasks used in the experiment and create effective figures.

Dr. Grossman is a member of my thesis committee. He helped to develop the post-experiment questionnaire and provided expertise to capture pertinent subject demographics and experience needed to achieve the research objective.

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