

User Interface Studies in the Virtual Map Environment

With the acceleration of interactive virtual map use and the proliferation of such mapmaking software, we need to learn much more about how interactive electronic media and animated map environments influence the communication of cartographic information. When assessing the communicative value of maps in any given environment where animation and other virtual maps are used, I argue that the interface itself becomes a significant factor in the use of the map, or map sequences. We need a revitalized and expanded role for a user-oriented or a user-interface form of research, not too dissimilar to the shifts in research emphasis undertaken by cartographers with the first wave of automation.

To cartographers, geographers, and others promoting the map as a primary vehicle of communicating spatial information and analysis, the question of how to contend with and best utilize the increasingly more powerful information technology and associated distribution techniques is ever persistent. Observing the impact of the computer technology on the mapping process during the 1960's and 1970's led Morrison (1974) to conclude that the technological expansion was a major catalyst forcing cartographers to be introspective about how maps communicate information. Now with the current proliferation of increasingly powerful micro-computers in education, government, business, and industry, much of the spatial information is portrayed and distributed in some form of virtual map, as defined by Moellering (1980). Once again we need to become introspective about map communication issues relative to the newer mapping environments.

The current "hot venues" for these virtual maps include electronic atlases, electronic encyclopedias, and the World Wide Web. These venues often incorporate map animation sequences and other multimedia components, and are increasingly including features which allow for the map reader to control many animation functions and interact with the map/atlas environment to exert some control over the display. When assessing the communicative value of maps in any given environment where animation and other virtual maps are used, I would argue that the interface itself (i.e., how to "operate" the map) becomes a significant factor in the use of the map, or map sequences. Thus, in terms of what we would like to know, I contend that we need a revitalized and expanded role for the user-oriented or a user-interface form of research as one appropriate avenue of inquiry given the literal explosion of virtual map use, particularly with increasingly interactive map animation.

The 'user-oriented approach' is used by Gilmartin (1992) and others as a catch-all phrase to incorporate all aspects of cognitive and perception based research. In traditional user-oriented research, map components and/or whole maps are used as stimuli to test the map viewer's (the percipient's) reactions or perceptions. The mental and psychophysical responses are measured by the researcher, and ultimately the maps' communicative power is assessed and hopefully enhanced by this line of inquiry. Most past perception studies are appropriately specific in isolating a single variable, such as simple circle size in a proportional symbol map, with other map elements held as neutral and constant as possible. The question is, can we now apply a more broad based user-oriented test

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INTRODUCTION

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in these new environments, where the means to control or interpret an animated map, for example, is so dependent on the integrated relationship between many of the map elements (e.g., the static and temporal legends, the means to pause, slow down, speed up, reverse direction, etc.)?

In a research project I wanted to measure the degree of viability or impact that the animated map would have on the electronic atlas environment, particularly when the electronic atlas would be used in an educational setting. I developed a series of map animation sequences using a constant base map, consistent map element placements, but varied the themes and thematic map types. I animated choropleth, isoline, flow, and moving symbol maps across a wide variety of human and physical geography topics in order to emulate some of the breadth of a thematic atlas. I then tested the user reactions using a semantic differential test to quantify their subjective reactions to the maps, and also gave them a brief geography quiz to ascertain what kind of geographic information was being communicated. During the testing, I also monitored the interactive control functions as to the number of starts, stops, pauses, animation speed, and number of viewing times for each of the sequences, which were used as a measure of perceived map complexity. In all, I was able to test nearly 500 map-to-map user communications and interactions (Torguson, 1993).

Originally, I set out to examine the relationship between the subjective reactions of the map users and the amount of geographic information that was communicated from these animated maps while emulating an educational "laboratory" setting. In the process, among other things, it was found that there was no statistically significant relationship between subjective impressions of the maps and how well students were able to glean geographic information from the map. This fact is good news for those using maps in educational settings, where student enthusiasm for maps, even animated ones, and geography in general varies considerably. Unintentionally, I also found that in this study I was testing and qualitatively evaluating the viability of the entire user interface of the animated atlas system. For example, the relatively high scores that resulted on questions that required viewing and interacting with both the static and temporal legends, as well as use of the interactive control functions, suggested that the functional and positional configuration of the controls and legends was accomplished in a practicable manner.

Because most animated map environments (animation software packages, atlases, and media players) have similar control functions, broader user interface studies should translate to any user-environment that employs the animated map. Further, other microcomputer environments that use "interactive" map domains, such as query based encyclopedias and World Wide Web/Internet applications (Peterson, 1996), as well as many scripted or directed software packages (Monmonier, 1992), could benefit from such study. ArcView, which contains both menu and scripted interfaces, is a good example of an application that is being used more frequently by both cartographers and non-cartographers. This increased use can be seen (for example) in the adoption of ArcView as the state standard for "presentation GIS" in Wisconsin (Koch, 1996).

Many cartographers develop map-related packages such as atlas and encyclopedia shells using programming languages which facilitate graphics user interface design and development, such as Visual Basic. For example, I recently released a beta version of a Cartogram Generation Program for Windows. In this program, the user interactively creates contiguous value-by-area cartograms. To address the interface issues, I may opt not only to test the viability of the software interface, but also to

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utilize a user-oriented study to compare manual and computer generated cartograms in regards to cartogram accuracy, the time it takes to complete a cartogram, and perhaps even cartogram aesthetics. Note that Visual Basic is becoming an increasingly popular programming language in both commercial mapping and educational environments (Slocum and Yoder, 1996). Cartographers and software developers using Visual Basic could benefit from user interface studies, because there are scores of possible menu, icon, and interactive/dynamic map display combinations which can lead to a potentially non-intuitive user interface.

DiBiase et. al. (1992) have suggested that with a quarter century of experience with perception testing, cartographers may now be more prepared than ever to study map animation communication. And with the acceleration of interactive virtual map use and the proliferation of such mapmaking software, user-oriented testing can also apply to electronic atlases and encyclopedias, scripted and menu driven software packages that are increasingly being used by non-cartographers, and new software programs that are being developed by the cartographic community. Obviously, we need to know much more about how interactive electronic media and animated map environments influence the communication of cartographic information.

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