Human-Computer Interaction Themes in Digital Government: Web Site Comprehension and Statistics Visualization

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ABSTRACT
Digital government applications often involve web sites to provide information for citizens and visitors from essential services such as passport application or motor vehicle registration to discretionary, but highly popular applications such as recreation and parks information. Another aspect of government web sites is the delivery of statistical reports with summary tables, aggregated data resources, and extensive raw data files. This review focuses on human-computer interaction themes to improve designs of web sites and statistics visualization, especially as they relate to digital government sites. It also addresses research methods that are appropriate for digital government interfaces.

Categories and Subject Descriptors
H.5.2.[**User Interfaces**] *Graphical User Interfaces, multimedia, online help, multi-layer interfaces, web site design, information visualization, statistical data presentation, digital government*

General Terms
Design, Human Factors.

1. INTRODUCTION
Digital government successes depend on well-designed technology that supports effective human performance. Databases, networks, operating systems, and mobile devices are some of the remarkable platforms that support the essential user experiences such as information search, collaboration, and knowledge discovery. Every day millions of users benefit from the government services provided by devoted professionals working in local, state, and federal government agencies. However, often the user experience is filled with frustration, wasted time, and unsuccessful efforts. Researchers and practitioners in the still maturing field of human-computer interaction are working hard to improve the user experience by providing validated guidelines, powerful tools, and theoretical models. As a result, innovative designs for web sites are accelerating user comprehension and promoting meaningful visualization of statistical reports [19].

Digital Government Conference 2005, May 15–18, 2005, Atlanta, GA, USA.

Our Digital government research project (GovStat) [12] and website [8] envisioned a comprehensive Statistical Knowledge Network, and focused on specific projects that would contribute to that goal. Our brief motto to capture the intent of our work was to enable users to "Find what you need; Understand what you find."

2. WEB SITE COMPREHENSION
The emergence of the World Wide Web offered remarkable new capabilities for digital government services and information access. The promise of widespread access to government resources attracted most agencies and led them to prepare so many web sites that portal sites such as FirstGov [7] and FedStats [2, 6] became valuable additions to facilitate usage.

The rush to place information on government web sites has produced mixed results, but improved research-based guidelines may help to raise quality [9]. Popular books on web usability are influencing designers and educating managers [10, 14] and providing guidance for ensuring access for users with disabilities [15].

On the research side, there are innovations for improving learnability of web sites and the sometimes complex processes required for form-filling or data exploration. Our research efforts focus on multi-layer interface design to enable a wide range of users to succeed [4, 18], nicely demonstrated by the main NASA web site that provides compelling material for "kids, students, educators, media & press, researchers, industry, and employees" [13]. A second topic is the use of recorded demonstrations, 10-60 second screen captured animations that show users how to accomplish a single task with a narration that explains what is happening while enabling users to maintain visual attention on the screen activity [16].

3. STATISTICS VISUALIZATION
One of the key roles of government agencies is to collect data and produce reports to guide decision makers in government and the private sector. The decennial census, mandated by the U.S. Constitution, and hundreds of other U.S. Census surveys of housing, business, etc. have provided valuable insights for urban planners, corporate leaders, labor union advocates, and numerous consumer groups. Other government agencies such as the Bureau of Labor Statistics offer closely followed reports on employment,

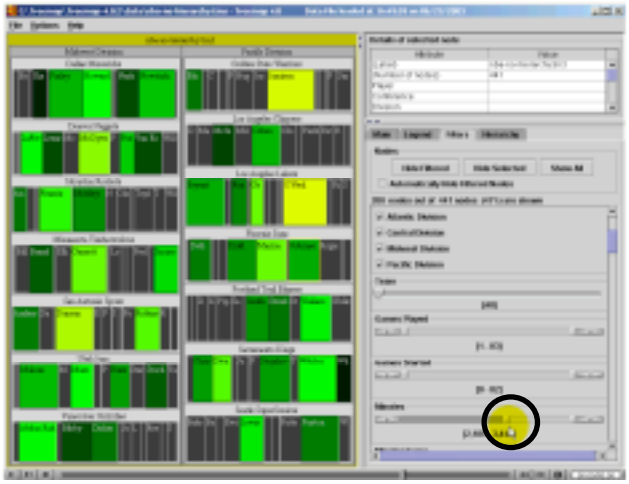

Fig. 1: A sample screen from a recorded demonstration of Treemap 4.0, produced with Camtasia. It shows the entire real screen of the application. Clicks can be heard, and the cursor is highlighted with a yellow circle. Here a slider in being moved. Synchronized voice commentaries explain the effect of this action on the display. (www.cs.umd.edu/hcil/treemap)

consumer prices, cost of living, etc. Finding and making sense of these valuable resources is facilitated by appropriate presentations such as tables, maps, and interactive visualizations. The challenge is to make these complex data sets understandable and usable by a wide range of users [1, 3, 19, 20]. There are many positive examples of government web sites with statistical information visualization [6], and innovative examples from non-governmental public service sources such as Fannie Mae [5]. Advances in information visualization tools are also providing remarkable new powers for expert analysts [11, 17].

ACKNOWLEDGEMENTS

This material is based upon work supported in part by the National Science Foundation under Grant No. EIA 0129978, and the US Census Bureau.

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