

## **INTRODUCTION TO VOLUME 1, ISSUE 3: WEB NAVIGATION**

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The amazing wealth of information and profusion of services available on the Internet are only useful when people can access them successfully. Unsophisticated and erratic search strategies make it hard to find desired services, and poor site designs confuse users. Therefore expanded research on diverse aspects of Web navigation is welcome: innovative approaches to designing Web sites for improved navigation, streamlined browser design to facilitate Web navigation, better training methods, and enhanced customer support. Information architects, Internet service providers, browser designers, Web designers, Webmasters and Web programming tool developers all have a role to play in making the Web easier to use.

As the nature of the Web has changed, the user population, and thus user behavior, has also changed. At the beginning of the 1990s, the Web was used by a small number of technically sophisticated users, who used it primarily for discretionary professional exchanges. People 'surfed' the Web, seeing what they would encounter.

As the Web has become a standard part of the personal computer, the Web has expanded from exploratory entertainment to a primarily goal-directed activity: finding information, purchasing products, communicating with others, or performing other work-related tasks. The population of Web users is no longer primarily technical professionals. Web users include the full range of people: the retired, teenagers, users with varying levels of education and motivation, users with disabilities, and users with a wide range of technical or computing experience. However, the disparity in access to technology, often called the digital divide, presents new challenges for designers and policymakers. Economics plays a key role as the cost is still high for many people, but even if it were free, there would still be impediments to broad adoption. Understanding these barriers to adoption, which exist in Web site interfaces and Web browser interfaces, and how they can be overcome, is a goal of this special issue.

As more government information and services are placed on the Web, expectations change for what users consider to be an acceptable level of usability. In the past, a software application or Web site was considered successful if, say, 85% of users could interact and reach their task goals successfully. When government information and services are presented on the Web, 85% success is no longer acceptable. Because citizens have a right to access this information and enjoy these services, a 100% success rate, or universal ease of use (usability), should be the goal. Everyone has the right to this information, and when certain segments of society cannot easily access important government information, there are major ramifications for society.

These strong requirements are needed because of the remarkable success of the World Wide Web. Site designers, information architects and information managers have been successful in steadily improving the quality of web services, but user expectations and needs have grown more rapidly. To accomplish the visionary social goals—such as access to government services, healthcare information, neighborhood support groups and community economic development, far greater effort needs to be applied by researchers, software developers and industrial developers. In order to produce effective browser software, comprehensible navigation support and well-organized Web content, researchers should conduct detailed analyses of what works and what doesn't, followed by creative designs that are refined through careful usability tests with typical users. Predictive theories and prescriptive guidelines could enable more Web designers to produce services that benefit a wider range of users. Collaboration of computer scientists with social scientists could lead to better identification of user communities, their skill levels and their needs.

### **WHY A SPECIAL ISSUE?**

By increasing the published literature on the topic of Web navigation, the guest editors of this special issue sought to create new bridges between computer scientists and social scientists. The initial call for papers was widely disseminated by way of email and discussion groups. An ambitious schedule was established to quickly push these fresh results through an intense process of review and revision. Responses from recognized research groups and some new ones demonstrated strong interest in the topic. Reviewers were encouraged to make prompt comments and then put pressure on the authors to make revisions.

This resulting special issue on Web navigation includes both full research reports, as well as research summaries. Many collect data on or observe actual user behavior; others do content analyses, while others muse more philosophically about design issues. While one would like to report that people are successfully using the Web, unfortunately, this goal is far from reality. Many different populations of users have problems accessing the information that interests them, which is addressed in this special issue.

Building and maintaining a Web site is a large undertaking, and there are many different roles involved in such a project. Systems analysts, information architects, tool specialists, programmers, Web developers and Webmasters all can influence the Web site navigation. The Web development tools that are used (such as FrontPage and DreamWeaver) can also influence the Web navigation. Even policymakers can influence Web navigation, by requiring that certain categories of Web sites be fully accessible to people with disabilities who use assistive technology.

All of these people involved can have different titles and multiple positions, but they all have a role to play in improving Web navigation. Unfortunately, when building or re-designing Web sites, many organizations still do not pay attention to usability-related issues, and ignore the issues related to Web navigation. Increased research on these issues, along with better tools, can make it easier for all involved to improve Web site navigation.

There are many causes of the problems that users face that are related to poor Web navigation and design. Solutions will come when all stakeholders recognize these problems, and work together to find and build solutions. The aim of this issue is to raise awareness of the problems that typical users face related to Web navigation and to stimulate interest in addressing these concerns. Work on these issues needs to proliferate!

#### **FOCUS AND IMPLICATIONS OF THESE ARTICLES**

The articles in this issue are presented in three groups: user behavior, design issues and tools. However, these are not absolute boundaries between the three groups, as when user studies touch on design and tool issues and the design and tool articles refer to user behavior.

*User Behavior and Frustration:* Several articles in this special issue will interest researchers and practitioners who want to better understand how users stumble, suffer and fail in their Web experiences. By understanding the difficulties users encounter with Web navigation, Web site designers may be able to construct more effective Web sites. Readers who themselves have experienced frustration related to Web navigation will be heartened to know they are not alone.

The first article by Ceaparu studies a specific page (the alphabetically organized topics at [www.fedstats.gov](http://www.fedstats.gov)) designed to facilitate citizen's access to government statistical data, but her disturbing results from an observational study of 15 knowledgeable users show that much work is still needed. Each user attempted 3 tasks, but only a total of 7 tasks out of 45 were correctly completed. Her seven recommendations, which apply to many Web sites, include thematic organization, better choices of terminology and universal usability.

Similarly discouraging results come from Lazar et al.'s study of 111 (mainly student) users, which indicates that up to 45% of users' time is wasted

in trying to accomplish their goals. These frustrating experiences can lead to high levels of annoyance and can even affect users' interactions with other people later in the day. The primary causes of frustrating experiences, related mainly to confusing or unclear Web navigation, should not pose insurmountable obstacles. With appropriate interface design, and multi-disciplinary cooperation, these obstacles can be overcome.

In the next article, Hargittai examines Web-searching patterns for a representative sample of 97 users as they look for tax forms online. Participants were observed during the search process and interviewed afterwards. While most users were able to complete the task successfully, they used many different strategies (e.g., using a search engine or a specific URL), and in many cases, took a long amount of time to complete the task. The author identifies confusing URLs (such as `irs.gov` vs. `irs.org`) and poor page designs as the two most common sources of problems. This study demonstrates that it is often not enough simply to post information online.

As the number of users above the age of 65 go online is increasing, they continue to encounter problems finding the information in which they are interested. Helpful guidance for information architects comes from Kurniawan and Zaphiris's sequence of three studies with 49 elderly users, who applied card sorting methods that resulted in insightful clusters of Web site organization. Based on the research, the authors encourage information architects to organize items based on functionality (or purpose), rather than geographic location of the resource. In addition, the category labels suggested by seniors were less formal than the terminology used by designers. The authors' methods and results have applicability for many Web site information architecture design projects.

Using a classic 2x2 experimental design, Jenkins, Corritore and Wiedenbeck show diverse patterns of behavior for different user groups. The authors studied how the absence/presence both of domain expertise and of Web experience influenced the search behavior of 16 nurses seeking information about osteoporosis. They observed that the nurses who were novices with respect to osteoporosis and the Web used inefficient search strategies, typically referred to as hub-and-spoke navigation. In contrast, nurses who were experts both with respect to osteoporosis and Web experience used more efficient search strategies. Results suggest how these distinct differences in search patterns related to expertise can influence the design of search tools and Web sites.

*Web-Site Design:* The next three studies examine Web navigation issues for Web site designers. MacKay and Watters address Web navigation issues for smaller screens, such as those on handheld and wireless devices. They survey four approaches for moving Web sites from larger screens to smaller displays: direct migration, data modification, data suppression and data overview. With direct migration, there is no change made to the Web site. Data modification entails changing some aspects of Web pages, such as reducing image sizes, changing tables to lists, or summarizing text. Data suppression entails

displaying only skeleton information (e.g., groups of textual links) that users can use to view more information. With data overview, the user is presented with an overview of the entire Web page, which allows them to focus on a specific area within the context of the entire page. The authors summarize their findings in a table, which can assist Web site designers in choosing an appropriate migration approach. This information can also be used to develop automated transformation tools, which Ivory, Mankoff, and Le discuss in their article below.

Cukier and Middleton use an elaborate content analysis to examine 184 Web sites of non-profit organizations in Canada. Their findings suggest that many users may have trouble finding content that is desired, and that navigation on these Web sites can be problematic. For instance, on nearly half of the Web sites examined, clear navigation is not present at all times. Searching capability is not present on nearly two-thirds of the Web sites studied. Poor navigation techniques were present in a surprisingly large number of sites, such as “mystery meat” navigation, where the navigation is not clear, and the users must guess as to where the link will take them. This paper also discusses some of the Web navigation considerations that are specific to non-profit organizations.

Danielson examines the impact of changes in navigation support within a Web site and proposes a model of “transitional volatility”. He studies three common types of Web-site information architectures—full overview (all links exposed on all pages), partial overview (top-level links exposed), and local context (top-level, sibling and children links exposed)—and he derives measures to aid in understanding users’ perceptions of navigation volatility. Danielson’s analysis of data collected from 30 users shows that the measures do illustrate differences in navigation behavior for the three information architectures and provide some preliminary support for his model.

*Browsing and Evaluation Tools:* The Cockburn et al. article carefully analyzes the design and usage of the heavily used BACK button that should interest designers of Web browsers. Their analysis of log files (Netscape history and bookmark files) for 17 users over an extended period demonstrates the importance of Web page revisitation. The authors provide evidence to guide decisions, and three high-payoff revisions to current strategies, which could enable more successful Web navigation and revisitation. For example, they show that a gesture-style BACK button (i.e., the user ‘flicks’ the mouse and presses the left mouse button as opposed to using the Alt+left arrows keys or the browser’s Back button) reduces navigation time by up to 18%. This article demonstrates the importance of understanding patterns of user behavior and the underlying computer science design issues.

Wen discusses the related concept of Post-Valued Recall (PVR) Web pages—that is, Web pages that are not initially recognized as being important enough to return to, but later on, merit closer examination. The author

conducted a study in which 12 experienced Web users completed three search tasks. Midway through the session, the users were distracted with an additional search task, in order to mimic shifts that can sometimes occur during a search process. In a post-study interview, Wen gave the users both bookmarked and PVR candidate pages to retrieve. Although users attempted to retrace their steps, they found it considerably more difficult to retrieve the PVR pages than the bookmarked ones. Wen addresses the challenges of assisting users in finding these pages.

Ivory, Mankoff and Le's detailed analysis of existing automated tools for improving Web sites and access to them by diverse users is also of interest to designers of browsers and to Webmasters. The authors characterize automated evaluation and automated transformation tools according to the type of user abilities they support. In addition, they discuss those few studies that have been conducted to establish the efficacy of such tools. For example, they show that although three popular tools—WatchFire Bobby, W3C HTML Validator and UsableNet Lift—identified more usability problems than designers can, experienced designers made changes to improve Web site quality without using the tools more so than when they used the tools. The authors compellingly document the need for effective evaluation and transformation tools to dramatically improve access and ease of use. This is a textbook example of how movement toward the goal of universal usability can be accelerated by tools derived from computer science research.

## CONCLUSIONS

The three issue editors appreciate the opportunity to compile a special issue designed to bring computer/information science researchers into closer cooperation with social scientists. This is a positive first step that needs to be accelerated to incorporate a broader range of appropriate social science theories, research methods and analytic tools. Social scientists and computer scientists working together can make a positive impact on improving Web navigation. By observing user behavior, social scientists can work with computer scientists to develop better Web tools to address the problems of Web navigation. Web development tools, used by Web designers and Webmasters, can be the key to improving the problems that users currently face with Web navigation.

Beyond studying and understanding the interplay between information technology and social behavior, there is the need to innovate, propose and explore novel directions that will influence future socio-technical systems. This aspiration becomes more timely in light of ambitious proposals for advanced systems to support electronic voting (e.g., registration and absentee ballots), tax services (e.g., property tax payment and dispute resolution), license applications (e.g., motor vehicle and commercial), passports, visas, and the like. Of still greater import and impact are the many proposals to increase security, fight terrorism, and control crime, while protecting privacy and citizen rights.

Computer/information scientists and social scientists can play a pivotal role in these emerging issues by providing policy makers with further informed analyses and a broader set of innovative policy options.

The Internet has been described a giant encyclopedia with the pages from these volumes scattered across a giant floor. It remains a great challenge of our time to enhance the public's ability to pick their way through the jumble.

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