Digital Government Information Services: The Bureau of Labor Statistics Case

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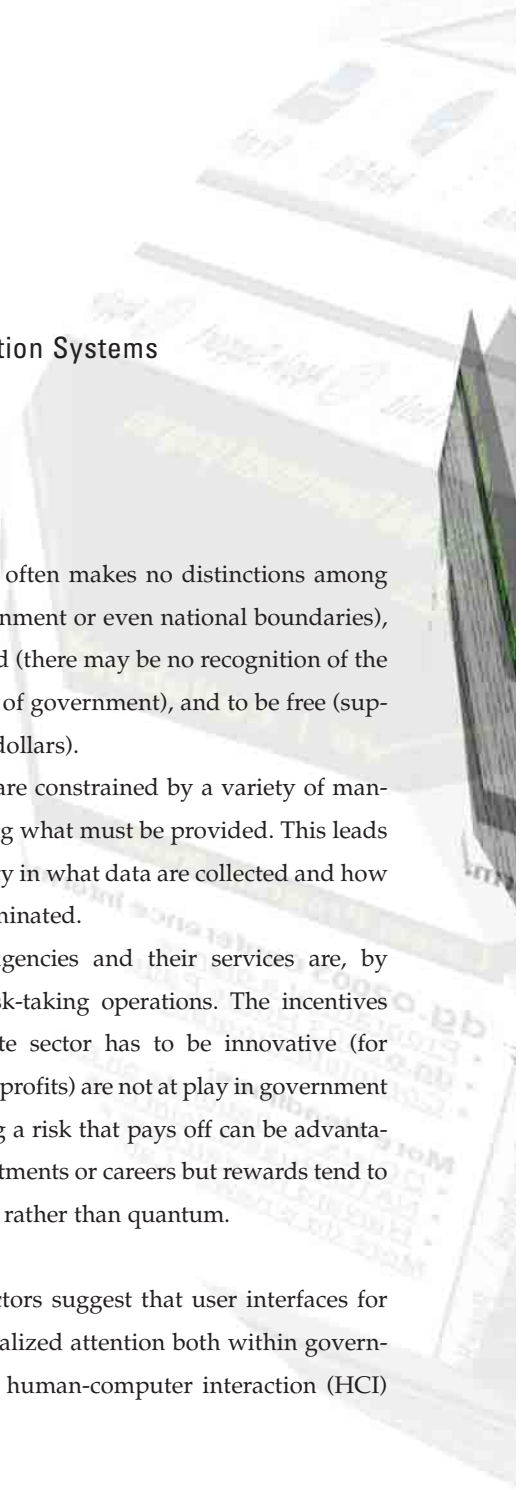

Digital government aims to better serve people by leveraging technology to make government services more accessible to a broad range of citizens. Digital government (DG) services fall into three classes: information dissemination, citizen transactions, and governance participation. Information dissemination via the Web has been by far the most pervasive service addressed by government agencies at all levels [4].

User interfaces are especially important challenges to DG for the following reasons:

1. User interfaces must support the broadest possible participation by constituents—this is universal usability in action.
2. Because the nature of government centers on information creation and control, user interfaces must support a wide range of specialized information services; for a national government, this means millions of Web pages and files.
3. Customer expectations are rigorous—people expect government Web sites to contain everything (the general public often makes no distinctions among levels of government or even national boundaries), to be integrated (there may be no recognition of the size and scope of government), and to be free (supported by tax dollars).
4. Governments are constrained by a variety of mandates specifying what must be provided. This leads to less flexibility in what data are collected and how they are disseminated.
5. Government agencies and their services are, by nature, low-risk-taking operations. The incentives that the private sector has to be innovative (for example, large profits) are not at play in government service—taking a risk that pays off can be advantageous to departments or careers but rewards tend to be incremental rather than quantum.

All these factors suggest that user interfaces for DG require specialized attention both within government and in the human-computer interaction (HCI) community.

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This article describes the ongoing development of Web-based services at a major U.S. federal statistical agency—the Bureau of Labor Statistics (BLS). BLS is the principal fact-finding agency of the U.S. government in labor economics and statistics. BLS has had a long-standing commitment to HCI principles and practices and was an early adopter of Internet technologies. In 1994 BLS provided file transfer protocol (ftp) and gopher access to labor data and introduced Web services after a prototype design and heuristic evaluation [1]. BLS designers and developers have been active participants in the CHI community and have been working with academic partners to define, implement, and refine the BLS Web site. The site currently consists of more than 45,000 Web pages and files and an online database of more than 100 million discrete observations of prices, wages, benefits, employment, and unemployment—some going back as far as 1913. Since the inception of the Web site efforts have been under way to assess user needs, prototype designs, conduct usability tests with prototype and production interfaces, and extend the BLS iterative design and implementation strategy.

User Needs Assessment

User needs assessment is especially important and challenging because the Web has provided a new avenue for extending services beyond the traditional base of specialists to a previously less-supported audience. This corresponds nicely to the DG goal of empowering all citizens to take advantage of economic and labor information to make better decisions.

Creating unbiased, reliable, and timely statistics is central to the mission of the Bureau of Labor Statistics. Equally important is the dissemination of those statistics to the people who can make use of them: other federal, state, and local governments; corporate and labor analysts; journalists; academic researchers; students at all levels from middle school to graduate school; and interested individuals.

More than a million users access the BLS site every month. They span the gamut in economic understanding, statistical literacy, and familiarity with computers. Users have an equally wide range of goals: Whereas some sophisticated users may be looking for often obscure historical trend data going back several decades, many more users are searching for a broad snapshot of the economy or possibly even a single number (the current unemployment rate, for example, or the 12-month change in the Consumer Price Index). The average user visits the BLS site twice per month and views seven pages per visit.

BLS, in cooperation with its academic partners, has used a variety of techniques and methods to better understand user needs, including:

- Interviews and focus groups with specialists and nonspecialists
- Content analyses of email messages from the public, HTTP queries, Web pages, and documentation
- Transaction log analyses

These data have driven design decisions on vocabulary usage, ordering of pages within the page architecture, and new tools and services (for instance,

"at-a-glance" tables, kids' pages, inflation calculator).

BLS has embraced usability testing as a critical component of the development process, opening a full-scale, onsite usability lab in 1996. In addition to the Levi and Conrad's paper [1], usability studies have been reported in papers at a variety of conferences, including the Usability Professionals Association (1997), National Institute of Standards and Technology Symposium (1997), United Nations Economic Commission (2001), American Statistical Association (1997), and International Conference on Establishment Surveys (2000). In 1997 BLS staff led a CHI workshop on usability testing of Web sites that focused on extending traditional HCI tools to the new medium, including transaction log analysis. These studies have guided the incremental updating of the BLS Web site as well as a major redesign launched in 2001. In addition to testing the official Web site, BLS has supported the design and testing of a variety of interface prototypes.

The **Bureau of Labor Statistics** has **embraced** usability **testing** as a critical **component** of the **development** process

Design Challenges

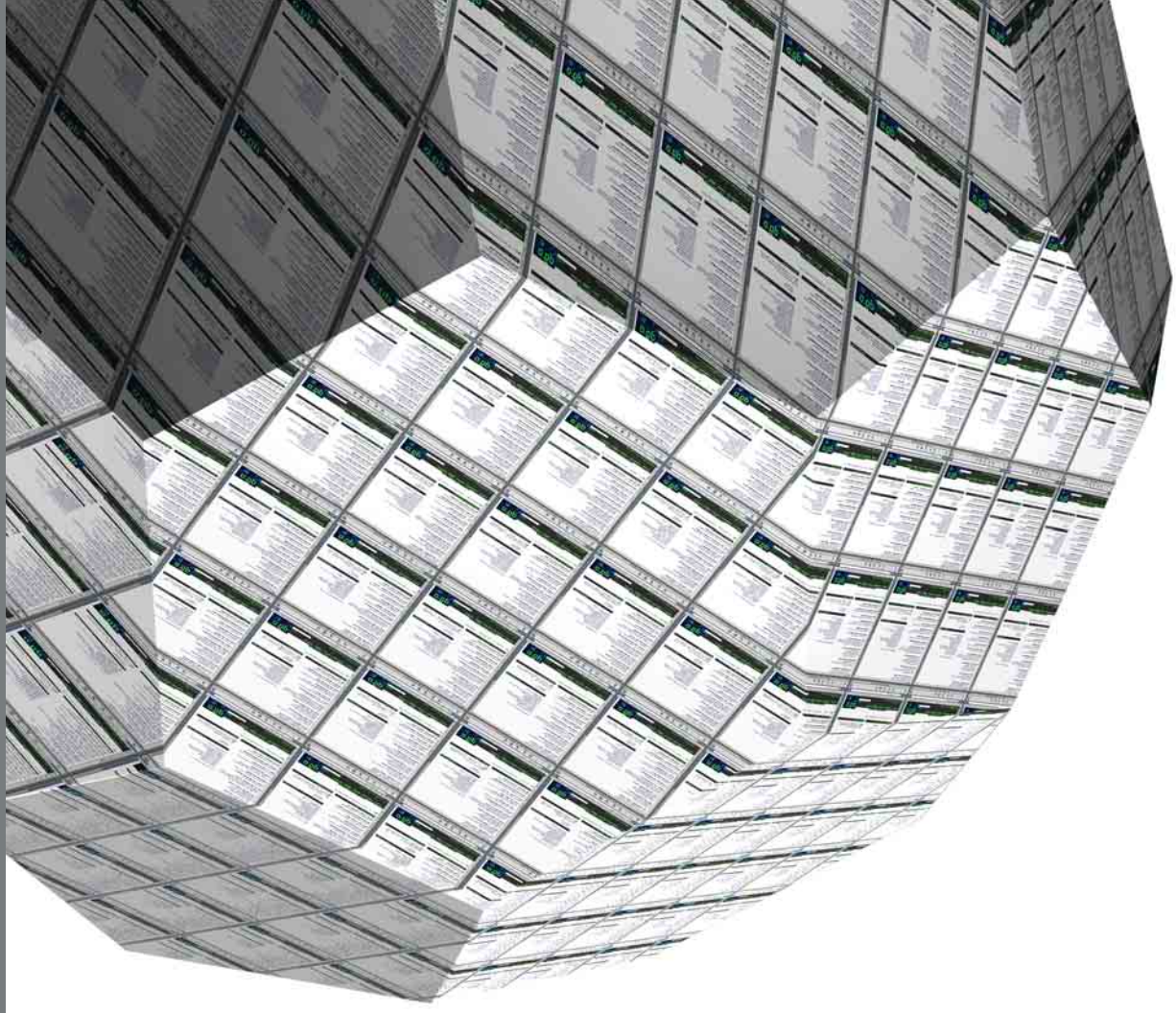
Users of the BLS Web site face two immediate challenges: how to find the information they need and how to understand the information once it is found. The first is a relatively straightforward problem of navigation exacerbated by the sheer volume of information on the site. Locating one page among 45,000, or one statistic in a database of 100 million numbers, is significant. The second problem is more subtle and relates to the economic and statistical sophistication of the user. Two examples can be used to illustrate this:

1. *BLS analysts typically use a highly specialized vocabulary.*

Terms such as *salary*, *wages*, and *income* may have significantly different meanings both within and across surveys. The lay user, however, may not distinguish between these terms and may thus misunderstand or misinterpret the data.

2. *BLS uses standard statistical techniques to apply certain transformations to the data it publishes.*

One technique is "seasonal adjustment," which removes the effects of events that follow a more or less regular pattern each year. These adjustments make it easier to observe the cyclical and other nonseasonal movements in a data series (employment in the construction sector, for example, is



always higher in the summer than it is in the winter). Users frequently are baffled that two—sometimes noticeably different—statistics are published for the same economic measure. Even users who understand the concept may not realize or remember that month-to-month changes should be calculated using the seasonally adjusted, rather than the unadjusted, series.

Design Philosophy

A long-standing partnership between BLS and academic researchers has led to a design philosophy for highly interactive systems that has influenced the BLS Web development process and foils current constraints on government Web sites. The main elements of this philosophy are the following:

Use a highly-structured, information intensive display.

Goal: To minimize clicking and scrolling and maximize grouped content on entry-level pages.

Requirements: A "work-like" look and feel first and an aesthetic look and feel second.

Rationale: Research demonstrates the efficacy of broad and shallow menus, the nature of the BLS content, and the user needs assessments.

Application: The current BLS design (see Figure 2), featuring almost 100 topics organized into 16 clusters, illustrates this philosophy.

Use dynamic representations and control mechanisms—direct manipulation.

Goal: To give users direct control over information.

Requirements: Strong visual cues and specialized control mechanisms such as sliders, mouse brushing, and effortless undo.

Rationale: Evidence exists that direct manipulation reduces cognitive load, the marketplace has adopted direct manipulation interfaces, and the BLS user population is diverse.

Application: The current design displays pop-up explanations for CPI and other terms in the latest numbers box and the interactive map.

Use end-user vocabulary.

Goal: To give users labels that are meaningful so that they can understand what is available and quickly get to the information they need.

Requirements: Mappings between the specialized and precise terms of government agencies and the vernacular for those concepts, and may lead to a multiplicity of terms for any concept.

Rationale: Usability testing, the diverse nature of the BLS service population, and the technical nature of the statistical and economic content.

Application: In the current design, the term *inflation* is used in the first group of concepts rather than the more precise and technical term *consumer price index* used in BLS reports.

Use multiple representations and views.

Goal: To give users different ways to understand and use a Web site and the information it contains.

Requirements: Multiple media and organizations so that users may choose how they wish to interact with an agency.

Rationale: The practice of providing alternative indices, signs, and commodity products and the diversity of the service population.

Application: Many alternative entry points exist in the current version to find data, including boxes for important numbers, the U.S. map, several indices (alphabetically, by audience and topic), the map, full text search, and topical links.

Prototype Development

There is a tension in this design philosophy and the nature of DG Web sites. Achieving these goals often requires specialized technology (such as Java applets or application plug-ins) and, because public sites must make information available on the entire spectrum of platforms, connectivity, and experience with technology, a technical constraint targeted at the lowest common denominator strongly applies. Over time, better browsers, connectivity, and users' Web literacy allow more advanced techniques to migrate into the "installed design space" for whole populations; however, DG sites must always be sensitive to installed base constraints and must thus be more conservative than commercial or public sites that serve specialized communities. To cope with this constraint, BLS has supported the design and testing of different user interface prototypes to explore what may be implementable as the installed base evolves. One early prototype used the user-task taxonomy that came from user needs assessments to mock up a graphical portal to BLS resources. The portal was organized into regions corresponding to quick data (for common requests seen in the transaction logs), deep data (full data sets for experts and researchers), reports (for the large number of students, journalists, and researchers who use the site), and tools and help for using the site. This prototype was user tested in the BLS laboratory, and some aspects such as the quick data summaries were later incorporated into the redesigned production site.

A second prototype was developed with BLS support as an alternative site map and entry point into the FedStats site that unites all U.S. federal statistical sites. This dynamic query interface, called a relation browser, was implemented as a Java applet; two laboratory studies and a nine-month field study on the FedStats site were conducted. The interface provides users with two selectable attribute sets that can be easily explored in pairs using mouse brushing. Although the tool has not been adopted in the BLS Web site at the present time, it continues to be developed and has been applied to more than a score of other Web site applications [3]. Currently, the same team is extending the relation browser, exploring other dynamic interfaces for statistical data, and working on automatic techniques to make large government Web sites digestible for alternative display to users (see www.ils.unc.edu/govstat for papers and demonstrations).

Other **government agencies** are also **adopting** strong **HCI** approaches to their **information services**.

Evolution of the Web Site

Since 1996 the BLS Web site has been significantly redesigned once and upgraded many times. These changes have taken into account the user studies, prototypes, and ongoing evolution of the installed base of users and systems in the general population. Although this oversimplifies the process, a look at the BLS homepages in 1996 and 2003 demonstrates some of these changes. Figure 1 shows the first home page in 1996. It was designed according to the early heuristic evaluation done at that time. It presents nine general entry points and serves strictly as a launching point for any information a user might need. Over time, this design was tuned in response to user studies and needs assessments, and by 1999 the basic design provided 12 general entry points and alternative textual links.

In late 2000, a major facelift for the top levels of the site was released as a result of feedback from users, analyses of logs and email, and a series of usability studies. One set of studies compared long lists of table titles on the home page and paged lists of table titles and found that users see the BLS home page as a portal and want to find what they are looking for and exit as quickly as possible. The overwhelming majority of users were not willing to scroll (even once) on the home page. On intermediate pages, if the users believed they were at the right

Figure 1

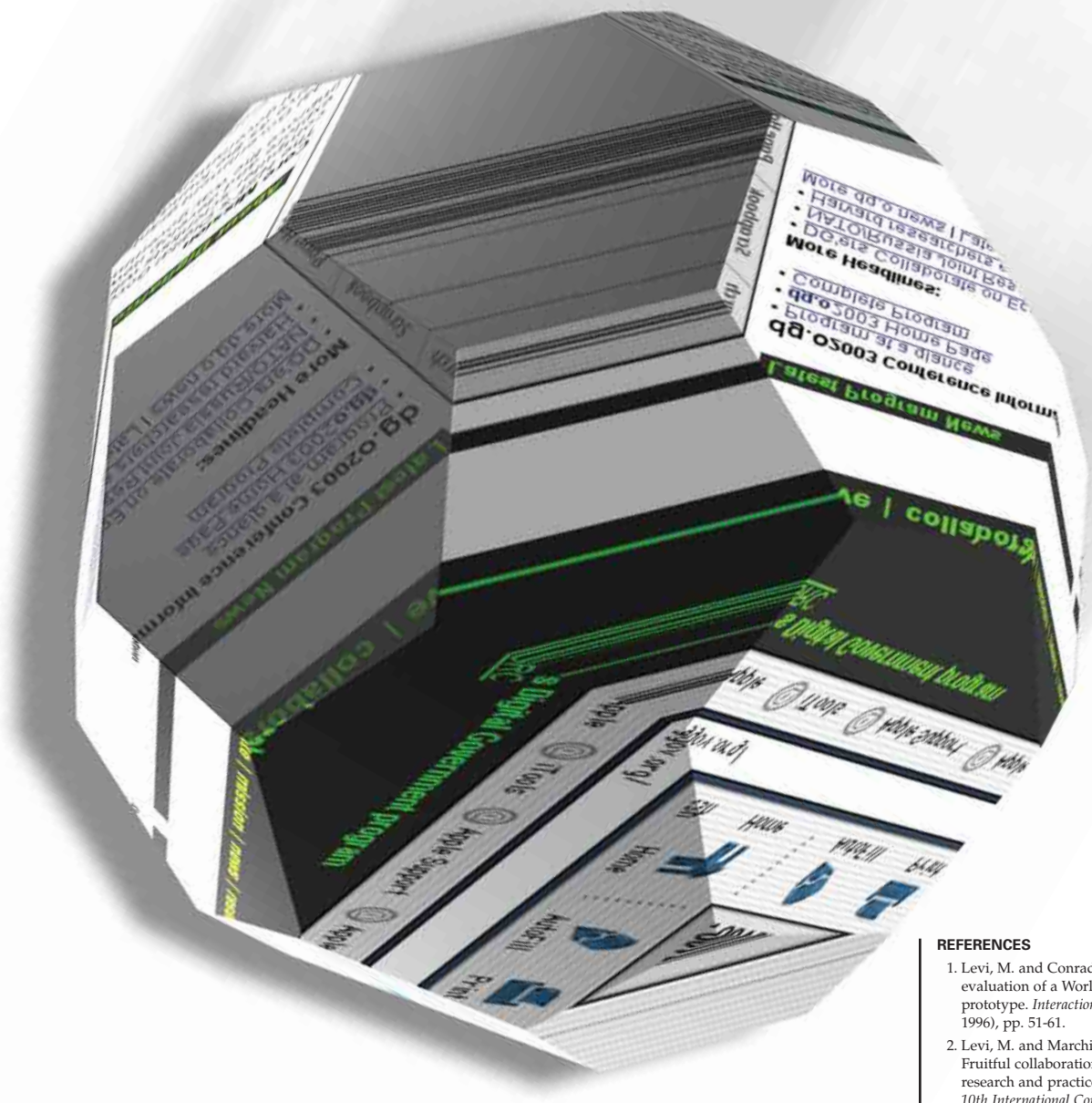
place, they were willing to spend as long as it takes to find the material. On the basis of these experiences and studies, the major facelift to the home page added new left column and top row navigation bars, a main screen of almost 100 user-oriented topics and subtopics, a latest numbers box with the most recent economic indicators from BLS, an improved data query interface to create customized tables with a single query screen rather than a long series of screens, and a map entry point for wages and occupations by region. In early 2001 a major redesign was released that extended the facelift throughout the site, added a "People are asking..." box and a pop-up inflation calculator. The new design presented a navigation column for 19 entry points based on the past design, and a clustering of 46 user-vocabulary topics organized into 12 categories. This version also was upgraded over time, and the home page as of April 2003 (see Figure 2) shows a highly businesslike homepage with eight navigation tabs at the top, an often-requested-statistics box, an often-asked-question box, and a U.S. map in the center column surrounded by 92 user-vocabulary topics organized into 16 categories.

Figure 2

Although this is an information-intensive display, the organization and labeling allow people to reach the information they need without a lot of mouse clicks. The current Web site instantiates the design philosophy in many ways: The design is information intensive with broad rather than deep choices, provides vocabulary that is much more user oriented (such as common language terms like *inflation* are used instead of only the technical measures for cost of

living), and provides alternative search and browse tools for users (for instance, search, tabs, maps, latest numbers, most requested). The installed base constraints do not yet permit substantial use of dynamic displays and control mechanisms (to minimize or avoid Java, JavaScript, and plug-in requirements); the strong visual organization and minimal use of mouseovers on the maps are a step in this direction.

BLS is committed to ongoing testing and user feedback and development. As the installed base evolves, so will the Web services. The BLS case illustrates a number of lessons that apply to other DG interface designs. First, adoption of user-centered design and usability testing as part of the overall development process is necessary to continue to balance the needs and expectations of broad classes of users with advances in technology. Second, although DG sites are highly constrained by a variety of user, statutory, and organizational culture constraints, effective design is possible if it is viewed as an ongoing effort informed by HCI principles and evaluation techniques. Third, the BLS case illustrates how government-academic partnerships can serve to advance incremental design and development that serve user needs [2]. Other government agencies are adopting strong HCI approaches to their information services. The Centers for Disease Control has used a similar user-needs approach to the evolution of its Web site [5]; the National Cancer Institute has developed a set of guidelines for Web site design (www.usability.gov/); and the FedStats statistical agency consortium has worked with several of the National Science Foundation's Digital Government projects to investigate spatial interfaces, dynamic query interfaces, and interactive tables on the Web (see www.diggov.org/). These efforts bode well for better government service and better citizen interactions with government information at all levels in the years ahead.



REFERENCES

1. Levi, M. and Conrad, F. A heuristic evaluation of a World Wide Web prototype. *Interactions* (July-August 1996), pp. 51-61.
2. Levi, M. and Marchionini, G. Fruitful collaborations: Integrating research and practice. *Proceedings of 10th International Conference on Human-Computer Interaction* (Crete, Greece, June 22-27, 2003), in press.
3. Marchionini, G. and Brunk, B. Toward a general relation browser: A GUI for information architects. *Journal of Digital Information* 4, 1 (2003). Available at http://jodi.ecs.soton.ac.uk/Articles/v04/i01/Marchionini/
4. Marchionini, G., Samet, H., and Brandt, L. Digital government (Introduction to Special Issue). *Communications of the ACM* 46, 1 (2003), pp. 25-27.
5. Robinson, S. Hesse, B., Shaikh, A., Coss, M., and Crawford, C. Using converging methods across disciplines to guide the redesign of a large, information-rich Web site. SIGCHI Extended Abstracts (Ft. Lauderdale, FL, April 5-10, 2003), pp. 654-655.

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