User-Centered Design and Usability Testing of a Web Site: An Illustrative Case Study

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Administrators at a large midwestern university recognized that their World Wide Web site was rapidly becoming an important factor in recruiting new students. They also expected this Web site to serve many different types of information needs for existing students, faculty, staff, and alumni. An interdisciplinary team of faculty, graduate students, and staff was formed to evaluate the existing Web site. A group from this team first conducted a needs analysis to determine the kinds of information the target population was seeking. This analysis led to the creation of a new information structure for the Web site. Usability tests of the both the new and old designs were conducted on paper. Users were able to find answers to frequently asked questions much more rapidly and successfully with the new information structure. This structure was further refined through additional usability tests conducted on the Web itself. This descriptive case study illustrates the value of user-centered design and usability testing of World Wide Web sites.

☐ In this article, we emphasize rapid prototyping and usability testing as methods for design research. We begin with an overview of user-centered design and usability testing. Next we describe the entire Web design project, the iterative process of rapid prototyping and usability testing, and how the findings helped to improve the design. Finally, we discuss recommendations for university Web site design and reflect on problems faced in usability testing.

Principles of User-Centered Design

As computers become more prevalent in society, computer system designers and developers have begun to use the term *user friendly* to label products they believe are easy for the lay public to use. However, a problem with this term exists. What might be "friendly" or "easy" for one user may not be friendly or easy for another (Nielsen, 1994). Because of this problem, principles of user-centered design have become very important in the design and development of software and information systems.

Norman (1988) defined user-centered design as "a philosophy based on the needs and interests of the user, with an emphasis on making products usable and understandable" (p. 188). He further explained that products are usable and understandable when (a) the user can figure out what to do, and (b) the user can tell what is going on.

Rubin (1994) described user-centered design as techniques and procedures for designing usable systems with the user at the center of the process. Most agree that principles of user-centered design place increased attention on devel-

oping products that are usable and useful by focusing on the user *throughout* the design process (Dumas & Redish, 1993; Eason, 1988; Gould & Lewis, 1985; Shackel, 1991).

In 1985, Gould and Lewis described three principles that should be followed to produce useful systems, and in 1988, Gould added a fourth principle: (a) early focus on users and tasks, (b) empirical measurement, (c) iterative design, and (d) integrated design. Early in the design process, users should be involved with prototypes and simulations and their interactions with the system should be observed and noted. As users uncover problems with the prototypes, designers should correct these problems and then allow users to again test the software.

Usability

Usability has been defined with terms such as *usable* and *useful;* however, there is no common definition. Nielsen (1994) describes usability as an issue related to the larger issue of system acceptability. He explains that the usability of a system is made up of five attributes: (a) learnability, (b) efficiency, (c) memorability, (d) errors, and (e) satisfaction.

Dumas and Redish (1993) believe that usability "means that people who use the product can do so quickly and easily to accomplish their own tasks" (p. 4). They explain that their definition of usability is based on four points: (a) usability means focusing on users; (b) people use products to be productive; (c) users are busy people trying to accomplish tasks; and (d) users decide when a product is easy to use.

Shackel (1991) defined usability as "the capability to be used by humans easily and effectively" (p. 24). He explained that usability depends on the interplay of four components—(a) user, (b) task, (c) tool, and (d) environment. In addition, Eason (1988) explained that usability must be structured in terms of human properties.

Clearly, not everyone agrees on the definition of usability. For purposes of this study we chose to adopt the definition from Gould and Lewis (1985 & 1988) which includes the key principles of early focus on users, empirical measurement, iterative design, and integrated design. In addition to this we considered two of the attributes of usability discussed by Nielsen (1994) as most important for our design research: efficiency and reduction of errors.

Usability Testing

The phrase *usability testing* has been coined to represent the process of involving users to evaluate a system to ensure that it meets usability criteria. "It [usability testing] is a research tool, with its roots in classical experimental methodology" (Rubin, 1994, p. 25).

Dumas and Redish (1993) defined usability testing as "a systematic way of observing actual users trying out a product and collecting information about the specific ways in which the product is easy or difficult for them" (p. 12). This definition ties neatly into the empirical measurement and iterative design principles of useful systems as previously described (Gould & Lewis, 1985).

Dumas and Redish (1993) also described five characteristics of every usability test:

1. The primary goal is to improve the usability of a product. For each test, you also have more specific goals and concerns that you articulate when planning the test.
2. The participants represent real users.
3. The participants do real tasks.
4. You observe and record what participants do and say.
5. You analyze the data, diagnose the real problems, and recommend changes to fix those problems (p. 22).

Relationship between Usability Testing and Formative Evaluation

How does usability testing relate to more traditional evaluation techniques from instructional technology, specifically formative evaluation? Formative evaluation is described as collection of data and information during the development of educational materials from members of the target population about the effectiveness of the materials. The collected data and information is

fed back into the development process to improve the effectiveness of the materials (Dick and Carey, 1990; Worthen and Sanders, 1987).

Even though these authors specifically mention educational materials, formative evaluation can be seen in many different fields of study, as well as many different materials, programs, and products. Several authors from the field of human-computer interaction (HCI) view formative evaluation as the backbone for usability testing (Booth, 1989; Hix and Hartson, 1994; Nielsen, 1994). These authors define formative evaluation almost exactly as defined by Worthen and Sanders (1987) and Dick and Carey (1990). Both usability testing and formative evaluation are described as falling under the umbrella of evaluation techniques.

Usability testing and formative evaluation have similar goals—to collect data and information about the effectiveness of products or materials from the target population during the design and development process. Both usability testing and formative evaluation employ representative target population users and experts in their evaluation methods. Data and information are collected during the design and development process in both usability testing and formative evaluation. Both techniques collect data numerous times during design and development. In other words, both employ an iterative process. Methods used to collect data are also similar in both usability testing and formative evaluation. They include observation, think-aloud, questionnaires, surveys, data logs, and interviews.

Even though usability testing and formative evaluation share many similarities, there are also some differences between the two techniques. One major difference is the primary focus of the evaluation. Formative evaluation often focuses on effectiveness of an educational program, as well as instructional and learning strategies. This is evidenced by the use of pre- and posttest measures to indicate learning gains and the relative subordination of user satisfaction issues. Usability testing, on the other hand, focuses on the whole system the user faces. Usability testing attempts to evaluate the usefulness of the product, but it also looks at other issues such as computer ergonomics, user fatigue, and the interface between the user and the system.

Another difference is the research disciplines with which these techniques have been historically associated. Formative evaluation has been conducted in the field of instructional design, whereas usability testing is rooted in technological product design, document design, and human-computer interaction. A final difference worth noting is described by Sugar and Boling (1995). They claim that usability testing seems to occur earlier and more often in the design and development process than does traditional formative evaluation.

DESCRIPTION OF THE PROJECT

In the summer of 1995, administrators at the Bloomington campus of Indiana University decided that their World Wide Web site would be treated as an important factor in recruiting students to attend their institution. In addition, University Computing Services (UCS) personnel at the university believed that the Web site could be used as a means of fulfilling the many different types of information needs for existing students, faculty, staff, and alumni.

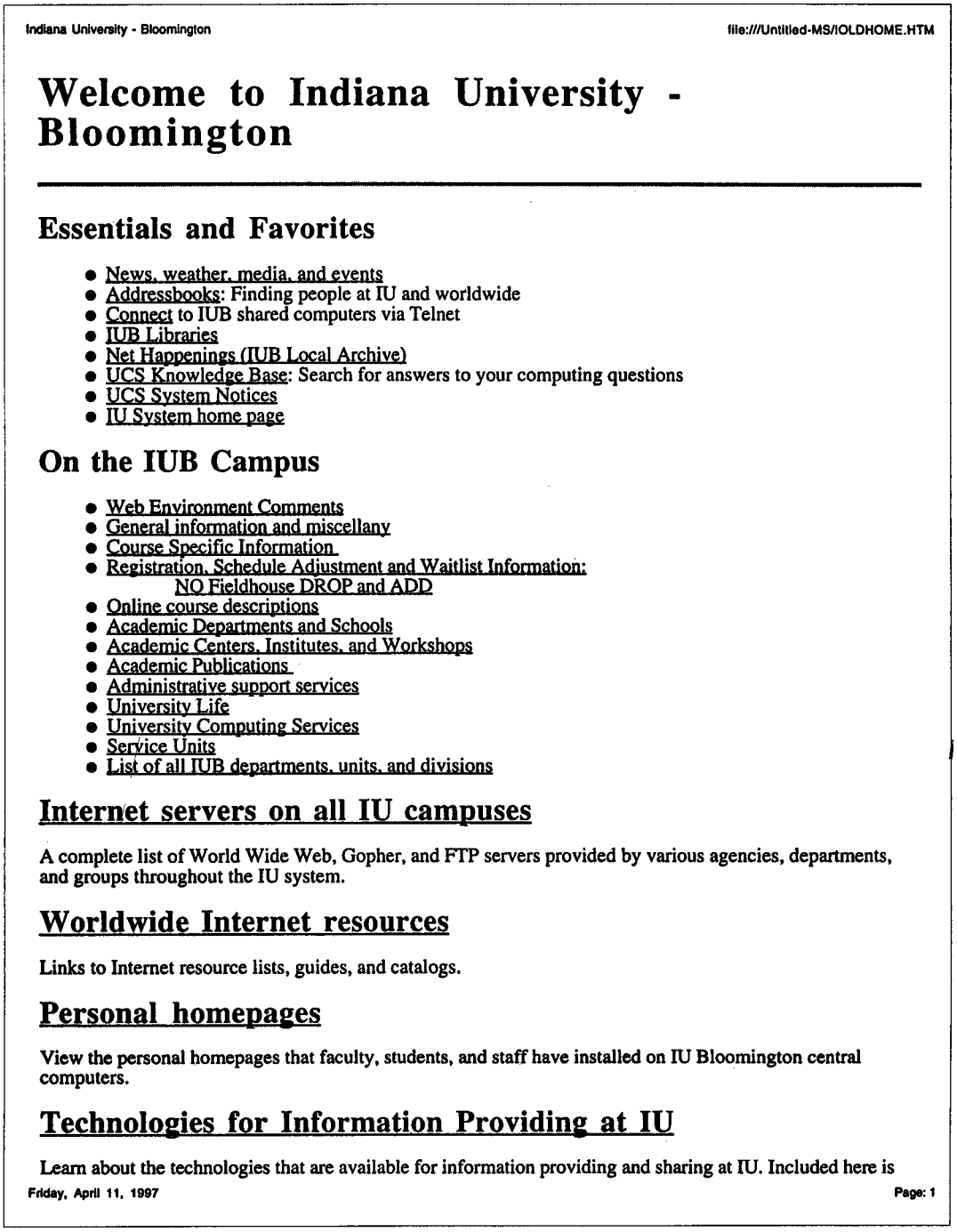
UCS was not certain whether the existing Web site was providing the type of information users were seeking, or how easy it was for users to find the needed information at the site (see Figure 1).

Thus, our task was to determine the usefulness of the old site, and to develop a new site, if necessary, that would better meet user needs. A team, led by the second author, was organized to conduct an extensive needs analysis and usability tests.

NEEDS ANALYSIS

The initial information-gathering phase primarily involved the identification of about 35 campus offices and departments that had a high volume of phone calls, in-person visits, mail, and e-mail correspondence from people requesting information. We interviewed information providers in each of these offices, asking them

Figure 1 ☐ University Web site before remodeling (partial view).



Indiana University - Bloomington file:///Untitled-MS/IOLDHOME.HTM

Welcome to Indiana University - Bloomington

Essentials and Favorites

- News, weather, media, and events
- Addressbooks: Finding people at IU and worldwide
- Connect to IUB shared computers via Telnet
- IUB Libraries
- Net Happenings (IUB Local Archive)
- UCS Knowledge Base: Search for answers to your computing questions
- UCS System Notices
- IU System home page

On the IUB Campus

- Web Environment Comments
- General information and miscellany
- Course Specific Information
- Registration, Schedule Adjustment and Waitlist Information: NO Fieldhouse DROP and ADD
- Online course descriptions
- Academic Departments and Schools
- Academic Centers, Institutes, and Workshops
- Academic Publications
- Administrative support services
- University Life
- University Computing Services
- Service Units
- List of all IUB departments, units, and divisions

Internet servers on all IU campuses

A complete list of World Wide Web, Gopher, and FTP servers provided by various agencies, departments, and groups throughout the IU system.

Worldwide Internet resources

Links to Internet resource lists, guides, and catalogs.

Personal homepages

View the personal homepages that faculty, students, and staff have installed on IU Bloomington central computers.

Technologies for Information Providing at IU

Learn about the technologies that are available for information providing and sharing at IU. Included here is

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what ten questions they were most frequently asked, and approximately how often. The interview process generated hundreds of questions, some of which were repeated across locations. For data analysis, an index card was created for each question, on which was included the question and its point of origin, who asked it, when, how often, and finally, the answer. A physical

card sort allowed for these questions to be collected together, in order to provide the team with a better idea of the total number of times each question was asked. For instance, many of the schools and departments reported receiving questions about parking. Each question taken separately placed the issue in the minor frequency category; taken all together, parking became a very frequently asked question.

Once questions were coded for frequency, all matches were collected together, and a final list of 339 questions was created. This list became know as the "most frequently asked questions" at the university (see URL: http://education.indiana.edu/ist/faculty/iuwebrep.html).

A further card sort resulted in the emergence of over 30 separate categories of questions. We organized these into 6 larger categories, which we used for our first prototype design.

We built the initial paper prototype based on results of the card sort. It is important to note that we used the language of the information providers, who were repeating the questions verbatim as they were typically asked by members of the target population. We generally did *not* use terms that were official university office names or functions as labels for our categories and descriptors, but used instead the words of typical users. For example, *Halls of Residence* is a university organizational name, but users had questions about *housing*. In this case, we used the latter term in the design of our information structure.

The first prototype included a home page, six second-level satellite pages, and for usability testing purposes, one section of third-level satellite pages. This newly designed information structure was known as the proposed Web site for the university. These paper pages were used in the next part of the project, usability testing.

RAPID PROTOTYPING AND USABILITY TESTING

Phase 1 Paper Prototyping and Usability Testing

The first phase of usability testing involved both the existing Web site and the proposed Web site (see Figures 1 and 2). A total of 21 people served as subjects in this phase of the design research. The purpose of the testing was to determine how quickly and efficiently users of both the existing and the proposed Web sites could find answers to the most frequently asked questions at the university.

For usability testing, the project team used the list of frequently asked questions, a paper copy of the existing Web site's information structure, and a paper copy of the proposed Web site's information structure. Paper versions of these Web sites were used so that both designs might be evaluated equally. If one site were on paper and the other were on a computer, subjects might be reluctant to criticize the existing system since it might appear to be more "finished" by virtue of its computer format.

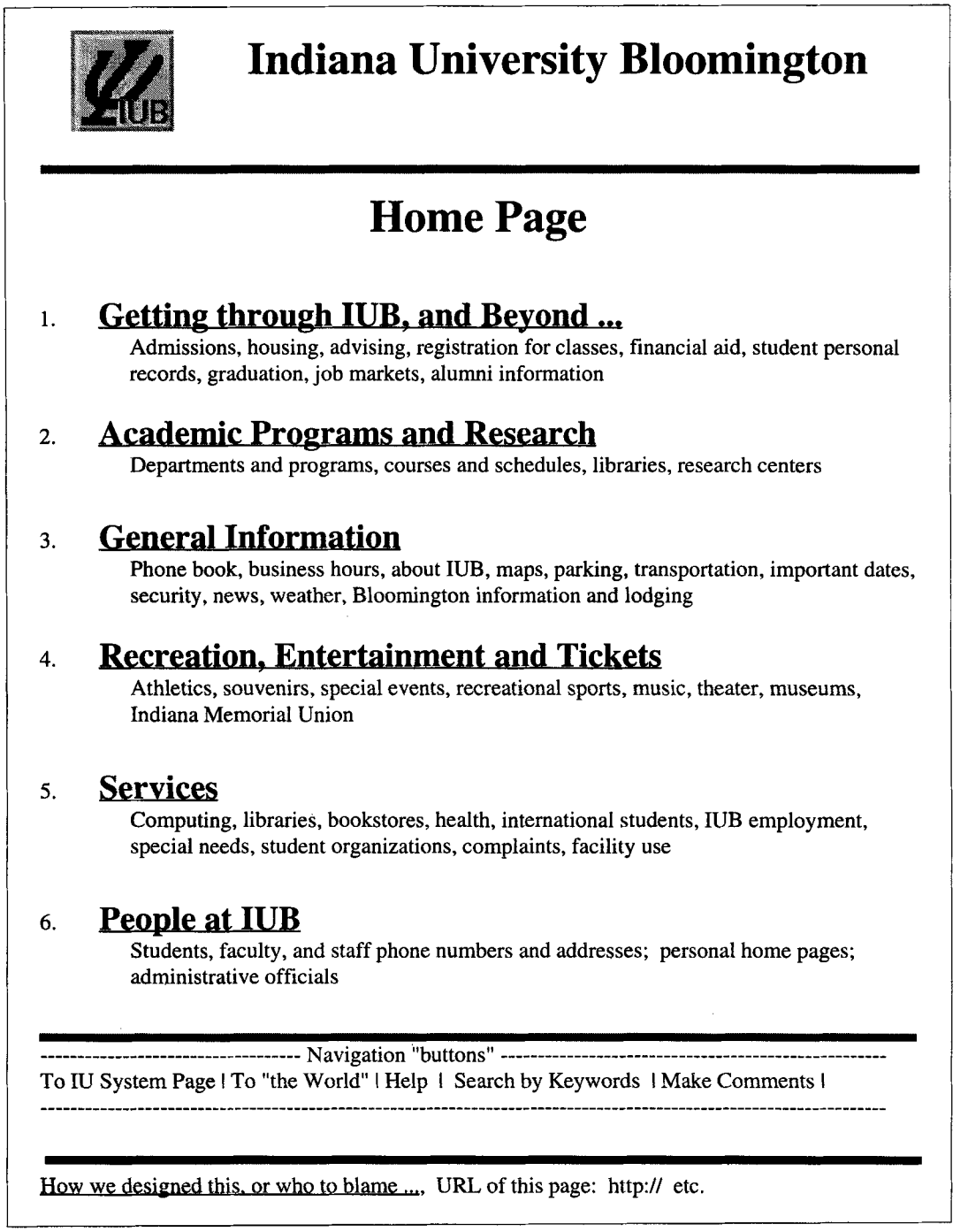
The subjects used in testing of both of the Web sites were drawn from the demographics that were being targeted by the university: potential students (current high school students), parents of potential students, current students (both undergraduate and graduate), faculty, staff, and alumni.

Each of the project team members tested both the existing and the proposed sites on different subjects from within these demographics. During this phase of testing, each project team member explained to each subject that they would be given a question and that they could use the paper pages to find the answer. The subjects were told that they could only view one page at a time. Subjects were not told why this was the case, but it was to more closely simulate how the Web site might function in a digital format.

In addition, each subject was told that any underlined words or phrases on the pages could be selected and used to move from page to page. The underlined words and phrases corresponded to hypertext links in a digital format. Each project team member used a practice question to demonstrate themselves how this would work.

Subjects were asked to *think aloud* at all times during the testing. Preece, et al. (1994) define think aloud protocol as "a special kind of verbal protocol in which the user says out loud what she is thinking while she is carrying out a task or doing some problem solving" (p.622). Many researchers use this technique in usability test-

Figure 2 ☐ Proposed University Web site (initial paper prototype for home page)



ing (Nielsen, 1994, Gould, 1988). Nielsen (1994) refers to it as "the single most valuable usability engineering method" (p. 195). This method allowed project team members to record each choice subjects made and any other observations they might have.

Project team members would then ask subjects to use the existing Web site and satellite

pages to answer one of the most frequently asked questions. Subjects would work their way through the site and satellite pages while thinking aloud.

Any problem areas found by subjects, or any backward movements because of selecting incorrect pages, were noted by team members. In addition, project team members would time subjects from when they started each question until they found the answer or gave up without the answer. Finally, project team members would note whether or not a path was found by subjects that would lead to where the answer could be found in the large and complex Web site at the university.

Each subject was asked to answer 15–20 questions using the existing Web site. Then the team member would ask the same 15–20 questions a second time using the proposed Web site and satellite pages. The order of paper versions was reversed for half the subjects, to minimize any ordering or recency effects. Non-overlapping sets of questions were divided among project team members.

Results of Phase 1 of Paper Prototyping and Usability Testing

Phase 1 usability tests indicated that, overall, the proposed Web site out-performed the existing Web site. Data to support this finding included:

Success rates. Subjects using the proposed Web site found many more locations containing answers to the most frequently asked questions than did subjects using the existing Web site.

Efficiency. When subjects found answer locations in both the existing and the proposed Web sites, in most cases they were able to find the location two or three times faster using the proposed Web site. Subjects of the proposed Web site were able to find most answer locations in less than one minute.

Alphabetical lists of links. One of the satellite pages of the existing Web site consistently performed better than the proposed site. This page contained a long, alphabetized list of all on-line departments.

Phase 2 Paper Prototyping and Usability Testing

We conducted a second phase of usability testing—this time without the old site—since it was determined to be insufficient overall to meet user needs. Before further testing the proposed site some revisions were made. We revised the satellite page that was used to find university departments—to a long list of alphabetized links. We reduced the size of a few multipage nodes to a single page, since we observed users tended not to choose links that were continued on a next page. We also modified link names and exemplars that confused some users, according to their suggestions.

Sixteen subjects who were representative of the target population participated in this phase. The goal of this phase of testing was to expose any additional problems that may have been caused by these changes, and to again test the entire site to find any additional problems that were not found in Phase 1.

Results of Phase 2 of Paper Prototyping and Usability Testing

Most of the changes seemed to correct problems observed earlier. A few additional problems were found in this phase of testing that had not been found in Phase 1. We discovered a few more underlined words and phrases (hypertext links) that were confusing or misleading.

In Phases 1 and 2 of paper usability testing, 37 members of the target population were involved, including prospective students, their parents, faculty, staff, and current students.

Phase 1 Computer Prototyping and Usability Testing

After both phases of usability testing of paper prototypes had been completed, Phase 1 of on-line usability testing began. There were three goals of this phase of on-line testing:

1. Identify problems with the proposed site that were evident on a computer that could not be determined during testing of the paper prototype.
2. Test the changes made to the site to see if they

corrected the problems users had in Phase 2 of testing of the paper prototype.

3. Again test the entire site to find any additional problems that were not found during usability testing of the paper prototype.

Computer prototypes of the proposed Web site and satellite pages were created based on the Phase 2 paper prototype; however, they were more complete than the earlier prototyped. For example, the satellite page on the paper prototype dealing with student housing was a place marker titled *student housing information.* The place marker contained no real information, but on the computer prototype satellite page *student housing information* was a link to the actual student housing Web site which contained information provided by the Halls of Residence.

Prototypes were tested on three different World Wide Web browsers. The browsers were Lynx (a text-only browser), Mosaic, and Netscape. Each of these browsers was used in testing because they were, at that time, the three most popular browsers used on the campus and because each differed in functionality. Two versions of the prototype were tested, each with some differences in formatting.

The procedures for this phase of testing differed slightly from those used in paper usability testing. With the additional demands of testing two versions of the prototype on three different browsers, testing time was increased dramatically. Usability testing at this phase took between 60–90 minutes. Therefore, instead of drawing from all 339 most frequently asked questions, a smaller representative subset of 15 questions was used. All participants were asked the same questions.

The eleven subjects used both versions of the prototype and all three browsers. During this phase, additional focus was given to ensure that subjects were selected with varying degrees of computer and World Wide Web experience.

Results of Phase 1 Computer Prototyping and Usability Testing

After testing only a few participants in this phase, the team determined that some important changes needed to be made prior to continuing on-line testing because of consistent and severe problems experienced by those subjects:

Frustrated Lynx users. Subjects using the Lynx browser had many problems locating the answers to the questions. This was because many of the paper pages provided more information than could fit on one screen in Lynx. Inexperienced Lynx users often overlooked additional screens of information at a node and were not able to use those links. Furthermore, when they did page-down at a node, they tended to get lost within the overall structure and often needed observer help to return to a known starting point.

Too many key presses. In the version where all headings and exemplars were links, Lynx users had to "arrow too much" to make selections. For example, they had to press the down-arrow key 15 times to choose *addresses.*

Too much scrolling. During the Netscape and Mosaic trials, in order to see all of the information, subjects were too often forced to scroll. Few subjects initially scrolled down to see the additional menu items and navigational buttons. Those who did were required to scroll up and down to view their choices of menu items. Sometimes subjects scrolled through the items so quickly that they overlooked the information they were seeking.

Phase 2 Computer Prototyping and Usability Testing

Based on the results of Phase 1 of on-line testing, several design decisions were made to overcome problems the subjects had faced. These guidelines were used to make changes to the proposed Web site for testing in Phase 2.

Compact vertical menus. Important menu choices need to be close together vertically and limited to one screen on most default browser configurations. This allows users to quickly view their options with less chance of overlooking options that previously were on a second screen, and with minimal scrolling. The reader should note that the amount of information per screen can vary in Netscape and Mosaic depending on user

preferences and computer platform. We used the default settings for Netscape and Mosaic. Lynx, however, was limited by an 80 × 25 ASCII screen.

Parsimonious text. The amount of information found on each page of the site should be limited, for the same reasons that menus are limited.

Clear navigation. Navigation buttons should normally be easily visible on the screen. Important buttons should not be on a second screen in default Web-browser configurations.

One design, without specific browser dependencies. There should be one design of the proposed site that will function well on *all* major browsers. The design should retain the same general "look and feel" to users regardless of the specific Web browser, computer platform, and operating system on which the browser is running.

Furthermore, there should not be one graphical design and one non-graphical design. This would result in too much additional maintenance over time.

Fast graphics. Graphic images should load quickly to minimize user wait time (cf. Frick, Corry, Hansen, and Maynes, 1995).

Based on these guidelines, changes were made to both prototype versions in an attempt to eliminate problems faced by subjects in Phase 1 of on-line testing. In addition, a third version was added, primarily to alleviate the problem Lynx users had with having to use arrow keys too much.

Results of Phase 2 of On-line Usability Testing

Success rates. By the end of this phase, most of the subjects using each of the three versions were able to find locations of answers to the 15 questions with few problems. However, we did notice occasional problems when subjects arrived at campus sites to which our top-level Web pages pointed, but which were not part of our design. For example, when subjects were attempting to find information on housing costs, they would quickly find the Halls of Residence Web site by traversing links on our top-level structure. Within that Web site, however, subjects typically struggled to find specific information on housing costs, since at that time this information was obscured by their design. They have subsequently modified their design to make it easier to find this information.

As another example, we noticed early in this phase of usability testing that subjects were having a great deal of difficulty finding information on an e-mail question. Subjects would typically take between 5 and 10 minutes to find an answer when *UCS Knowledge Base* was listed as a link name that pointed to their search engine. In a revision of the computer prototype we replaced computing services' terminology with *Answers to computing questions,* and we changed the link destination to a menu of frequently accessed topics in the knowledge base (rather than pointing to their search engine). In subsequent usability tests, subjects chose this renamed link immediately when they came to it, and usually found the answer about e-mail in less than 30 seconds. In this case, we solved the problem by changing the language on a satellite page in our top-level structure and pointing to a part of their site that computer novices found more useful.

Foreigner floundering. Each version seemed to work a little better if the subject knew something about the university prior to testing. This finding is important to keep in mind when designing information structures of any type. Designers should remember that much of the time information familiar to them is foreign to outsiders. It is important to get potential users of the system, who are outsiders, involved in the usability testing—assuming they are part of the target population.

No clear winner. Most of the changes made to the first two electronic versions seemed to make using the site easier and more efficient. The added third version functioned as well as the other two versions. At this point there was no version in which a clear majority of the subjects completed tasks more successfully, more quickly, or that they preferred over other versions.

Some subjects preferred the prototype that used no exemplars, because the screen was not

as crowded and they could see all of their options at the same time. Lynx users particularly liked this version and the third version because they required fewer keystrokes. Other subjects did not like the no-exemplars prototype because it did not provide sufficient cues next to the menu options. These subjects had to rely totally on the menu item words or phrases for direction. Some of these words and phrases were not as descriptive as several subjects felt they needed to be.

Some subjects preferred the "all hot" version because it had exemplars next to the menu items. This allowed them to feel more confident that they knew what information could be found in each item. However, some subjects did not like the fact that all the exemplars were hot. This seemed to make the screen more busy and crowded. Some subjects thought this version was "ugly" in Lynx, but fine in Mosaic and Netscape.

Several subjects liked the third version because it included many of the best properties of the other two versions. They preferred this version because it had exemplars next to the menu labels. They would first quickly scan the menu labels (which were bold and underlined) *vertically*. They would then choose a label that seemed relevant to the task at hand and read the category exemplars *horizontally* to see if it was the best choice.

The reader can find more detailed information about this design-research project on the Web itself at URL:

http://education.indiana.edu/ist/faculty/iuwebrep.html

and can actually try some of the usability testing tasks on-line through a further link to the main testing page at URL:

http://www.indiana.edu/~iubnew/test.html

RECOMMENDATIONS

Based on the results of each phase of the usability testing, the project team recommended that the university adopt the prototype design with vertical lists of links with non-hot exemplars to clarify the meaning of each link. This version was a compromise between the first two electronic designs, and it appeared to minimize the most serious problems users encountered on all three Web browsers—particularly with Lynx. At that time a significant portion of faculty, students and staff lacked sufficient computing facilities for graphical Web browsing and used Lynx as their only practical alternative for Web access.

PROBLEMS FACED

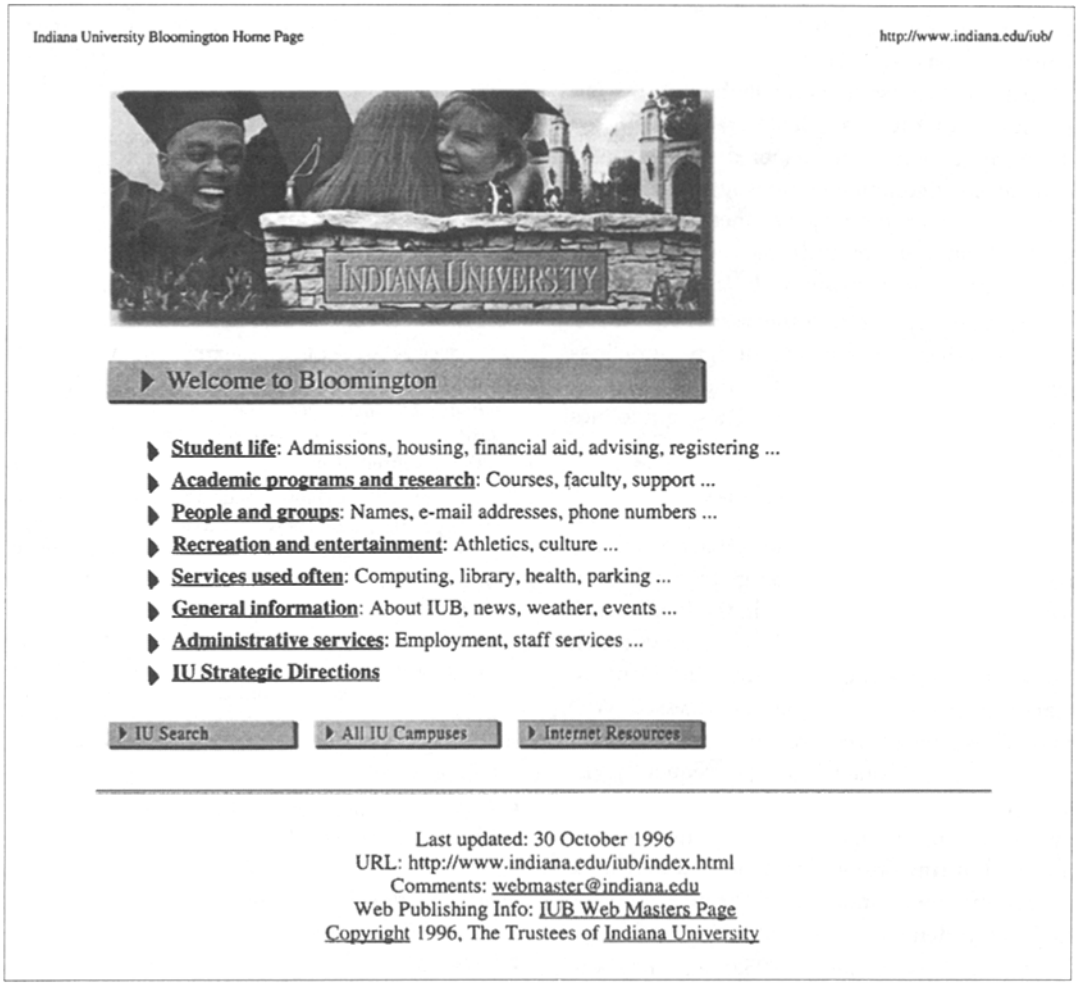
As usability testing progressed it became apparent that answers to several of the most frequently asked questions were not available anywhere in the existing Web site. Many of the offices and departments did not have Web sites of their own or the information they provided was not sufficient to answer the questions. As a result, while creating the paper versions of the proposed Web site and the three versions used in on-line testing, several of these locations were created by the project team. These locations were "dummy" sites, and were put in to enable users to find locations where answers to the most frequently asked questions could be found.

As part of the project team report, it was recommended that offices and departments across campus needed to review the most frequently asked questions and provide the information needed as part of a Web site. In particular, the offices and departments dealing with potential students and their parents were encouraged to supply this information.

A second issue faced by the project team was that of graphics used in the Web site. Our project team dealt primarily with the design and testing of an information structure, not with the design of graphics for the site. A separate team worked on the design and development of the graphics. However, the graphics had an adverse impact on the speed of the proposed site and therefore on its usability. The project team reported the findings to the larger committee. However, university officials wanted those graphics to represent the image of the institution, and so the graphics remained.

A relatively minor issue was the rewording of some of the links by computing services. For

Figure 3 ☐ Current University Web site (all underlined words and phrases are links).



example, the link named *Housing* was changed to *Halls of Residence* with the words *campus housing* listed next to the link. Our early usability tests of the paper prototype showed that *housing* was a term better understood by users. However, the argument was made that the name of each link should match the name or title of its destination, and the Halls of Residence did not want to change its name.

A unit within computing services also wanted to changed the link named *Answers to computing questions* back to *UCS Knowledge Base.* We managed to dissuade them from doing this, since usability tests clearly showed that users did not know what a knowledge base was and invariably skipped over this valuable resource.

On a few occasions, parties within the university attempted to make arbitrary changes to parts of the design. Data from usability testing helped to prevent this. We invited observation of further usability tests so that anyone could observe our methods and verify our data. Thus, decisions about the design of the Web site were not about "Who's right and who's wrong?" or "Who is more important?" Rather, design decisions were reached on the basis of evidence from usability testing.

CONCLUSION

The university did adopt the information structure from our computer prototype for the new Web design, which went on-line officially on October 15, 1995 (see Figure 3). It is nearly iden-

tical to our recommended version. The production version underwent additional user tests and was further refined, in order to accurately point to information (several of the pointers in the prototypes were unusable because the information was not at that time available on-line). The site has been refined even further during the past year, as user comments and suggestions were made. However, the major elements of the top-level information structure have been retained and appear to be working well.

Based largely on our design research, Indiana University has created Web design guidelines for all units on all campuses and encourages them to follow the guidelines. These guidelines can be viewed at URL:

http://www.iuinfo.indiana.edu/policy/

The new Web site has been attracting a large number of visitors according to reports in August and September, 1996, in the *Indiana University Alumni Magazine* and the IU newspaper, *Home Pages*. Both cited data from independent market research on frequently accessed Web sites. Those market researchers found that Indiana University is one of 50 most frequently visited Web sites in the world which are accessed by home computer users. It is also interesting to note that during orientation of new students, the university now demonstrates the new Web site to show students what our campus offers.

During the summer of 1995, we spent about four months to conduct the needs analysis, design paper and computer prototypes, conduct numerous usability tests, and to revise the prototypes in an iterative fashion. This kind of design research led to major improvements in the IU Bloomington site. This case study illustrates how user-centered design can help make usable and useful Web sites.

We invite readers to visit the Bloomington site at URL: http://www.indiana.edu/iub □

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