39

Holistic Rapid Prototyping for Web Design: Early Usability Testing Is Essential

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Overview

You want to design a Web site that will organize access to courses or programs that your organization offers, or one that serves as the "front door" to all the Web pages for your school, college, or company. Maybe you have already created several Web pages, even whole sets of pages for individual courses or training programs, and they look pretty good.

Now that you are getting ready to tackle the design of an entire Web site, however, you recognize that it may be difficult to anticipate the needs of everyone who will use the site, and probably difficult to get timely feedback about what works and what doesn't once the site is on the Web. Your urge is probably to sit down at a computer, learn a couple of the new Web tools that promise great results, and start producing pages.

When you design your own Web site, we recommend that the first thing you do is to start on paper, not on a computer. Create holistic paper prototypes very early in the process and test them out with the people you expect to actually use your site. A holistic prototype contains the entire top-level structure of your Web site, and enough strands to exemplify its primary features. Creating a holistic prototype is important because features that might work well in isolation, or in small sets of pages, do not necessarily add up to a good Web site design. Testing early in the process is important so that you have time to correct problems and so that structural changes are still relatively easy to make.

Why Create a Web Site in the First Place?

Before you create any prototype, of course, you will have answered several key questions:

- What problem are you trying to solve? Will another method solve it more easily?
- How will putting parts of your courses on the Web benefit your students? What does use of this kind of technology allow your students to do that could not be done before in some other way?
- Do the students in your courses and programs have convenient and easy access to the Web? If they don't, they won't be able to use your Web materials, and you should be focusing on an alternative way of providing information.

The answers to these questions are different for every situation, and only you can answer them for your situation. Providing you have solid justification for using technology, and infrastructure to support your students' use of the Web, the next step is to prototype your site.

The Basic Process: Start on Paper; Make a Prototype, Test and Revise; Then Build Your Site

For efficient Web site development that avoids the most errors possible and offers the most of what your users want, we recommend that you:

- create holistic, paper prototypes very early in the process;
- test the prototypes on the actual people who will use your site;
- revise your design; and
- then build the site on the computer.

What Is a Holistic Prototype?

A holistic prototype contains the entire top-level structure of your Web site, and enough strands to exemplify its primary features; for example, multi-page documents, search functions, and different information formats (maps, tables, image maps, forms, lists, text-only documents). This kind of prototype is a hybrid between the "horizontal" prototype, which represents all elements but none in detail, and the "vertical" prototype, which represents detailed functionality for only one path that a user might take (Nielsen, 1993).

Why Paper?

Creation of Web pages is relatively fast and easy, so it may seem that you should create a rapid prototype on the computer and not waste effort on a redundant paper product. While electronic prototyping may work well enough for small sets of Web pages, our experience suggests that paper prototyping is a more effective approach, and ultimately a more efficient one for large sites, simply because paper prototyping offers benefits that electronic prototyping does not (Rettig, 1994).

Hands on. The creation of a paper prototype requires that designers put their hands on the information they are organizing—literally. We have found it useful to put individual "pieces" of information on index cards. For example, in the redesign of the top-level information structure for the School of Education at Indiana University-Bloomington, we began with a needs analysis. We found out what questions are asked frequently when people call the school or visit in person, and we put each question with its answer on an index card—350 cards in all. Then we sorted those cards into groups with common themes, making new cards with the "theme" labels. From these groups, we derived the paper prototypes of our top-level Web pages. The activity of cutting and pasting, reading and re-reading, and sorting and stacking the index cards forced everyone who was involved to get closely acquainted with content of the planned Web site (Frick, Corry, Hansen, & Maynes, 1995).

Portability. Paper prototypes are portable; they can be used in test sessions where there are no computers, which usually means that time and location of sessions are more flexible than they would be for electronic prototypes. We put our paper prototypes into a three-ring notebook with dividers with labeled tabs. When we conduct a usability test, the subject can view only one "page" at a time, choose a link, and skip directly to the "next page" by check-

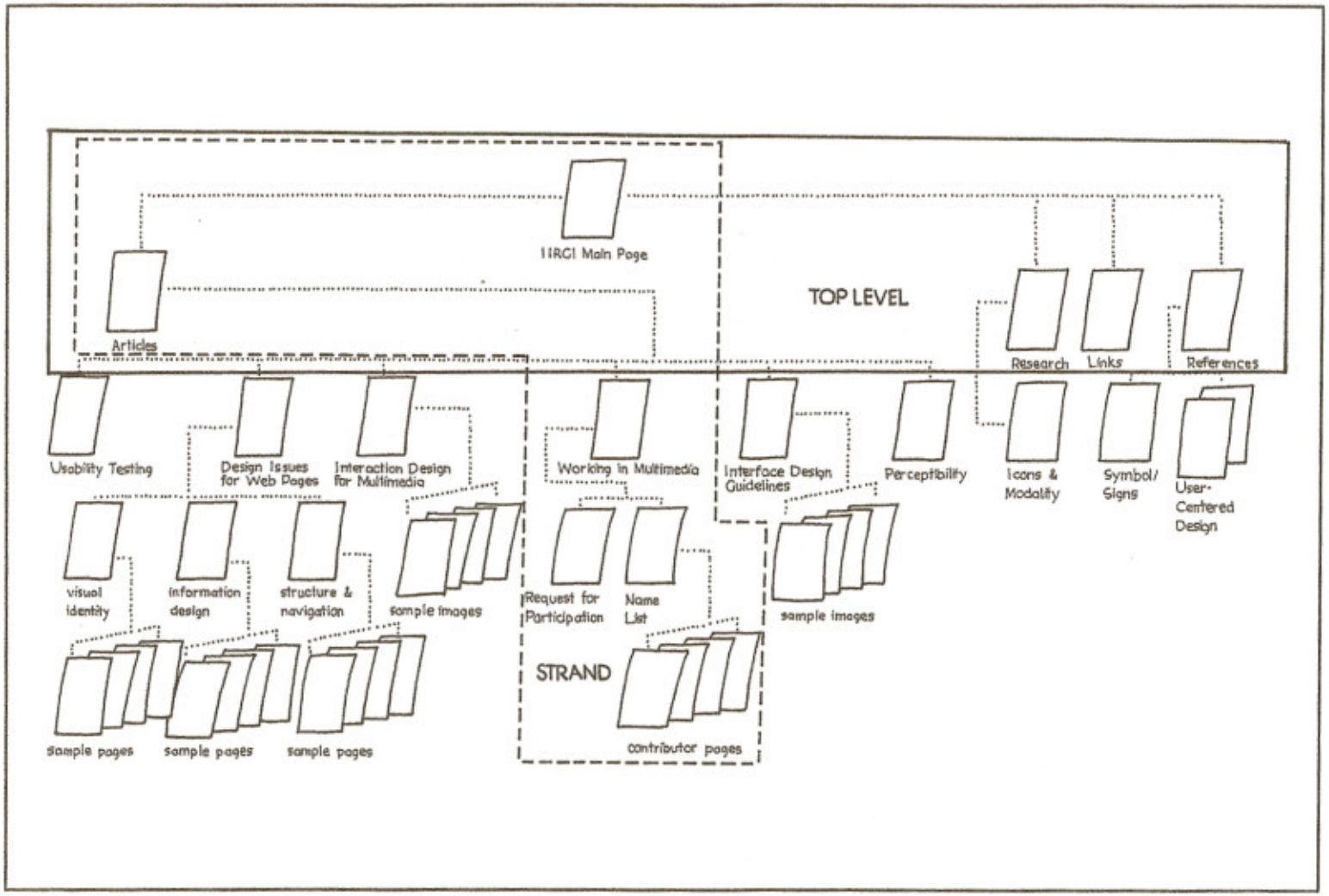

Figure 1. "Top level" and "strand" from the Interface Interest and Research Group Web Site.

ing the labeled tab on the divider. You can conduct usability tests with a notebook like this virtually anywhere that you and a subject can sit down together.

Draft form. Paper prototypes seem inherently less "finished" or "real," than do electronic prototypes. Your subjects may feel more comfortable working with paper prototypes, and criticizing them than they would if the Web pages seemed to exist already. Designers themselves are more willing to scrap a paper prototype that isn't working and start over than they are to throw away a large set of electronic files and start from scratch.

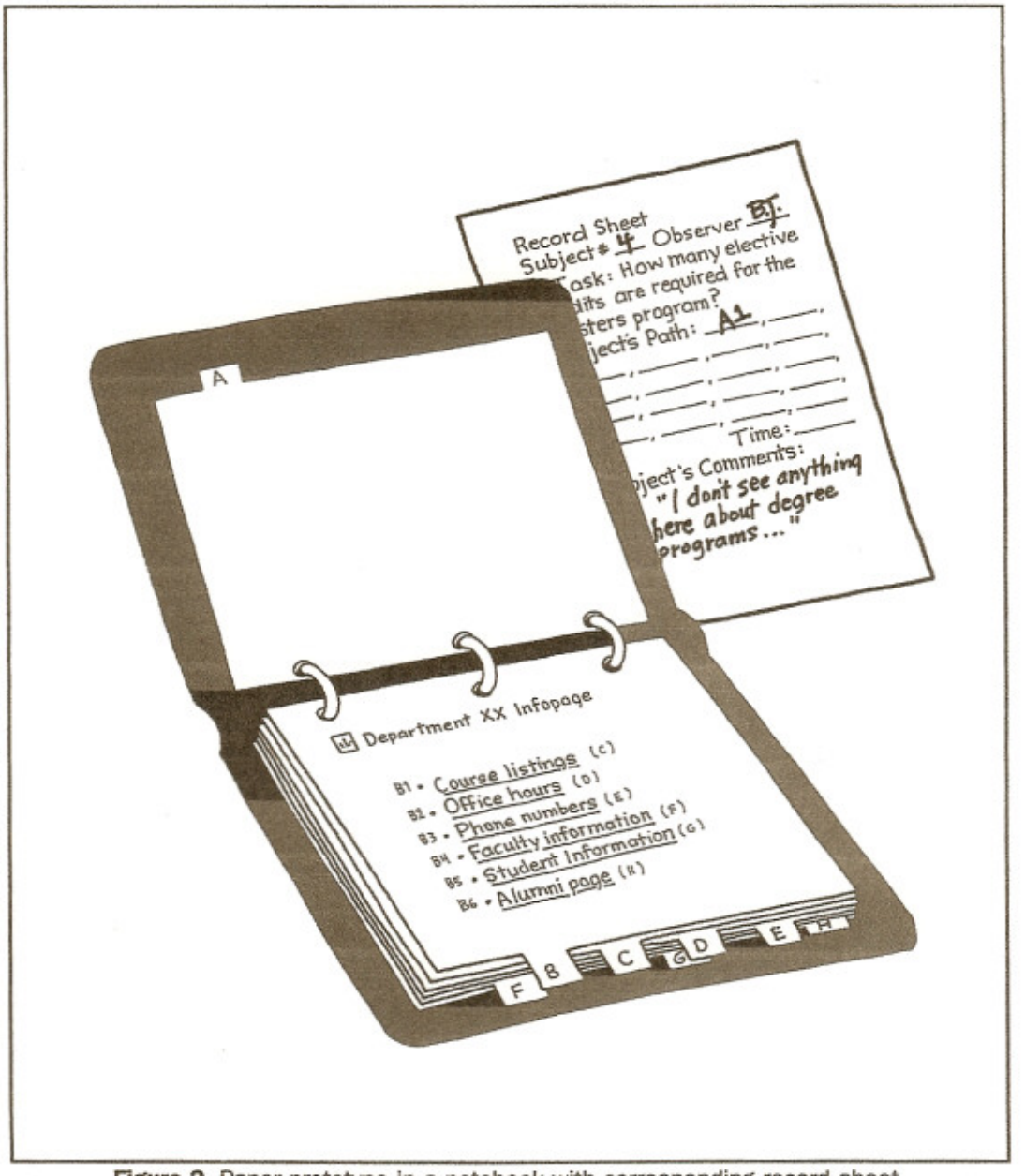

Figure 2. Paper prototype in a notebook with corresponding record sheet.

How Is a Test Conducted?

Prototype testing may be conducted in as many specific ways as there are projects, but you can follow a fairly standard pattern in testing your holistic paper prototype and be assured of useful results.

1. **Design the test.** You will not be developing new methods for this test, but you will have to decide on several basic components of your tests: the target population profile (from which you will identify your subjects), the tasks you will ask subjects to complete, the number of sessions you will conduct, and the method you will use to record your observations.

2. **Identify and recruit your subjects.** The temptation is to ask your friends or colleagues to be your subjects, but these people probably don't fit the profile of your target population (Boling & Kirkley, 1996). When members of the target population are not available, match their critical characteristics as closely as possible. What's critical? If nothing else, computer experience (particularly Web experience), prior knowledge of the content, and learning context (age, reading level, profession, motivation toward the content). Most of the time your target population is not homogenous; some may have a lot of computer experience, while others have none. When you recognize such disparity, you should define several profiles and find subjects to match each profile. Choose subjects whose characteristics are very similar to those of the eventual users. If your course is usually full of college sophomores who have taken two semesters of calculus, with about 75 percent men, then you need to find eight typical sophomores with the calculus prerequisite, where six are males and two are females. You do not need a large number of subjects to identify the most serious problems with your materials (Lewis, 1994; Virzi, 1992).

3. **Conduct test sessions under authentic conditions.** When you conduct a session, normally you will do this with one subject at a time. Ahead of time, you should have identified authentic tasks that you expect your target population to do. You are likely to have to make some compromises in authenticity when you test rapid prototypes, but do not compromise authenticity of tasks. These tasks can be very basic, such as finding the course Web site at your institution, logging into the course Web site, finding the syllabus, finding the answer to a frequently asked question, etc. Do not assume that your students will be able to do these tasks "because they are so easy and obvious." Some examples that could be relevant to the advanced calculus course: find the course syllabus; when is the mid-term exam?; find the quiz for chapter 3; read the instructor reply to a class question on _____; ask the instructor a question outside of class; and so on. When authentic conditions are not available, be sure that you make one key condition authentic by providing only the amount and type of support the subject would ordinarily get in using this site. If the people using your Web site are at home alone with no one to call for help when they get stuck, then they should not be able to ask for any help during the test session. If you will be giving your students a handout covering basic Web navigation, then your test subjects should get this handout, too (Gomoll, 1990).

What Will Usability Testing Tell Me?

Testing your prototype with authentic users and tasks will uncover big problems in the design of your site so that you can fix them before the site becomes active. During the test sessions you should watch for the times when people have trouble with:

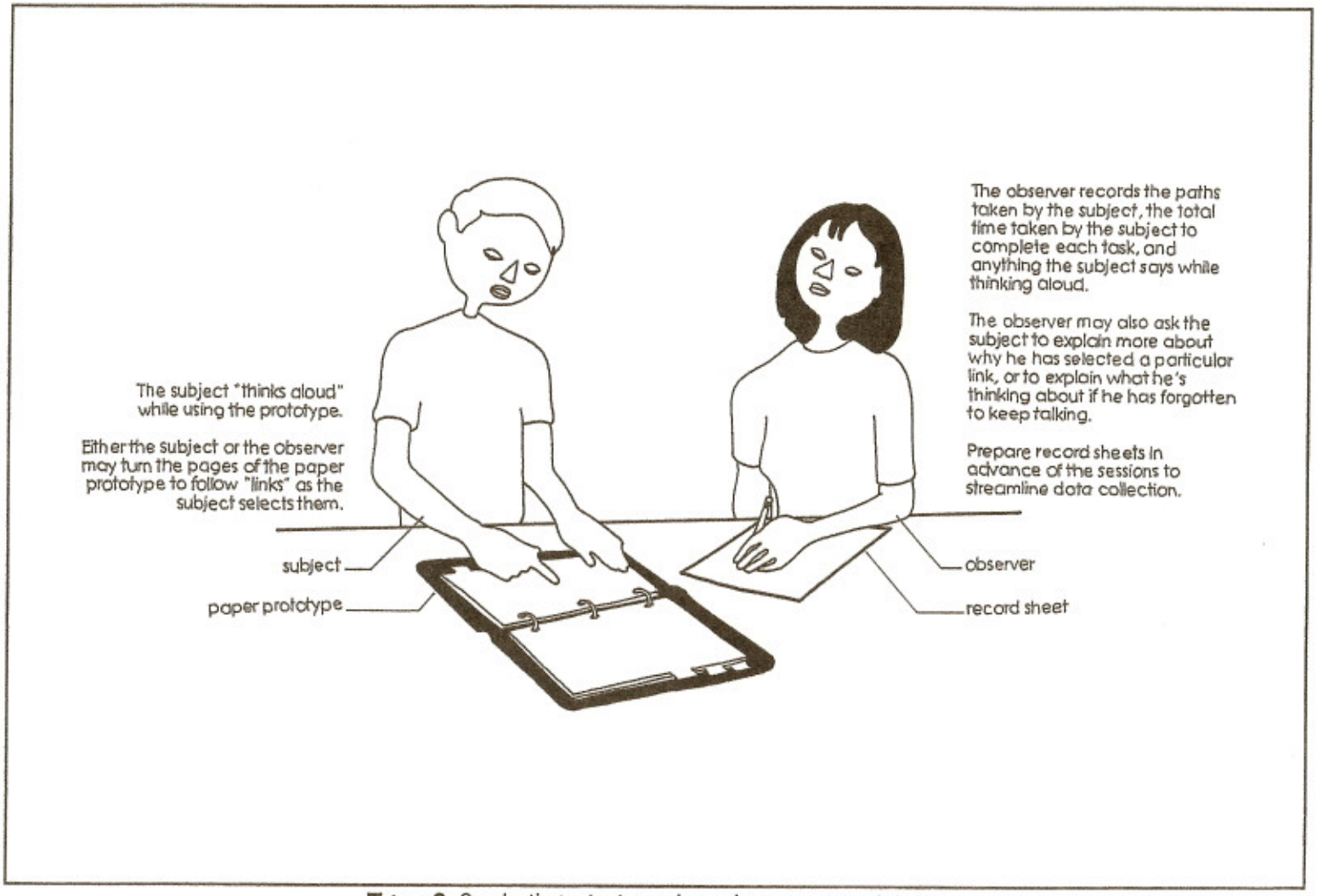

Figure 3. Conducting a test session using a paper prototype.

- simple errors in the content of the site;
- differences in vocabulary between you and the users of your site;
- links or paths which made sense to you but are now confusing them;
  - correct paths followed with lack of confidence;
  - missed paths;
  - incorrect paths followed with confidence;
  - incorrect paths followed in desperation.

Like a good detective, you need to figure out what's important to attend to and what you can ignore while you are making these observations. If subjects consistently ignore a useful link for a certain task, the reason may not be immediately obvious. It may have to do with language or expectations that were established earlier in your materials and are inconsistent with what is currently in front of them. You need to encourage your subjects to continue to "think aloud" (Gomoll, 1990). You need to ask them questions when you don't understand what they're doing, and actively listen to what they say. Remember, you're looking for problems or errors and for patterns of error that repeat from one subject to the next. Testing may also help you predict problems that you can't fix because of existing technical or organizational constraints, or simply because you don't know what to do about them. For example, in usability tests conducted on the current Indiana University Bloomington Web site in 1995, we discovered that no one had been designated to provide information for a few key areas that users wanted to know about. We had no choice but to create placeholders for those areas until arrangements could be made to put the information online.

Testing will not tell you that your design is successful. Common sense can tell you that if you see four or five people struggle with the same problem, the problem probably does exist. However, just because you see four or five, or even ten, people use your pages successfully you can't assume that everyone will do so. The most you can conclude is that you are unable to predict any problems based on these observations (Boling, 1995).

What Problems Might I Expect with This Kind of Testing?

As with any other process, part of the value lies in the skill with which you complete the prescribed steps. Even as a novice, you can get valuable design direction from prototype testing if you avoid a few common pitfalls.

Observation problems. Becoming a good observer may take some practice. Be sure both to watch what subjects do during usability tests, and to listen to what they say when they "think aloud." Interject a question here and there, asking the subjects to clarify what they just did instead of assuming that you understand their motivation or frame of mind.

Being your natural, helpful self. If they wouldn't have you by their side when they attempt to use your site in real life, you must not ruin the authentic context of the test by helping them out during the test. Learn to say, "What do you think you should do?" in a friendly, helpful tone, and then wait.

Blaming the subject. Don't. The problem is with the design, not the subject. Don't even let subjects apologize for failing to do some of your tasks. Encourage them to spot errors or problems, and reinforce them when they do!

Becoming a "test-junkie." Sometimes people find usability testing so eye-opening that they are paralyzed in design, unwilling to make any decision that is not tested. Go ahead and apply your design judgement, the best guidelines you can find, and your own experience to the

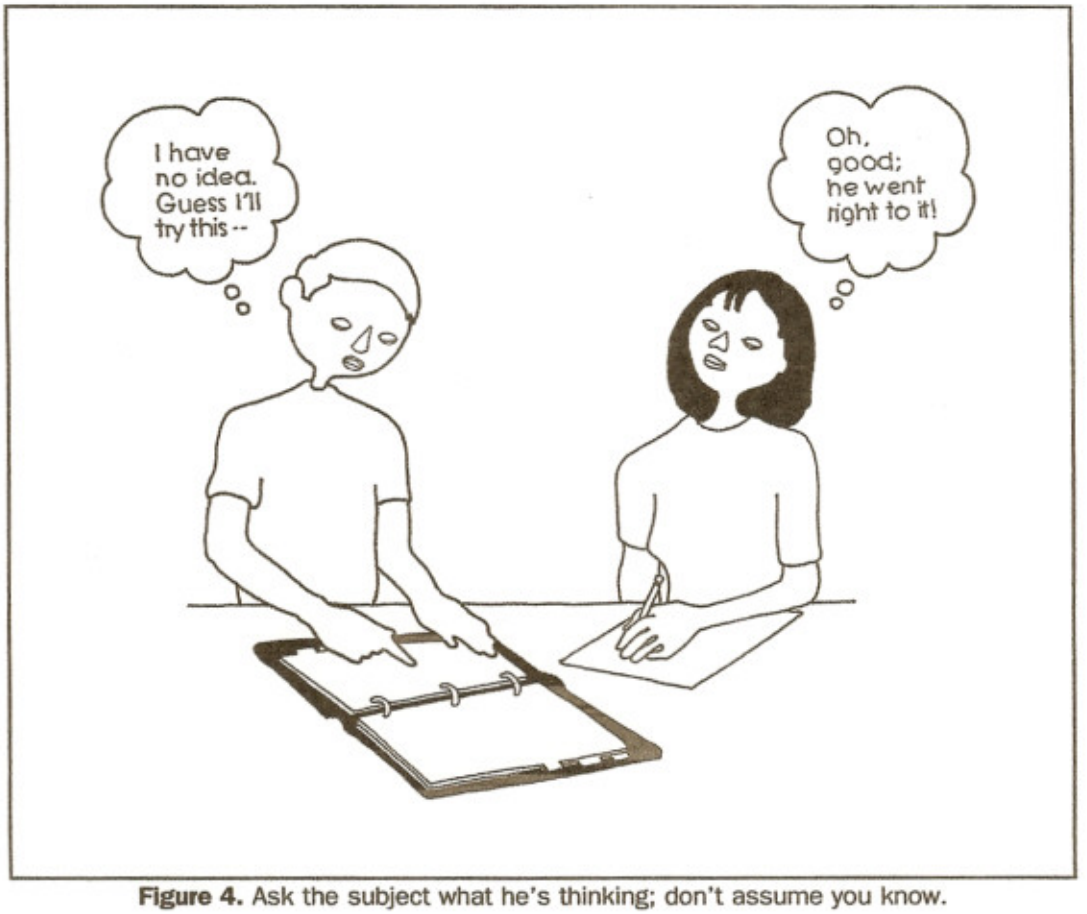

Figure 4. Ask the subject what he's thinking; don't assume you know.

design and redesign of your prototypes—these are still valuable tools, and they will keep you from wasting time building and testing truly terrible prototypes.

How Will I Use This Information?

Once the sessions are complete, it is tempting to start revising your design immediately. By conducting a systematic debriefing, though, you can make sure you have considered all your findings and that you are actually fixing the right problems. These general steps will help you make sense of the data from your tests:

1. Combine all observations from everyone who conducted sessions.
2. Sort the observations, combining similar ones and noting their frequency.
3. Diagnose the observed errors. What may be wrong with the design that caused these errors to occur?
4. Prioritize the design problems and decide what revisions will be made.
5. Note interdependencies (parts of the design that weren't a problem but which will have to change because of the planned revisions).

PRIORITY	CHARACTERISTICS	EXAMPLES
LEVEL 1 ... must fix	users get stuck and cannot recover	browser crashes documents are missing or garbled text disappears
LEVEL 2 ... should fix	users may get stuck but manage to recover	confusing links, terms, graphics or text visibility problems glaring errors in spelling or factual information slow-loading graphics, sounds, etc. missing information
LEVEL 3 ... would be nice to fix	doesn't cause a lot of problems but reduces overall quality of the site or results in negative comments	minor typographical errors in text blocks "ugly" graphics
LEVEL 4 ... fix when and if the other problems are corrected	most people won't even notice, but we know it's there	small spacing problems extra pixels "floating" in a graphic

Figure 5. Method of prioritizing problems diagnosed from user test data.

Conclusion

After you have completed one or more rounds of prototyping, testing, and revision for a site using paper, it is important to test your electronic version of the site. Features like scrolling windows, the browser's "Back" button, and input fields on forms may cause their own problems for your target population, and an electronic prototype is the only way to find that out. By this time, though, you can tackle those problems knowing that your information structure is solid and understandable for the people who are going to use it.

Related URLs:

http://www.indiana.edu/~iirg/index.html
http://education.indiana.edu/ist/faculty/iuwebrep.html
http://www.sun.com/sun-on-net/uidesign/usabilitytest.html

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