

DESIGNING FOR WEB SITE USABILITY

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ABSTRACT

Web site design is popular and prolific, meeting the communication needs of a large user community. Many of these sites are poorly designed. This paper contends that it is not enough for educators to train designers in the mechanics of HTML, tool usage, and modern web site design techniques. Effective web page design needs to put usability first, before tool mastery. Designing usable web pages requires an understanding of the site's audience, category, content, usability goals, and how to measure to achieve these goals. Web page design classes need to include iterative, order-independent, user-centered and evaluation-centered web site design processes to encourage the design of effective web sites.

Keywords: User Interface Design, Web Page Design, Usability Design, Usability Goals, Mental Models, Usability Evaluations, User Profiles, User-Centered Design, and Evaluation-Centered Design.

INTRODUCTION

The World Wide Web is a vast repository of information that connects people, providing them access to millions of web resources via the Internet. Information is conveyed through the use of text-based web pages written in a page description language called the hypertext markup language (HTML). The users of disparate machines can cross over architectural boundaries to process, display and communicate thanks to the advent of TCP/IP.

The information stored across this vast communication network is enormous and growing daily. At least 10,000 new web pages are published daily, designed and developed by people who give little thought to how the information will be used and by whom.

This paper examines the need for stronger user interface design practices in the development of a web site and recommends that the classes taught put usability design first, before tool mastery or the employment of fancy techniques. There is no implied criticism of those developers who concentrate predominantly on the production of web pages that use these latest techniques. Their efforts are applauded and many of them consider their user market when selecting the right techniques to convey their message.

USABILITY AND WEB INTERFACE DESIGN

User interface design involves the examination of who will be using the product and how it will be used to support the performance of tasks [Hix & Hartson 1993]. Activities, such as profiling the user classes that are performed to design user interfaces can also be performed during web page design. While web pages may seem simple to develop, a stronger examination of their audience, category, and content lends itself to understanding their usability goals.

So key activities in the design of a web site include: identifying target audiences and classifying them into user classes, identifying what type of web site this will be, and determining the content of the site and any constraints or boundaries to it.

Profiling these user classes, selecting a category, and understanding the nature of the content are fundamental activities which every web page designer needs to consider. How to perform these tasks is less obvious.

Audience

Who will be visiting the web site under development? If a target population can be identified, answering some key questions about the nature of this audience aides the designer in the selection of good desktop publishing and layout considerations, such as the use of color, background images, fonts, styles, and multimedia components. It also helps to determine the degree of control the user will need through the activation of objects and hypertext selections [Champeon, 1999].

If the site is being designed for teens that are *Goths* and enjoy a lifestyle that includes a certain amount of pathos, passion and the feeling that the world is a dark place indeed, they will not respond well to a site that was developed for the *Young Republicans*. The representative audiences may be similar in age, sex, demographics, and share many things in common, but their preferences and what appeals to them could be vastly different. Color selections alone will vary, with the *Goths* responding better to a black background and startling images and font techniques, whereas the *Young Republicans*' site will most likely include metaphors which foster the notion of patriotism and use red, white and blue fonts and images.

How does one profile the user into user classes? Mayhew [Mayhew 1992] discusses user profiles that identify the psychological characteristics as well as the knowledge, general experience, and task experience of the representative user community. Similar types of users are grouped into user classes. The motivation, reading level, color sensitivity, culture, primary language, software knowledge, and background experiences of users is important as it alters the solution set for the design.

Category

Why is the category or type of web site important? The category identifies basic goals that need to be met for the web site to be successful. For example, a web site designed to sell products will have goals that vary greatly from a web site that is ego based or designed to

inform the public of a health threat. The solutions, techniques, and design practices will vary greatly between the two categories.

Common categories for web sites include:

- Sites that Sell Products or Services
- Information Sites
- Entertainment Sites
- Ego-Based Sites

The primary usability goal is derived from the selection of a category. If the site is designed to sell products, then the performance requirements for the site are going to emphasize fast load times over high quality multimedia components that slow down the overall load times. It will impact the color and desktop publishing layout decisions, how product information is structured, and the selection of effective metaphors.

Content

Once the category has been identified, the designer needs to obtain detailed information concerning the content of the site prior to finalizing the layout. But content is not confined to the subject of the site, its reason for existence. Content includes the solutions and strategies employed to make it easy for the user to accomplish important tasks, such as information retrieval and navigation, making a purchase, and obtaining feedback.

Design questions that need to be answered include the following:

- What are the mental models common to the target audience?
- What analogies can be employed to make the web site easy to use?
- What information needs to be included?
- How should this information be organized across the collection of web pages?
- Which desktop publishing styles will best communicate the message?
- Which multimedia components will effectively communicate this information?
- How will the user navigate the site?

Metaphors teach the user how to perform vital tasks using the web site while minimizing the need for detailed instructions [Laurel 1990]. They help to reduce the complexity and need for detailed instructions, but must be selected based on an identification of mental models that the target audience commonly understands [Cooper 1995]. For example, when the icon of a scissors is used in a user interface, this icon serves as a metaphor for the task of cutting some text or a graphic. The mental model of how the task is performed includes applying the scissors to the paper, so we know that something on the paper has to be selected before it can be cut.

Not all users share common mental models and some users will have bad or poorly understood mental models [Mayhew 1992]. Selection of good mental models requires considerable thought and awareness of how one activity in the real world might correlate to another in the web page.

Continuing with the product sales example, common metaphors that teach people how to successfully buy products include the *shopping cart metaphor* and the *checkout*. With minimal descriptions, users have expectations of how the site will behave to support their performance of a sales task. They know that they have not paid for a product until they have visited and completed the checkout task if the site has been designed in a manner consistent with the mental model of a *shopping cart* and *checkout*.

Selecting good mental models, understanding their correlating metaphors, and mapping them to the user's cognitive model is not trivial [Schneiderman 1992]. How users perceive a mental model and respond to it ties into the notion of a cognitive and conceptual model. Each of these terms builds on the experience of the user thinking about a task, finding a correlation in the real world, mapping that activity in the web site, and how they have understood the task once interaction with the metaphor is complete.

The other questions concerning content and navigation also need to be answered, but require less explanation here.

USABILITY DESIGN PRACTICES

User interface design experts recommend a variety of simple, yet effective design practices which help a design team to gain an early vision of the product, communicate ideas, and provide a forum for evolving, designing, developing and evaluating a web interface. These practices and activities include:

- Selecting an Order-Independent Process
- Setting Usability Goals
- Profiling the User Classes
- Identifying Mental Models
- Selecting Effective Conceptual Models and Metaphors
- Developing Storyboards
- Developing Site Maps
- Selecting Good Test Tasks
- Performing Early Usability Testing
- Measuring Each Usability Attribute
- Assessing if Usability Goals Have Been Met
- Repeating the Process, Using Iterative Refinement

An order-independent process allows the designer to perform the work in the order that best meets personal and creative needs. Stumbling blocks to creativity include linear thinking, a dependence on performing tasks in order despite the lack of available information at this time.

Testing the usability of the web page early and often is vital to rapid interface development and assessment of a usable web site design. Empirical testing permits the trained observer to watch a user perform tasks that have been detailed solely by what needs to be done. Users are not told how to perform the task. Instead, their behavior is observed and it is quite possible that there are different methods of accomplishing any one task.

Setting goals is discussed in the next section, and without goals, it is hard to assess that they have been accomplished. Selecting metaphors based upon the mental models of the target audience was discussed in the category section. Incorporating objects and effective GUI techniques in a web page does not automatically happen. It is the conscious understanding of which menu type to select based on the nature of the task.

For example, if the web page asks the user to complete a form and provide feedback and the list of options is mutually exclusive, requiring the user to select one and only one, would a radio menu be the optimum choice or a check box menu? It is disturbing how many web sites ask for one selection and then provide the check box menu which does not reinforce and promote accurate usage.

Storyboards and site maps help designers visualize the site and its specific pages, their layout and navigational properties. The site map is an effective design tool, but is also popular when included in a web page for use by visitors, easing the navigational burden [Champeon 1999].

Test tasks must be selected which represent tasks common to a wide number of users and they must be phrased to state what must be performed and not how it may be performed. This testing is performed early and often in iterative refinement, permitting the designer to measure usability attributes, which quantify the usability goals. An attribute might be the amount of time it takes for the page to load, and the quantification of it is no more than 10 seconds. The test would be measured and recorded for later analysis, especially if the page took longer to load.

Iterative refinement requires the designer to repeat the process until the site is complete and has met the usability goals within the scope of the schedule and budget for the project.

USABILITY GOALS

Without goals, it is hard to know how to design the site. Without quantifiable usability goals, it is impossible to measure and assess whether it is usable with a degree of confidence. The ability to design a site well, that is measurably successful, and repeat this activity across future sites, should be the goal of every web site designer.

So usability goals need to be identified, then they need to be quantified [Hix & Hartson, 1993]. To quantify them, a numerical value needs to be set for each goal. For example, one usability goal of a web site might be *high task performance*. In a subject domain other than web design, this goal might refer to the volume of transactions. In the context of a web site, the designer might define it as referring to the speed in which the web page loads and displays the requested information given a particular hardware configuration, bandwidth, and accounting for congestion in trafficking. This quantifiable goal might be assigned a value 10 seconds. A usability evaluation would measure the time it took for users who represent the target audience to load the web page. Assigning a number to define a performance metric gives the designer a baseline for measurement, comparison, analysis, and the determination of what to do next.

Examples of usability goals include: easy to learn (measurable by the time it takes to perform common tasks); subjective satisfaction (measurable by a survey instrument); low usability error rate (noting when the user falters in the performance of a task, goes to the wrong location, has a typographical error, fails to successfully perform the task); high task performance; and retainability (measuring the interface usage over time, assessing that the user retains knowledge of how to use an interface that is infrequently used based on periodic tasks, such as completing a tax return).

How often is the need for specific and quantifiable goals taught and emphasized in the classroom? Selecting and defining effective goals is not an easy task. Yet without measurable goals and a well-defined metric to serve as a point of comparison, evaluators cannot determine if the web site and its interfaces are usable.

MEASUREMENTS IN ASSESSING USABILITY

Empirical testing is critical to assessing usability. Observing the behavior of a user during the performance of common web site tasks provides an opportunity for collecting measurements that will be analyzed to determine whether the site is usable [Nielsen 1992]. A user-centered design process involves the user early in the process [Norman & Draper 1986]. In an evaluation-centered design process, the user performs common test tasks so that the trained observer can collect measurements that will later be analyzed to assess whether usability goals have been met.

Once usability goals have been identified and quantified, users who represent the target audience evaluate the site. Their behavior during the performance of these tasks is noted, and measurable activities are recorded. These measurements might include:

- How long it takes for each page to load?
- How responsive is the system to a user's request?
- Does the user go to the wrong web pages when seeking specific information?
- Are there navigation problems?
- Is the message unclear or hard to understand?
- Does the site support the user's behavior during the performance of these tasks?

Once testing has been conducted, and measurements taken, they are analyzed to determine what needs refinement and change. This process is repeated under an iterative, evaluation-centered process until the web site meets its usability goals. Many aspects of the design and development process can be changed, not just the design and development of the actual site. These might include the test tasks and how they are phrased, the goals themselves, the content, the conduct of the evaluations, and the measurement collection activities.

CLASSROOM OBSERVATIONS

Teaching web designers how to design for usability is not a trivial activity. Many designers are resistant to the notion of a user-centered and evaluation-centered design approach. Many tend to put content and the employment of sophisticated presentation techniques first.

Anyone can develop a web site that loads and runs reasonably well, and might even look attractive to the untrained eye. But the design and development of an effective and measurably usable [Nielsen 1992] web site requires an assessment of the audience, an identification of the common tasks that they will perform, and an empirical evaluation of the web site's usability to assess if usability goals have been met. The order in which activities are performed is less important than whether the evolving web site has been effectively tested at each stage of the process and converges upon these quantitative usability goals.

The ability to predict the design of a usable web site that meets well-defined needs and to repeat this activity on future projects is the goal of the professional web designer. To this end, it is recommended that the design practices that are effective in user interface design for other subject domains be employed during web site design to ensure the usability and productivity of future web sites.

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