Programming the Internet—Lecture Notes

Week 8: Web Design, Usability, and Accessibility

Web Design Patterns

Everyone has an opinion about what makes a good Web site, but that does not mean it is all a matter of opinion. Considerable research has been done in the areas we are about to discuss determine the optimal design and functionality of Web sites. Although the fields of Human Computer Interaction (HCI) and User Experience (UX) do deal with visual aspects of Web design, such as the selection of appropriate colour combinations, the modern emphasis of Web design is more on functional issues such as the ability of the user to complete a task efficiently. People are most likely to visit Web sites to search for information or purchase goods and services. How easy is it for them to achieve their objective? Is it clear how people should navigate around the site? Is it easy for visitors to find what they want? Are they satisfied with the site? All of these considerations are testable and are often measurable. By trial and error, organisations have reached a growing consensus about some of the desirable design features which Web sites should have. Many of these ideas have been articulated in the form of design patterns.

In 1978, Christopher Alexander wrote a book about architecture (as in the design of buildings) called *A Pattern Language*. This book identified over 250 common problems in architecture and proposed a similar number of design patterns to provide solutions to those problems (Alexander, 1978). Since then, many other disciplines have adopted the idea of design patterns.

Many of the design problems facing Web designers are very common and are similar on most sites. It is, therefore, quite natural that many design patterns have been suggested as generic solutions to commonly recurring problems. Van Duyne, Landay and Hong (2007) have written a classic book on the subject called *The Design of Sites*. The first chapter of this book is freely available in electronic form (Van Duyne, Landay & Hong, 2009a). For an overview of the design patterns they define, see Van Duyne, Landay and Hong (2009b). There are also other useful resources available on the subject (Van Duyne, Landay & Hong, 2009c).

There are many other sites on the Web that provide examples of design patterns and the following may be worth a quick look: Yahoo! (2012), Welie.com (2008) and Jovanonic (2009). Some classic design patterns for mobile phones can also be found at Neil (2012).

So what problems would design patterns typically address? Here are some examples:

- Establishing what design is appropriate to each genre (type of Web site): Van Duyne, Landay and Hong (2007) suggest that personal e-commerce sites need to make it clear why people should purchase

from them, provide multiple ways to find products and avoid ‘surprises’ by making privacy and security policies and additional charges clear. Web design, therefore, goes well beyond what HTML code we are going to use and extends to higher level business objectives that are crucial to the organisation.

- Deciding on ways to help people navigate around our sites. This might involve placing tools to search and browse the site at the top of a page.

- Helping customers to complete tasks by minimising the number of steps required, providing progress bars to let customers know where they are in the process and making sure the *Back* button always works.

Van Duyne, Landay and Hong (2007) stress the importance of a Web site meeting the customer’s needs (customer-centred design). This consideration is not necessarily something that a Web programmer will always be able to assess. Web sites are produced for a particular business purpose and there is, therefore, likely to be a need for people with both business and technical computing skills to ensure that the business goals are met by those writing the code.

Web Usability

One of the main aims of design patterns is to promote usability, which may be defined as ‘the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use’ (International Standards Organization 9241-11, 1998). The stressing of Web usability has been partly a reaction against the idea that Web sites simply need to look good or be ‘cool.’ Users come to sites to find information, leave a message, buy a product and so forth, and if they cannot achieve these goals, they will abandon the site and go elsewhere. Hence, the need for usability.

Examples of usability problems would be the following:

- A Web site that is confusing and not intuitive or self-explanatory

- Failure to realise that users may select the first reasonable option rather than pondering over the best possible link or menu choice

- A navigation path to a desired piece of information that requires too many mouse clicks or too much thought

- Having too many words on a Web page

- A home page that does not tell us the name and purpose of the Web site

- Confusing instructions that lead to personal injury or damage to property

One of the leading figures in this field has been Jakob Nielsen (2012) who has a Web site called *useit.com*. This site contains a wealth of information about usability studies. Many people find the design of Nielsen's site very plain, so other writers may make the point that usability and a striking appearance are not necessarily incompatible.

Another major figure, Steve Krug (2012), also has a Web site with useful resources, including sample chapters from his books in electronic form. A major theme of Krug's work is that we should not make the user think too much. Navigation around a site should require little thought and effort. The user who is challenged to think too much about how to achieve his or her goals is one who is about to give up and leave the site.

Both Nielsen and Krug tend to concentrate on qualitative research, meaning that they ask test users to identify problems in a Web page or site. Nielsen (2000) argued that as few as five test users would identify 85% of usability problems.

However, in other cases, we may be seeking some quantitative assessment of a Web site by a group of representative users. Leading researchers in this aspect of usability are Tullis and Albert (2011) and Albert, Tullis and Tedesco (2012), who also have Web sites containing a wealth of resources. Their emphasis is on metrics, or ways of measuring things. They would typically suggest measuring performance (such as how long it takes for a user to complete a task or how many users perform a task successfully) or satisfaction (such as asking users, on a scale of 1 to 7, how they rate some aspect of a Web site).

For those interested in this topic, it would also be worth visiting the site of the User Experience (formerly Usability) Professionals Association (UXPA, 2012). The UXPA produces an online journal, the *Journal of Usability Studies* (2012), which is run by leading practitioners in the field. Papers can be accessed freely without a subscription.

Other Aspects of Web Design

For those who are interested, there are many opportunities for self-directed learning. Web design is a huge topic, and we can each choose how deeply to immerse ourselves in it. The following are areas that could be explored later:

The design of navigation systems (the way we navigate around a Web site by clicking on links) is something of an art. James Kalbach (2007) addresses this topic on his site, *Designing Web Navigation*. It addresses key questions such as how we navigate around the Web and how, in general, we find information and move from an abstract concept to a concrete solution.

Peter Pirolli introduced the term *information foraging* to describe the way users seek information. They are compared to animals following a scent that leads to food. The way this affects our design of Web sites is described in detail by Peter Pirolli and Stuart Card (1999), and further information about the author is available in the Parc (2012) resource listed in the References at the end of these notes. An interview with Pirolli is available at WebSiteOptimization.com (2007). Here, he talks about 'satisficing'. Because we do not have an unlimited amount of time to search for information, we settle for something less than the very best solution.

Information architecture, which deals with the structuring of information on a Web site, has emerged as a separate subtopic, although there is inevitably some overlap with the other terms used in this section of the Lecture Notes. There is now an Information Architecture Institute (2012) and a *Journal of Information Architecture* (2012). An interview with two respected authors in the field, Peter Morville and Lou Rosenfeld, can be found in Evans (2002). In this interview, Morville talks about the priorities for designing the architecture of a new site, namely, identifying the site's audience and what information needs it has, how to make the content accessible to users and whether the designs can be implemented given the organisation's resource constraints.

The way we search for information has generated the concept of search patterns. If this is a subject of interest to you, further information can be obtained from the work of Morville and Callender (2012a, 2012b). Search patterns might include the use of autocomplete when typing in search terms, making sure that search facilities return the most relevant results in the top three (best first), using federated searches that look through several databases at once, the development of an advanced search facility (such as that offered by eBay) and approaches to pagination or the number of results shown per page.

The task of designing Web interfaces is addressed well by Scott and Neil on their Web site (2009). A number of examples of interface designs are presented, and the authors outline six design principles: allowing the editing of content without changing Web pages; reducing the effort needed to interact with a site; displaying information without page refreshes; providing invitation cues for users to move to the next level; using transitions or visual effects to mark the fact that a change has taken place (such as making areas of the screen bright or dim); and using real-time feedback when searching for information.

It is not expected that students will necessarily be producing Web sites inspired by these principles, but it is possible that they will find some brief acquaintance with these concepts of use in supervising or negotiating with those who are.

Web Accessibility

The previous section listed topics that could be explored as optional extras. Web accessibility for people with disabilities does not fall into that category. There are three reasons why businesses would want to make sure that their Web sites can be used successfully by people with disabilities:

1. Legislation: It is likely that we shall be doing business in at least one country that has legislation requiring Web sites to be accessible. We want to avoid a prosecution.
2. Publicity: Even when an inaccessible Web site does not break any laws, the negative publicity arising from complaints by disability groups can be damaging to the business. We may also feel that we have an ethical responsibility to ensure everyone can access your Web site.
3. Sales: If a number of potential buyers cannot use our Web site successfully, it is likely to result in lost sales. In difficult economic times, the loss of a small percentage of possible buyers may mean the difference between a profit and a loss. We shall want to make our site available to as many buyers as possible.

Understanding the Issues

Given the visual nature of Web sites, the emphasis for accessibility has inevitably been on the problems created for people who are totally blind or partially sighted. There are two main issues to bear in mind:

1. A visually impaired person will typically rely on a screen reader, a piece of software that reads out loud the text on a Web page. Pictures will convey no information to these users without the use of the *alt* attribute.
2. A mouse relies on the visual alignment of a mouse pointer and an object on screen. This feature is of no use to someone who is blind. Navigation around a page is likely to be by means of keyboard commands.

A number of free screen readers are available, and it certainly would be useful to download one of these at some point to understand how they work. Some free screen readers are NVDA (2010) and *Thunder*, which are available at ScreenReader.net (2012a). One screen reader for a mobile phone would be Georgie, the details of which can be found at ScreenReader.net (2012b).

The *Tab* key is often used by visually-impaired people to move from one screen object to another, e.g. moving between fields in an HTML form. It is possible for the default Tab order to be changed using JavaScript and *tabIndex* (W3 Schools, 2012). Each browser has its own set of keyboard shortcuts that can be used instead of mouse clicks, but many of them are not common to all browsers. Details of various such cross-browser shortcuts can be found at How-To Geek (2012). For individual browser shortcuts, look at the Google (2012), Microsoft (2012) and Mozilla (2012) Web sites. Programmers

can define their own keyboard shortcuts using the HTML *accesskey* attribute. An example of this was given in Week 4. Further details of how this can be done are can be found at WebAIM (2012a).

Universal Design?

One way of accommodating people with disabilities is to create a second version of a Web site which is tailored to their needs. However, this approach has been criticized by disability interest groups. The concept of universal design, under which there is one version of a site that is suitable for everyone, has been gaining ground in recent years. Trying to accommodate everyone is not without its difficulties, and some compromises may need to be made. Some argue that accessible sites also tend to be highly usable by those without disabilities. Many of the issues surrounding this topic are discussed in these sources: Chisholm and May (2009) and WebAIM (2012b).

Accessibility Standards

To accommodate users who require accessibility measures, a number of organisations have drawn up standards to guide Web developers in producing accessible Web sites. One of the most important sets of standards is produced by the World Wide Web Consortium (W3C) *Web Content Accessibility Guidelines (WCAG) 2.0* (W3C, 2008). Some sites comply only with the earlier version, 1.0, of these guidelines (W3C, 1999).

The W3C guidelines deal with considerations such as the need to provide text alternatives to non-text content, creating content that can be presented in different ways, making all functionality available from a keyboard, providing users with the time to read and use content, making text readable and understandable and maximising compatibility with assistive technologies.

Another key standard, relevant to those wishing to do business in the United States, is known as Section 508. This refers to Section 508 of America's Rehabilitation Act 1998. It is accepted as setting out *de facto* accessibility standards even in areas where the act may not have legal force. Details can be found at US Federal Government (2012). It is highly desirable that students have some understanding of these two sets of standards.

The following sources provide additional information for those who are interested in exploring the topic more deeply. We should start with three more documents, produced by the W3C Web Accessibility Initiative (2010) *WAI Resources on Introducing Web Accessibility*, W3C (2010a): *Techniques and Failures for Web Content Accessibility Guidelines 2.0* and W3C (2010b): *Authoring Tool Accessibility Guidelines*.

Governments often provide guidelines to their own departments about rules that should be followed in producing Web sites. In the UK, you can find these guidelines at the Department of Culture, Media and Sport (2011): *Inclusive web design practices published* and in the United States, you can find these

guidelines at Usability.gov (2012): *Your Guide for Developing Usable and Useful Web Sites*.

Britain's Royal National Institute for the Blind (RNIB, 2012a; 2012b) has produced useful resources for developers designing for the visually impaired with their *Web Access Centre* and the *See it Right Standard*.

There are a number of online tools available to help check the accessibility of Web pages. One of these is WAVE (WebAIM, 2012c). A review of additional free tools also is available (WebAIM, 2012d).

Other Disabilities

Web sites can be a challenge for people with non-visual disabilities. A thorough assessment of Web site accessibility would not neglect the needs of the deaf (WebAIM, 2012e), those with motor disabilities (WebAIM, 2012f) and those who have dyslexia (British Dyslexia Association, 2012).

There is a useful online tool at Vischeck (2012) which simulates the appearance of a Web site presented to users who have different kinds of colour blindness. The user enters a URL and a link to that site is returned. When the link is clicked, the user should see the page as a colour-blind person would see it. The owners of Vischeck admit that it will not work in all cases, but it is a useful tool.

The Elderly

All elderly people do not have disabilities, but research has identified a number of special requirements that older Web users may have. The 'silver surfers,' as some have called this demographic group, have a significant amount of purchasing power, and hence most businesses will want to ensure that their Web sites are accessible to them. Andrew Arch (2008a, 2008b) has produced a review of the literature on elderly users for the W3C and has written a useful research paper.

Dana Chisnell and Janice Redish (2005) produced a substantial report for the Association for the Advancement of Retired Persons (AARP) in the US. They followed this up with a paper setting out guidelines (heuristics) for understanding how to produce Web sites that are accessible by the elderly (Chisnell, Redish & Lee, 2006). They found that using the Internet is very difficult for the least expert among older adults. Other problems include: type that is too small and not adjustable, language that is difficult or unfamiliar to this audience, and information architectures that are too deep, causing the user to become lost or disoriented.

More practical advice has been produced by the National Institute on Aging (2012). It advises Web designers to do the following:

- Break information into short sections.

- Give instructions clearly and number each step.
- Minimise the use of jargon and technical terms.
- Use single mouse clicks.
- Allow additional space around clickable targets.
- Use 12- or 14-point type size, and make it easy for users to enlarge text.
- Use high-contrast colour combinations, such as black type against a white background.
- Provide a speech function to hear text read aloud.
- Provide text-only versions of multimedia content.
- Minimise scrolling.
- Choose a search engine that uses keywords and doesn't require special characters or knowledge of Boolean terms.

Writing for the Web

Research shows that readers of Web pages tend to scan the text during a search for some specific information rather than reading every word. This finding has encouraged a number of authors to suggest that writing for the Web is a specialised skill which requires a slightly different approach (Redish, 2012). Two sample chapters from Janice (Ginny) Redish's book are available from Redish.net.

Redish suggests reducing the number of words on a Web page and altering the formatting of text to make it easier to scan. This is not quite the same as saying that pages should score highly on readability tests such as the Gunning Fog Index or the Flesch Reading Ease test. Those interested in such tests can find information and an online tool at Juicy Studio (2012).

Search Engine Optimisation

Search engines index Web sites on the basis of information submitted to them manually or by the use of pieces of software called *spiders*, which search the Web automatically recording details about new Web pages. Each relevant business would like to see its site towards the top of the search results list when a user performs a search in Google or some other search engine. It is widely known that sites with certain features are ranked more highly than others, so there is an important branch of Web development known as Search Engine Optimization (SEO) which tries to ensure that a Web site exhibits those desirable qualities (Tizag.com, 2008).

Improvements in a site's search engine ranking can be made through the intelligent use of keywords and by building up the number of other sites that provide links to our own. It is, however, a game of cat and mouse with the search engines, which often change the criteria they use to rank Web pages. The key business issue in search engine optimisation is that some of the tactics that are used by developers in their quest for improvements may be seen as illegitimate or questionable.

Ross Malaga (2008) refers to some of these dubious practices, often known as ‘black hat’ techniques. They include presenting one page to a search engine and another version to the user, setting up hundreds or thousands of bogus sites, each with links to the site that is looking for a high search engine ranking, or exploiting security vulnerabilities to change the content of a competitor’s Web site with a view to getting them banned from a search engine’s rankings.

It is, therefore, important that there should be some business control over the activities of any staff or outside agencies that are charged with carrying out SEO. Getting caught doing something questionable can damage the business’s reputation and does not exhibit respect for professional ethics.

Summary

In this final week, we have examined the very important topics of Web design, usability and accessibility. We have seen the special challenges of writing for the Web and designing sites for the elderly user. Finally, we considered why developers might wish to include features that will see them placed highly in the lists returned by search engines.

It is to be hoped that the skills and knowledge you have acquired in this module will, when added to your previous experience, make you more valuable to your organisation.

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