Chapter 4

USABILITY AND ACCESSIBILITY

Usability and behaviors

A growing number of books and articles address the issue of website usability, both for the Web in general and specifically for library sites. Authors bring backgrounds in Web design, research into computer interfaces and computer-human interaction, or experience from specific fields such as librarianship to the subject. Grabbing one of these books is tempting for flipping to sections on design guidelines, how to run a usability test, or whatever aspect of usable design is of greatest interest.

Before doing that, though, consider exactly what usability is. A website is usable if its users comprehend what the site is and what it offers and are able to use the site for its intended purposes.

Users bring sets of learned browsing behaviors and expectations about Web design to a website. These behaviors have been picked up and reinforced by their contact with many sites and create a framework of expectations that shape what usable design is. In other words, sites that anticipate and work with user behaviors are more likely to be usable than sites that fail to understand these behaviors or choose to work against them.

The most important user behavior to understand is that users seldom actually read Web pages. They mentally divide a page into areas related to site identity, navigation, and page content, and scan the appropriate area for the information they need.

When a page's structure is similar to other pages already familiar to users, this breakdown happens quickly and users can easily answer questions such as, Where am I?, Where can I go next?, and What can I find right here?

On the other hand, pages that present the user with unfamiliar structures interrupt this process, and the answers to these basic questions are several cognitive steps away.

Also understand that users rapidly identify and follow the first link that is likely to go where they want. They don't invest time in choosing one best link because making a quick guess is more time-efficient. They know they can click the Back button and guess again.

Also consider that users follow hits from search engines and links from other locations to enter a site on any page. Although designers often expect users to learn a site's identity and structure by starting on the homepage and working inward, many users arrive at an interior page and only reach the homepage afterward, if at all.

A basic aspect of all users' behavior is unpredictability. Beyond the most general tendencies, this behavior must be observed to be fully understood. As a consequence, the best guidelines and advice in the world cannot substitute for real-world observations of users trying to navigate a website.

With these behaviors and caveats in mind, most usability guides provides suggestions that can be divided into three categories: consistency, clarity, and confirmation.

Consistency. Because Web surfing is usually a series of rapid-fire decisions, usability is reduced quickly when sites create obstructions or slowdowns for

users. Obstructions include the presence of too many or too few choices on a page, a site design metaphor that does not communicate itself immediately, or use of language the user does not understand.

A site can take advantage of this behavior if the Web manager applies two levels of *consistency*. First, the site's basic structure should be consistent with the expectations users have developed using many other sites. Second, design elements that provide site identity and navigation should remain consistent throughout the site.

Sites designs that are consistent with this set of user expectations allow users to understand and navigate the site faster than those that do not.

Some expectations users bring from other sites are so basic that articulating them can be difficult, so a radical new site design may deviate from the expectations and thus fail. Only when the site is in place will the designer hear reports that users fail to grasp the site's design. Consider at the most basic level what users expect from a site:

From a usability standpoint, criteria such as user expectations can even become the functional definition of what a site is, which would make clear where and how to divide a large site into several mostly independent subsites.

- **A homepage whose primary responsibility is to establish the site's identity to the user and to streamline access to the starting points for the site's main divisions.** This responsibility requires that the homepage prominently feature the library's name and logo, if there is one, and that it not be over-packed with features, links, or words. It should link to the top sections of the website and provide shortcut options to the highest priority search options, such as a site search or a keyword catalog search.
- **Interior pages whose primary responsibility is to provide a view of information from one of the site's main divisions.** These pages provide the bulk of a site's content and are more likely to be destination pages, where users pause to absorb content in greater depth than the homepage or intermediate pages that consist almost entirely of menus.
- **Site navigation gestures that provide users paths from any page on the site to the homepage, any other major starting points, and tools for locating specific pages.** Whatever design is used for these gestures—links running horizontally across the top of the page, or vertically down the left side are both common—it must remain consistent throughout a site. The design's purpose is to furnish each page with consistent navigational options. On large, multisection sites, they may be broken into gestures that remain consistent across the entire site and gestures that are tailored to the particular section in which a page is located. For example, all pages on a library site may have a row of navigational tabs for Home, Catalog, All Databases, Special Collections, and Live Reference. To this row, pages in the site section listing databases may add a second row of tabs for Databases By Name and Databases By Subject, and pages in the Special Collections section may all carry a second row of tabs for Genealogy Resources and Newspaper Archives.
- **Gestures that display to users their current location within a major division or within the overall site.** These gestures include devices such as the hierarchical paths Yahoo popularized, which combine the needed "You are here" function with links to increasingly general topics. For example, a page may include the location gesture, Library Home > Special Collections > Genealogy Resources > By Area > Ohio where each section in this hierarchical path link to the main page at that level (the By Area links to the menu of geographical areas with Genealogy Resources lists; the Genealogy Resources link to the menu of all the ways to explore genealogy resources, and so on).

- **Site mechanism pages that provide additional navigational functions,** such as site indexes or site searches, or that provide administrative information about the site itself, such as privacy policies or about the library pages.

Many libraries support not only a website but also sets of public workstations for in-library use. Many of these libraries choose to use the same page both as their site's homepage and as the browser homepage on the public workstations. From a usability perspective, this choice is poor because the two pages must have different functions.

Users expect a site homepage to place priority on establishing a site's identity and giving a top-level overview of available services. They also expect a browser homepage to de-emphasize site identity in favor of a more complete, lower-level list of available services.

A single page can seldom fulfill both functions in ways that are consistent with user expectations, so usability increases by maintaining two separate pages for these two functions.

Clarity. In Web design, clarity has several meanings. Clear page structure lets users immediately identify which parts of the page provide navigation, which provide content, and which provide site identity or promotion. Which functions predominate on which page depends largely on the role of the page as described above, but sections of pages that take up space without contributing to that page's role erode site clarity.

For example, a prominent logo on the homepage assists in establishing site identity; the same logo placed on every interior page does not assist in content delivery and works against clarity on those pages. At the same time, a less prominent logo built into the site navigation gestures can keep site identity established for users coming in through the homepage. It also begins to establish the identity for users linking to interior pages from other sites or search engines.

In addition to clarity in page design, Web managers must consider clarity in language use. Library jargon creates barriers for users who are unfamiliar with it. At the same time, specialized library terms have developed to frame a specific meaning that is not directly captured by more general wording.

A page that guides users on subject browsing in LCSH or MeSH terms cannot accurately describe the concepts of controlled vocabularies or thesauri without including some technical terminology. In many cases, authors cannot predict what terminology users will understand. The only solution is to use the clearest language that communicates what the page needs to say and to test whether users understand it.

Confirmation. The best guesses about user behavior and perception of a site's usability can go only so far. A commitment to providing a usable site includes a commitment to testing. The people who know best how users react to a site are the site's users.

Usability testing can be a long, formal affair, or it can be a series of quick, less formal events. Testing determines which aspects of the site design mesh with user expectations and which fail to communicate with users. In theory, the only perfect test would be to observe every user interacting with the site, but such a test is not possible. Instead, most organizations preparing for usability tests attempt to find representative users from one or more target groups of users, such as undergraduates, graduate students, and faculty, and observe them as they use the website for typical purposes.

A carefully done usability test conducted along these lines with 15 to 20 volunteers does provide helpful information about user behavior that would otherwise be hidden from the site designers, but the type of test remains a complicated procedure. Preparing and administrating formal tests require such time and effort that even highly motivated libraries can only conduct them every few years. Meanwhile, site design changes go untested.

Usability expert Jakob Nielsen considered this problem of conducting formal tests and arrived at an unexpected conclusion. Although a large-scale formal study remains the best way to discover all the usability problems a site imposes on all users, a small-scale informal study can find almost all of a site's usability problems. At the same time, the smaller study does not create a serious administrative burden and can be done more frequently. Ultimately, a test that is conducted reveals more than a test that is not.

Accessibility

Many aspects of a website's operations can be couched in the term *accessibility*. If the local network is down or the Web server has crashed, the material on a site is inaccessible to all users. Likewise, if a site is written entirely in English and a user speaks only Spanish, the site is inaccessible to that user.

In a more specific sense, a website is accessible if it does not impose any undue hindrances on users with disabilities. The disabilities most likely to affect use of the Web are vision impairments, mobility impairments, and certain learning disabilities or cognitive impairments.

Vision impairments include partial or total blindness; degrees of color blindness, which reduces or eliminates a user's ability to distinguish between particular colors; and difficulties reading small text or text with low foreground-background contrast. Depending on their needs, users with these impairments may access a website with the assistance of software that enlarges parts of their screen (screen magnifiers), converts on-screen text to speech (screen readers), or directs the source of HTML pages directly to a speech synthesizer (speaking browsers).

Motor impairments include difficulty or inability to use mice and other pointing devices. Depending on their needs, mobility-impaired users may rely on keyboards to provide all input to programs or sites, or they may use alternative input devices such as pointing sticks.

Certain learning and cognitive disabilities affect the level of visual distraction a user can tolerate before losing concentration on important information. These users are comparatively likely to disable technologies such as JavaScript, image animations, and some plug-ins to reduce the likelihood that pages are visually distracting.

Users may also take advantage of a browser's built-in ability to keep control of font size and color in their own hands, rather than the author's.

Many users who may not define themselves as disabled still benefit from steps taken to make sites accessible. For example, providing pages that function sensibly without JavaScript support ensures pages are accessible by users who disable scripting for reasons of disability. It also ensures pages are accessible to users of browsers on personal digital assistants (PDA) such as the Palm Pilot, where browsers typically cannot run JavaScript. Ensuring that text can be resized benefits both users with specific vision disabilities and

anyone who simply wants larger text to offset eye fatigue due to normal aging or extended on-screen reading.

What accessibility requirements apply

Depending on a website's owner or projected audience, policy or by law, the website may have to meet certain accessibility requirements.

The web's primary accessibility standard is the Web Content Accessibility Guidelines (WCAG), written by the World Wide Web Consortium's Web Accessibility Initiative. WCAG provides a thorough description of what makes a website accessible and a set of checkpoints for measuring a site's accessibility.

Recognizing the potential difficulties in guaranteeing the highest degree of accessibility and the varying accessibility needs of different sites, WCAG identifies three priority levels in its checkpoints and three corresponding degrees of compliance. Level A compliance meets the Priority 1 checkpoints (those that are essential to making a site minimally accessible to all users). In practice, any site can be brought up to Level A compliance with minimal effort and little need for redesign. AA compliance with Priority 1 and 2 checkpoints ensures a site's accessibility is substantially complete, and AAA compliance with all three priority levels indicates a thorough consideration for all forms of accessibility from the design level down to the final page.

World Wide Web Consortium's Web Accessibility Initiative, www.w3.org/TR/1999/WAI-WEBCONTENT-19990505

Although WCAG is an excellent general guide to making a site accessible, some sites are to subject other standards that may vary from it slightly. In the United States, the most prominent of these guides is Section 508 of the Rehabilitation Act Amendments of 1998. Section 508 sets accessibility requirements for information technology (including websites) that is developed, maintained, or procured by federal agencies. Whether other websites are bound by the Section 508 rules, or subject to more general guidelines from the Americans with Disabilities Act, is a matter of legal debate.

Section 508 of the Rehabilitation Act Amendments of 1998, www.access-board.gov/sec508/508standards.htm

Making a site accessible

Many accessibility features can be worked into pre-existing websites. On the other hand, some features, such as use of only accessible tables and accessible scripts, can require basic redesign of current Web pages. To avoid problems with these features, consider some accessibility questions before beginning work on a new website.

First, determine what accessibility standard applies to the site, or what standard the library chooses to meet. Compliance with Section 508 is explicitly required only for sites written by and for the U.S. federal government. Provisions in other legislations may or may not require states and state-funded agencies to follow suit. This area is sufficiently unclear so Web managers may need the advice of legal counsel to understand their obligations.

Many sites choose to follow WCAG, which is the consensus statement from the World Wide Web Consortium (W3C) on how best to provide accessible websites. In most countries that have Web accessibility requirements—other than the United States—WCAG is the official standard.

Choosing to comply with WCAG raises another question. The specific checkpoints described under each guideline are assigned to one of three priorities:

- Priority 1 checkpoints *must* be met, or some users won't be able to access information in a Web page.
- Priority 2 checkpoints *should* be met, or accessing information for some users will be difficult.
- Priority 3 checkpoints *may* be met to improve accessibility for some users.

To use the WCAG, Web managers must first decide which priority level to comply with.

When establishing the overall design of a site, be aware of decisions that could make every page on the site either inaccessible or difficult to make accessible. For example, sites with a table-based template for all pages may find that the template by itself makes every page inaccessible.

Four easy steps to a mostly accessible website

Depending on a site's scope and pre-existing design, ensuring it is accessible may be a simple or difficult job. Web managers who adopt, or are required to abide by, WCAG or Section 508 standards need to confirm their sites meets all the standard's provisions. Picking a starting point can be daunting though.

These four steps solve most website accessibility problems, usually with little or no redesign work:

1. Provide appropriate text alternatives for every nontext element on the site. (WCAG Guideline 1, 508 Provisions A and I) In an HTML document, all images, image form inputs, linking areas in image maps, applets, and frames must be associated with accompanying text. In an HTML <img> element, this is done through the required alt attribute:

```
<img src="floorplan.png" alt="Floorplan">
```

Legitimate differences of opinion exist over what the appropriate alt text for an image might be. Bear in mind that alt text is an alternative to viewing the image; it is not necessarily a description of the image and is not supplementary information to display in a tooltip to a user already viewing the image.

A commonly cited rule of thumb is to include in the alt text whatever would be said when reading a page over the telephone. Longer or more descriptive text intended to accompany rather than substitute for an image may be more appropriately tagged as the image's title, and still longer descriptions of an image may be placed in a separate document with a link provided by the img element's longdesc attribute:

```
<img src="floorplan.png" alt="Floorplan"
 title="Call number ranges in the third floor stacks"
 longdesc="callnum-locations.html">
```

Apply the alt and title attributes to image inputs in forms.

Just as alt text and longdesc links make images accessible to screen readers, client-side image maps become accessible if they include titles for each linked area:

```
<map name="hotlinks">
 <area shape="rect" coords="0,0,100,100"
 title="Library Homepage" href="/index.html">
 <area shape="rect" coords="100,0,200,100"
 title="Site Search" href="/search.cgi">
</map>
```

The 508 provisions listed in this section correspond to paragraphs in Web Based Intranet and Internet Information and Applications, 36CFR1194.22. So Provision A, for example, comes from Paragraph 1194.22a of the Section 508 requirements.

The alt attribute has been required in HTML since version 4.0 was released in 1997. It was labeled optional in the two previous official versions, 3.2 and 2.0, but for accessibility reasons should always be used, regardless of the HTML version in use.

Mozilla-based browsers, including Netscape 6 and 7, provide minimal support for the longdesc attribute; the linked document is available by examining the image's properties in the context menu. No versions of Internet Explorer or Opera support longdesc yet.

These guidelines require, for example, that audio files be accompanied by captioned text of the same audio. Section 508's Provision B also requires that multimedia presentations include synchronized, equivalent alternatives, meaning captions for the audio portion of a multimedia video must be timed to the audio version.

2. Use honest markup for document structure, use appropriate stylesheets with relative units of measurement for presentation, and check that a page is readable without its stylesheet applied. (WCAG Guideline 3, 508 Provision D) Misusing HTML elements in an attempt to create presentational effects makes pages less accessible. Screen readers must assume that tables present tabular information rather than controlling page layout, and that the blockquote element presents a block of quoted text rather than indented text. These users are adversely affected by websites that specify font sizes, table or, column widths, and other dimensions in absolute measurements, especially pixels.

The CSS specification provides other absolute units: inches, centimeters, and points. These units are equally unyielding to resizing.

Some browsers, most notably Internet Explorer, do not resize fonts specified with absolute font sizes, meaning that a section of text calling for an often unreadable 8 pt font remains at 8 pt even when the user resizes the rest of the text on screen to "Largest."

3. Use color to communicate information only in conjunction with textual cues. (WCAG Guideline 2, 508 Provision C) One of the most common vision disabilities is color blindness, which partially or totally affects the color perception of as many as 10% of all men and about 0.5% of women. Color blind users see little or no difference between certain pairs of colors, which can easily make directions such as "click the green arrow to continue" meaningless.

4. Avoid anything that blinks. (WCAG Guildeline 7, 508 Provision J) Users with some forms of epilepsy can have seizures in response to displays that flash or blink at rates between two and four times a second at the low end, and between 55 and 59 times a second at the high end. Avoid blinking text and blinking animated images entirely or ensure their blink rates fall outside these ranges.

Four slightly less easy steps to nearly complete accessibility

In addition to the four guidelines above, which are likely to make most sites highly accessible, four further guidelines deserve special consideration, even though they are more likely to require page redesigns.

1. Provide "Skip navigation" options. (508 Provision O) A common design feature of many pages is a horizontal row of navigational links to a site's main sections or a similar vertical column on the left side of the page. Sighted users can easily skip these links until and unless they are needed, but users relying on screen readers usually have to hear the entire set of navigational options read on every page before receiving the page's actual content. Pages that include this option typically make the link the first body element, pointing to a named anchor immediately before the substantive part of the page's content:

```
<a href="#content">Skip navigation</a>
<!--site navigation tabs… -->
<a name="content">…
```

Site designers who prefer to make this option less obvious to users of graphical browsers can build the link around a tiny or transparent image that sighted users do not normally see:

```
<a href="#content"><img src="1-by-1.png" alt="Skip
navigation"></a>
<!— site navigation tabs… —>
<a name="content">…
```

2. Use tables only for tabular information; include in data tables markup necessary to associate each cell with appropriate headers. (WCAG Guideline 5, 508 Provisions G and H) Table-based markup is chronically difficult for screen readers to present in an understandable way to users, and column-oriented tables especially can be incomprehensible when a screen reader presents it in order of its HTML source, a process called *linearizing* the table. For example, this table makes sense in a visual environment:

Search limit options	
Show only records in Main Library	Sort by title
Show only records in North St. branch	Sort by author
Show only records in South Ave. branch	Sort by date

When presented by a screen reader, the text would be read this way:

Search limit options
Show only records in Main Library
Sort by title
Show only records in North St. branch
Sort by author
Show only records in South Ave. branch
Sort by date

Many page designs that use tables to control layout create confusion when linearized by a screen reader. In addition, difficulty exists in reading long tables in a screen reader and reliably keeping track of where in the table the current cell is located. The accessible solution is to create data tables with appropriate headers for rows and columns, using the HTML 4/XHTML 1 scope attribute to identify whether a header applies to a row or to a column of data.

Consider this table:

Library Hours, Spring 2003

	Monday – Friday	Saturday	Sunday
Main Library	8:00am – 10:00pm	10:00am – 5:00pm	1:00pm – 7:00pm
North St. Branch	8:00am – 8:00pm	1:00pm – 5:00pm	Closed
South Ave. Branch	8:00am – 8:00pm	Closed	Closed

Typical, but inaccessible, markup for this table might be:

```
<h3>Library Hours, Spring 2003</h3>
<table>
<tr>
 <td></td>
 <td>Monday – Friday</td>
 <td>Saturday</td>
 <td>Sunday</td>
</tr>
<tr>
 <td>Main Library</td>
 <td>8:00am – 10:00pm</td>
 <td>10:00am – 5:00pm</td>
 <td>1:00pm – 7:00pm</td>
</tr>
<tr>
 <td>North St. Branch</td>
 <td>8:00am – 8:00pm</td>
 <td>1:00pm – 5:00pm</td>
 <td>Closed</td>
</tr>
<tr>
 <td>South Ave. Branch</td>
 <td>8:00am – 8:00pm</td>
 <td>Closed</td>
 <td>Closed</td>
</tr>
</table>
```

This markup is inaccessible because, for example, a screen reader reading the "1:00pm – 5:00pm" cell cannot offer any information on what that cell means or what headings apply to it. Similar but accessible markup for the same table might be:

```
<h3>Library Hours, Spring 2003</h3>
<table>
<tr>
 <td></td>
 <th scope="col">Monday – Friday</th>
 <th scope="col">Saturday</th>
 <th scope="col">Sunday</th>
</tr>
<tr>
 <th scope="row">Main Library</th>
 <td>8:00am – 10:00pm</td>
 <td>10:00am – 5:00pm</td>
 <td>1:00pm – 7:00pm</td>
</tr>
<tr>
 <th scope="row">North St. Branch</th>
 <td>8:00am – 8:00pm</td>
 <td>1:00pm – 5:00pm</td>
 <td>Closed</td>
</tr>
<tr>
 <th scope="row">South Ave. Branch</th>
 <td>8:00am – 8:00pm</td>
 <td>Closed</td>
```

```
 <td>Closed</td>
</tr>
</table>
```

In this version, a screen reader reading the "1:00pm – 5:00pm" cell can know that this cell is in the "North St. Branch" row and the "Saturday" column.

3. Make information and navigation provided by client-side scripts or plug-ins accessible to users with screen readers, users with alternative input devices, and users with scripting disabled. (WCAG Guidelines 6 and 8, 508 Provisions L and M) In this area, WCAG and Section 508 are slightly different. Section 508's provision on scripts says that information provided by scripts must be readable and usable with assistive technology such as screen readers and without the use of mice.

This provision means, for example, that an image provided via JavaScript must include alt text, or that tables written by scripts include accessible markup. If a page requires client-side software such as a plug-in, it must provide a link to a version of that software that meets the 508 provisions for software applications.

WCAG goes further for scripts and plug-ins, by requiring a page to work correctly when scripts and plug-ins are disabled, or to link to an alternative accessible page.

4. Provide textual cues for all form inputs. (WCAG Guideline 12, 508 Provision N) Form inputs, especially those inside data tables, often give screen readers no indication of exactly what data is to be entered. Some forms automatically improve when tables are edited to linearize correctly.

All forms can benefit from use of markup that explicitly identifies which text labels each input. For example, this series of inputs is inaccessible:

First Name	Middle Initial	Last Name
[INPUT]	[INPUT]	[INPUT]

As seen above, a screen reader linearizes this as:

First Name
Middle Initial
Last Name
[INPUT]
[INPUT]
[INPUT]

A more accessible design linearizes so inputs immediately follow the identifying text:

First Name	[INPUT]
Middle Initial	[INPUT]
Last Name	[INPUT]

This design becomes still more accessible by explicitly connecting the identifying text to each form input with HTML's label element. Using labels, the markup for this table would be:

```
<table>
<tr>
 <td><label for="firstname">First Name</td>
 <td><input name="fname" id="firstname"></td>
</tr>
<tr>
```

```
 <td><label for="middleinitial">Middle Initial</td>
 <td><input name="minit" id="middleinitial"></td>
</tr>
<tr>
 <td><label for="lastname">Last Name</td>
 <td><input name="lname" id="lastname"></td>
</tr>
</table>
```

Confirming a site's accessibility

Unlike HTML and CSS validation, where syntax is either right or wrong, many aspects of accessibility are subjective and must in part be checked manually.

Bobby, http://bobby.watchfire.com/bobby

Bobby. Bobby was originally a project of the Center for Applied Special Technology (CAST); in 2002 it was acquired by Watchfire Software. Bobby has been available to check page accessibility since 1996.

The current version allows users to select either WCAG or Section 508 rules, enter a page's URL, and perform those checks that can be done automatically. Bobby then lists the manual checks necessary to ensure compliance with the chosen standard. Note that since the move from CAST to Watchfire, Bobby checks only Priority 3 compliance with WCAG.

Manual checks. Meeting the checkpoints in an accessibility standard provides reasonable assurance that a page will in fact be accessible to users with a wide variety of assistive hardware and software. Page authors often receive additional benefit from experiencing their site in a way that approximates, to an extent, how their site works with some types of assistive equipment.

Although buying copies of screen readers or speaking browsers for all authors can be prohibitively expensive, two free techniques can provide a good approximation.

- Use a graphical browser with images and scripting disabled and set the author's fonts and colors to "never to use." Most graphical browsers provide preference settings to disable these features; the Opera browser provides a toolbar button to switch between the author's and user's style settings.

Opera browser, www.opera.com

- Download and test with a text-only browser. Lynx is a text-only browser available for Windows, Linux, and most versions of Unix.

Lynx, http://lynx.browser.org