

# Working to 508: Web Page and Interface Design for Compliance with the Americans with Disabilities Act (ADA)

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*This scenario-based progression targets designers and developers who are interested in learning about assessment for web page design for compliance with the Americans with Disabilities Act (ADA). It introduces the topic by providing a background on web page design for individuals with special needs (varying physical and sensory abilities). Then, it presents basic concepts for developing accessible web pages, raises awareness of the need to comply with the ADA, Section 508, and provides resources for further investigation. Emphasis will be given to interactive discussion that centers on assessment questions to consider for concurrent, accessible and user-centered design approaches for web pages.*

## USABLE, ACCESSIBLE WEB PAGES AND INTERFACES

Working to 508: “Do the web pages that you view pass the test (<http://www.cast.org>)?” “How well do those pages achieve ‘every-citizen’ user interface design requirements (<http://stills.nap.edu/readingroom/books/screen/11.html>)?” A recent survey by the Royal National Institute for the Blind (RNIB) (2001) tested websites for 17 stores and banks for accessibility compliance for low vision users. None of the companies achieved a 100% acceptance rate on five key criteria.

In *More Than Screen Deep*, Gregg Vanderheiden suggests that software influences the design of an interface more than hardware; therefore, making screen displays more accessible to individuals with varying physical and sensory abilities. Rosenfeld, Olsen, and Rudnicky (2001) provide information on how future universal speech interfaces should be designed and predict that speech may provide many interactive possibilities that will surpass graphical user interfaces. They also note that while such designs require high effort in development, they will be easier for people to use.

## CHALLENGES FOR DESIGN OF WEB PAGES FOR INDIVIDUALS WITH VARYING PHYSICAL AND SENSORY ABILITIES

Electronic displays of information pervade everyday life. The most obvious examples of such displays are, of course, personal computer monitors; however, electronic displays are found in countless other applications as well. Some common examples are airport information monitors, traffic warning and control boards, interactive self-service financial transaction terminals, appliance controls, and automobile dashboard gauges and controls. Ideally, the ubiquitous presence of electronic displays means that they must be usable by the widest audience possible.

To understand user needs, web developers will want to know who the audience is for their website (Flanders & Willis, 1998; Nielsen, 2000). Five filter questions are helpful in understanding what you know about the audience: (1) “Who is your audience?” (2) “How well does the site meet the needs of your audience?” (3) “Do web surfers get what they come for when they visit your site?” (4) “What do users think of your site once they get there?” (5) “How does your audience act once they get to your site?” (<http://inq.philly.com>). (For additional information on audience analysis for web page design, see Reece (2001)).

This paper provides design principles for two key audiences: special needs (individuals with varying physical and sensory abilities) and international end-users. *Special Needs Surfers* tend to use a variety of assistive technologies based upon their needs (Burgstahler, 1999; <http://www.humanware.com>; <http://www.sun.com>). *International Surfers* may be near or distant in location and may appreciate language translation support for text and color on key web pages. They may have difficulty with jargon, technical terms, and slang words.

“The most serious accessibility problems, given the current state of the web, relate to blind users and other users with visual disabilities because most web pages are highly visual” (Nielsen, 2000, p. 302). As a result, this visual delivery medium may encourage one to design around graphical objects that are not properly explained for non-graphical modes of communication (Sullivan, 1996–1997). Developers may need to make compromises in their web page designs to accomplish

multimodal delivery for special needs audiences (Reece, 1992; Reece, 1993–1994; Reece & Scheiber, 1993).

Seven basic principles of universal design may be helpful to designers in creating accessible web pages: (1) “equitable use,” (2) “flexibility in use,” (3) “simple and intuitive use,” (4) “perceptible information,” (5) “tolerance for error,” (6) “low physical effort,” and (7) “size and space for approach and use” (Connell, Jones, Mace, Mueller, Mullick, Ostroff, Sanford, Steinfeld, and Vanderheiden, 1995) [http://www.design.ncsu.edu:8120/cud/univ\\_design/princ\\_overview.htm](http://www.design.ncsu.edu:8120/cud/univ_design/princ_overview.htm)).

Computer technology makes it possible for people with varying physical and sensory abilities to use information when web pages are written in **valid** hypertext mark-up language (HTML) (Royal National Institute for the Blind, 1995–2001). To accommodate these end-users, it is essential that text alternatives be provided for every non-text element on a web page (Royal National Institute for the Blind, 1995–2001). It is user needs that vary depending on variations in physical and sensory abilities.

This paper identifies 14 categories for assistive technologies that may be used by special needs audiences. Some of these technologies include: (1) **Color Setting Adjustments**, (2) **Computer Monitors** (screen size, (Fine & Peli, 1996)) (3) **Contrast Control** (computer monitor settings, Closed Circuit Television (CCTV) positive and negative settings, special filters (Lightstone, 1997)), (4) **Custom or Special Key Functions** (larger keys, extra spacing between keys, large print key top labels, StickyKeys, RepeatKeys, SlowKeys, MouseKeys, ToggleKeys, BounceKeys, keyboard guards, special switches, abbreviation, expansion (macros), (5) **Custom and Rehabilitative Technologies**, <http://www.arch.gatech.edu/crt/crthome.htm>, (6) **Flexible Browser Settings**, (7) **Input/Output Devices** (Input: special-purpose keyboards (Braille, left- or right-handed, mini, expanded, ergonomic), trackball, mouth stick, head stick, splinted hand; Output: voice output), (8) **Keyboard Emulation** (scanning, Morse code input), (9) **Magnification and Clarification Devices** (prescriptive (glasses, contact lenses, computer glasses, readers), non-prescriptive (readers), hand-held (magnifiers), stand-alone (CCTV), or application driven), (10) **Multiple Modes of Access** (calculator, computer, television, telephone, cell phone, fax, automatic teller machine, TDD business lines, portable desk accessory (PDA), wireless technologies) (11) **Resolution** (number of pixels, rows, and columns on screens), (12) **Special Media** (anti-glare screens, disk guides), (13) **Software** (cursor control, screen reading, speech recognition, optical character, e-mail, word prediction, web browsers, word processing, spreadsheets, data bases, project management, time

management, on-screen help), and (14) **Text Formatting** (ASCII text, familiar typeface, print at visual threshold, semi-bold emphasis, fonts in Roman posture, large print, easy-to-recognize numeric character set, contrast in foreground and background, HTML ALT parameter).

Application of these computer technologies to special needs and international audiences is given in Appendix A.

## EVERY CITIZEN INTERFACE DESIGN CONSIDERATIONS

“Is that a PDA in your pocket?” If you’re wearing the Dockers Mobile Pant (<http://www.dockers.com/mobilesitelet/flash/mobilePantFrame.html>), your answer might be “yes!” “How alt-modal are these information appliances for special needs audiences?” For people with varying physical and sensory abilities, it would be helpful if these electronic products had aural capability or mixed audio and visual forms as well as on-screen forms.

The National Academy of Sciences (1997) reports that “every-citizen” interfaces have “modality-independence (alt-modal)” and “flexibility/adaptability;” they allow users to choose between alternate sensory modes when using technology (National Academy of Sciences, 1997, p. 40). For example, when reduced vision readers view web pages, they may want to have the information stored so that it is not tied to a specific form of presentation or is device or “modality independent.” ASCII text is an example of “modality independent” because it can be presented on-screen and/or on-paper (visually), through a voice synthesizer (aurally), or through a dynamic Braille display or Braille printer (tactually). Alternately, reduced vision readers may want to receive their information in multiple modalities (“modality redundant”). In such cases, a movie clip may include a description of the audio track (e.g., caption) along with an audio and electronic text description of the video track so that all of the information could be presented visually, aurally, or tactually.

“Flexibility/adjustability” refers to “alternate selection techniques that can accommodate varying physical and sensory abilities” (National Academy of Sciences, 1997 p. 40). Vanderheiden suggests six modes that address flexibility/adjustability (Appendix B).

## WORKING TO 508 ... HOW TO GET STARTED

The Architectural and Transportation Barriers Compliance Board (Access Board) is responsible for formulating accessibility standards for electronic and information technology covered by section 508 of the Rehabilitation Act Amendments of 1998. Information on ADA-508 can be found at <http://www.508.org>.

## WORKING TO 508 ... HOW TO DESIGN ACCESSIBLE USER-CENTERED WEB PAGES

This section identifies effective accessible design principles for web pages. Principles are given in 30 categories in Table 1: audio, browsers, color, content and structure, filtering (lists, frames), fonts, forms, images, links, multimedia, navigation, network, PDF files, screen flicker, spacing (interletter, interword, leading, length of line, margins, paragraph style, spatial relationships), standards, style sheets, tables, text-only pages, testing and validation, timed responses, user interface (applets, DHTML, Java, JavaScript, plug-ins, programmatic objects, scrolling text, shockwave, web page downloads), user interaction, user preferences, video, web page downloads, and writing and style. The principles are adapted from current literature on accessible design and ADA-508 guidelines. ADA-508 principles are noted in the table.

**Table 1.** Principles for Accessible Web Pages

<b>Audio</b>	
508	Provide audio and text transcripts for video. Use closed captions or other text equivalents for audio or video.
<b>Browsers</b>	
	Build-in backward compatibility when writing HTML code.
	Plan for work-arounds when dealing with browser-related bugs.
	Test web pages to ensure that on-screen displays are accurate for each of the supported browsers.
	Track browser name, version number, operating system, and non-standard settings during the test phase.
	Apply interim solutions to accommodate end-user preferences for assistive technologies and older browsers.
<b>Color</b>	
508	Apply color so that web pages can be understood if users do not have the ability to identify or differentiate between

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- specific colors.
  - Maximize contrast between foreground and background elements.
  - Avoid using color when it is necessary for the end-user to make meaningful distinctions between items.
  - Avoid busy backgrounds that may interfere with reading.
  - Avoid loud textures, patterns, or images.
  - Use portable colors for backgrounds.
  - Contrast dark colors from the extremes on the color wheel with very light mid-scale colors.
  - Avoid contrasting light colors from extreme locations on the color wheel against dark mid-scale colors.
  - Avoid use of achromatic colors (white, grey, black) that are similar in brightness.
  - Avoid contrasting low chromatic colors with those that are similar in brightness.
  - Avoid contrasting hues from adjacent parts of the color wheel, especially if the colors do not contrast sharply.

### Content and Architecture

- Minimize the need for users to remember material as they navigate screens.
- Use simple, direct, concrete language.
- Provide orientation information regarding site structure and content.
- Use a consistent layout.
- Use a consistent presentation style across web pages.

### Filtering (Lists, Frames)

- Use ALT string to identify filter images such as bullets in lists.
- 508 Provide meaningful NOFRAMES content plus appropriate links to other pages on the site.
- Omit frames whenever possible.
- Avoid IFRAME until the technology becomes portable.
- Use browser-compatible specifications when creating frame borders.

### Fonts

- (See also, "User Preferences.")
  - Apply user-defined dynamic fonts.
  - Use standard outline fonts.
  - Maintain flexibility in changing fonts via browser.
  - Use Roman posture.
  - Avoid italics.
  - Use semi-bold or bold.
  - Minimize use of underscore to prevent confusion with linked material.
  - Avoid uppercase.
  - Use fonts with familiar, easy-to-recognize
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characters.

### Forms

- 508 Create forms that allow people using assistive technology to access the information, field elements, and functions required to complete and submit the form.
- 508 Provide instructions for use.
- 508 Provide cues for use.
- 508 Provide links to alternate, accessible forms, (e-mail, voice mail, TTY, etc.) for forms for those that are inaccessible by people with varying physical and sensory abilities.
- Avoid using image map “submit” buttons.
- Use text labels for all controls.
- Group and label related controls.
- Group and label menu controls.
- Consider using alternate page links with additional contact information.

### Hardware and Software

- Identify all of the platforms for web page delivery during the discover phase of the project.
- Check screen resolution settings and quality of on-screen display of web page.
- Plan for non-optimal situations with hardware and software in web page designs.
- Plan for future trends and design changes as the site develops.
- Plan for platform differences (desktop computers, Palm OS, WebTV, wireless technologies, etc.)
- Use compromise when designing for multimodal (print and on-screen) delivery.

### Images

- 508 Use ALT, longdesc, or in element content for images, multimedia objects, logos, photos, artwork, Java applets, or other types of web page content that cannot be reduced to ASCII text.
- 508 Use client-side image maps instead of server-side image maps except when it is necessary to define regions that do not have an available geometric shape.
- 508 Use redundant text links for each active region of a server-side image map.
- Use the alternative text attribute (ALT text) of the image to provide a textual description of the image for people accessing the page in a non-graphical method (e.g., text only, speech, or Braille).
- 508 Use ALT text labels for image maps.
- Use links for lengthy text descriptions of

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Use ALT parameter to describe invisible graphics or language preferences.

- 508 Use descriptions of links when using a client-side image map.
- Use the alternative text attribute (ALT text) of the image tag to provide a textual description of the image for people accessing the page in a non-graphical method (e.g., text only, speech, or Braille).
- Use ALT text labels for image maps.
- Use links for lengthy text descriptions of graphics.
- Use ALT parameter to describe invisible graphics or language preferences.
- Use descriptions of links when using a client-side image map.
- List links as text when confined to use of server-side image maps.
- Use empty string annotations for decorative graphics.
- Use a nonscript alternative when using scripts.
- Provide alternative text when using applets.
- Provide semantic titles to horizontal rules.
- Use easy-to-recognize graphics.
- Avoid using small graphics as buttons.

### International

- Use metrics when this unit of measure is clear to the target audience.
- Provide metric equivalents whenever possible.
- Provide or link to a table of conversions whenever possible.
- Specify relevant measuring systems when a unit may be ambiguous.
- Provide currency units and country indicators in pricing information.
- Provide links to current exchange rates as needed.
- Avoid use of religious and political symbols.
- Avoid using color as a symbol. (See also, principles for “Color.”)
- Avoid using facial expressions or hand signs as icons.
- Clarify dates by spelling out month and using a four-digit designation for year.
- Avoid using time indicators whenever possible.
- Express time using a description that is offset from the current time (e.g., “The newscast will begin in 4 hours and 30 minutes.”)
- Specify a target audience for web pages when the message is aimed at a local market.
- Provide contact information (includes

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	country code) suitable for a global audience.
	Use a common international language.
	Use simple, direct text.
	Avoid idioms.
	Avoid slang.
	Avoid metaphors.
	Apply multiple languages when essential.
	Avoid using national flags to identify language support for the site.
	State the names of each language supported in its native tongue: English, Espanol, Francias, etc.
	<b>Links</b>
508	Provide a method that allows users to skip repetitive links.
	Provide text versions of the links associated with image maps.
	Write link names so that they are self-explanatory.
	Avoid presenting links directly next to each other.
	Provide text-based links for graphics of text as links to facilitate browser changes for font size accommodations.
	Verify that the links that readers need on a page are visible without scrolling.
	Use concise link names.
	Use substantive, descriptive words that convey information about the link.
	Accommodate screen readers by delimiting list of links.
	<b>Multimedia</b>
508	Use text captioning for audible output.
508	Use audio descriptions for important visual information.
	Use text equivalents for multimedia elements.
	<b>Navigation</b>
	Provide a clear method of navigation (orientation, information, navigation bars, site map, etc.) for users.
	<b>Network</b>
	Optimize and test your site to accommodate minimal network capabilities of end-users.
	<b>PDF Files</b>
	Provide HTML or plain text versions.
	Make charts or graphs in the PDF file accessible.
	Provide URL for "Access Adobe" at the Adobe website.
	<b>Screen Flicker</b>

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508	Design web pages so that they avoid screen flicker with frequencies greater than 2 Hz. And lower than 55 Hz.
508	Avoid using applets that cause screen flicker frequencies greater than 2 Hz. and lower than 55 Hz.
	Avoid using content requiring plug-ins that cause screen flicker with frequencies greater than 2 Hz. and lower than 55 Hz.
	<b>Spacing (Interletter, Interword, Leading, Margins and Length of Line, Spatial Relationships)</b>
	Avoid close interletter spacing for people with central visual field defects.
	Use a wider spacing (e.g., monospaced fonts) than is provided in proportional fonts.
	Use a wider spacing (e.g., monospaced fonts) than is provided in proportional fonts.
	Use leading that is 25–30% of the point size.
	Add spacing between paragraphs.
	Apply more space between paragraphs than between lines.
	Avoid placing important material on extreme right or left areas of the screen for people with total peripheral vision loss.
	Avoid using spatial relationships to clarify text (e.g., "the button on the right" or "the paragraph below.")
	Use generous spacing around small buttons whenever necessary to use them.
	Allow extra-wide binding margin for web materials intended for print.
	Permit 50–65 characters per line.
	Avoid leading reader's eye off screen prematurely.
	Use generous space between columns.
	<b>Standards</b>
	Apply standards: W3C technologies, ADA-508, etc.
	Apply standards when designing for different screen resolutions
	<b>Style Sheets</b>
508	Organize documents so that they are readable without associated style sheets.
	<b>Tables</b>
508	Label table rows and columns.
508	Use mark-up to associate data cells and heading cells for tables that have two or more logical levels of row and column headings.
	Summarize or repeat complex tabular information in alternative, non-tabular

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	format.
	Check that the tabular information is coherent when columns are removed.
	Summarize or repeat complex tabular information in alternative, non-tabular format.
	Check that the tabular information is coherent when columns are removed.
	Create tables that transform gracefully to accessible browsers and other related technologies.
	Use tables for tabular information.
	<b>Text-only Pages</b>
508	Use text-only pages when it is necessary to make a web page comply with accessibility and 508 guidelines.
508	Update the content of text-only web pages when content of the associated primary pages change.
	<b>Testing and Validation</b>
	Use automatic accessibility and browser testing and validation tools
	Use direct observation.
	Check for clarity of language.
	Test for ease of navigation.
	Validate syntax (HTML, XML, etc.).
	Validate style sheets.
	Use a text-only browser or an emulator.
	Use a variety of graphics browsers and test for sounds and graphics loaded, no mouse, frames, scripts, stylesheets, and applets unloaded.
	Test with self-voicing browsers, screen readers, magnification software, small displays, etc.
	Test with end-users.
	Check spelling and grammar.
	Review content for clarity, accuracy, and simplicity.
	Obtain evaluation comments from a variety of reviewers (subject-matter experts, expert and novice end-users with special needs, international audiences, etc.)
	Test web pages on all hardware and software platforms during each evaluation phase.
	Ensure that web pages are accurate when newer technologies are not supported or turned off.
	Ensure that external links to web pages are valid.
	<b>Timed Responses</b>
508	Alert users that a timed response is being required.
508	Allow users sufficient time to complete timed responses.
508	Provide a mechanism for allowing users to

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	<b>User Interface: DHTML, Shockwave, Scrolling Text, Java, JavaScript, Plug-ins, etc.</b>
508	Identify information provided by scripts with functional text that can be read by assistive technologies.
508	Use plain links to enable users to access subsequent pages of your site.
	Provide plain text HTML alternatives for material presented in formats other than plain HTML.
	Ensure that meaningful content is available for Flash movies to users who cannot access Flash.
	Use plain links to enable users to access subsequent pages of your site.
	Ensure that JavaScript pages function correctly without scripts or provide parallel pages that do not use JavaScript.
	Offer Flash and non-Flash versions of pages to ensure that users have control over how information is presented.
	Avoid moving, blinking, and auto-refreshing text.
	Avoid using “rollovers” and non-standard pop-up menus.
	Design for device independence.
	<b>User Interaction</b>
	Use auditory rather than visual browsers.
	Avoid requiring users to click on small or moving targets to proceed to another page.
	Check that the TAB order uses a coherent sequence for the content.
	Use TABINDEX attribute for cases where the tab sequence needs revising for coherence.
	Avoid requiring users to type whenever possible.
	Avoid requiring users to make frequent transitions between clicking and typing.
	<b>User Preferences</b>
	Allow end-user control over preference settings for fonts, link colors, image loading, plug-ins, enabled features (Java, JavaScript, cookies, security features, speed, or other preferences) (See also, principles for “Fonts.”)
	<b>Video</b>
	Provide audio and text transcripts for video.
	<b>Web Page Downloads</b>
	Allow a maximum of 20 seconds for download of web pages using a medium

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speed internet connection.

### Writing and Style

Use and easy-to-understand language.

Indent first line of paragraph.

Use hanging-indent style for paragraphs.

Provide detail by linking to additional information.

Use brevity.

Use a clear focus.

Use simple, concise words.

Apply a grade school reading level.

Write headings that facilitate skimming and scanning reading styles.

Use quotes, questions, statements or surprise, news blurbs to gain audience attention.

Use accurate grammar, spelling, and punctuation.

Avoid jargon.

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*Sources:* Adapted from textual material in Alschuler, 1998; Arditi, 1994; Brink, Gergle, & Wood (2002); Chisholm et al. (2001); Flanders & Willis, 1998; Fontaine, 1995; Kilian, 1999–2001; Fontaine, 1995; Lay et al., 2000; Lynch & Horton, 1999; Miller, 1956; Nielsen, 2000; The Lighthouse, 1995; Text Matters, 2001; Reece, 1993–1994; Reece, 2001; Reece, 2002; Royal National Institute for the Blind, 1995–2002; Sullivan & Manning (1996–1998); Usable Web., 1999–2002.

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## APPENDIX A

**Table A-1.** Assistive Technologies and Matches with Special Needs and International End-users

Assistive Computer Technology	Vision	Speech	Hearing	Cognitive	Learning	Mobility	International
Color Setting Adjustments	■						
Computer Monitors	■						
Contrast Control	■						
Custom or Special Key Functions	■						
Custom and Rehabilitative Technologies	■	■	■	■	■	■	
Flexible Browser Settings	■	■	■	■	■	■	■
Input/Output Devices	■	■	■	■	■	■	■
Keyboard Emulation	■						■
Magnification and Clarification Devices	■						
Multiple Modes of Access	■	■	■	■	■	■	■
Resolution	■		■		■		
Special Media	■						
Software	■	■	■	■	■	■	■
Text Formatting	■	■	■	■	■	■	■

## APPENDIX B

**Table B-1.** Application of Flexibility/Adjustability Characteristics to Varying Physical and Sensory Abilities and International Considerations of End-users

Mode	Definition	Recommended Application to Varying Physical and Sensory Abilities of End-users						
		Vision	Speech	Hearing	Cognitive	Learning	Mobility	International
Standard	Uses multiple senses and fine motor control							■
List	Calls up list of information and uses list feature to select items	■						■
External List	Makes lists available through software or hardware ports	■		■				
Select and Confirm	Provides information without activation (confirm	■			■	■	■	■

Mode	Definition (action required after selection)	Recommended Application to Varying Physical and Sensory Abilities of End-users						
Auto-step Scanning	Presents information in groups or sequentially for selection	■					■	
Direct Text Control	Uses keyboard or speech input	■	■	■	■	■	■	■

Source: Adapted from textual description in (National Academy of Sciences, 1997).

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