

Barriers to Access: A User Oriented Perspective to Web Programming

by

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Abstract

Designing for visitors with impairments also improves the level of access achieved by any visitors of the website. The urge to make the design more appealing for fully able users must not infringe on the ability for less able users to access the information or distract from the content of the page. Keeping different demographics of visitor in mind will allow the programmer to meet the goal of universal access. The United States government and the World Wide Web Consortium have published standards of compliance for making websites friendlier to visitors. Access to information is a concern on social, technical, and legal grounds as it is considered a legal right to have access to telecommunications services, which includes the Internet. The development of regulations concerning web documents in the future need to continue to receive accessibility attention in order for the use of the World Wide Web as an efficient and inclusive paradigm for transmitting information to continue to benefit all types of users and user environments. By improving the way users access and interact with internet content, we can improve workplace productivity and better include average users in modern life.

Table of Contents

[Acknowledgments](#)

ii

<u>Abstract</u>	iii
<u>Table of Contents</u>	iv
<u>Chapter I. Introduction</u>	1
<u>Chapter II. Guidelines for Determining Accessibility</u>	5
<u>Governance</u>	
5	
<u>World Wide Web Consortium</u>	
5	
<u>Web Accessibility Initiative</u>	6
<u>Federal Standards</u>	7
<u>Differences between Section 508 and WAI</u>	8
<u>Chapter III. History of Disability Standards and Legislation</u>	11
<u>Early Legislation</u>	
11	
<u>Recent Legislation</u>	
12	
<u>Critical Definitions</u>	13
<u>WAI History and Media Coverage</u>	14
<u>Chapter IV. Explanation OF SECTION 508 Guidelines</u>	18
<u>Introduction</u>	18
<u>Text Equivalents</u>	
18	
<u>Style Considerations</u>	
21	
<u>Image Maps</u>	22
<u>Data Tables</u>	
24	
<u>Page Structure</u>	25
<u>Timed Responses</u>	
31	
<u>Missing WCAG checkpoints in Section 508</u>	
32	
<u>Chapter V. Barriers to Access</u>	35
<u>Age-related problems</u>	35
<u>Temporary Impairments</u>	
38	
<u>Language</u>	38
<u>Screen Size</u>	39
<u>Web Browser</u>	
39	
<u>Chapter VI. Federal Website Accessibility History</u>	44

Public Internet History	44
Website Audits	45
whitehouse.gov	
45	
dol.gov	
48	
usdoj.gov	50
ssa.gov	53
medicare.gov	55
disabilityinfo.gov	
56	
Chapter VII. Conclusions	60
Chapter VIII. Works Cited	1

I

Introduction

In the race toward digitization in many facets of society, more and more documents, news articles, and forms are being published as, or can only be found as, internet (or intranet) documents. This in itself is not a problem; in fact, it makes retrieving information faster and easier for many people. However, there is a segment of the population which may be restricted from accessing this repository of information. Users with sensory, motor, or mental disabilities can have a range of difficulties which may hinder use of a particular site or render the site completely un-navigable. Also, considerations need to be made for the impairment of senses or movement due to aging

or injury. Designing for visitors with impairments also improves the level of access achieved by any visitors of the website. By law, documents published by the United States (U.S.) Government must be made available to everyone, regardless of personal facilities or computing hardware. Designing with different demographics of visitor in mind will allow the programmer to meet that goal of universal access.

Web publishing as a means of dispersing information quickly and efficiently is gaining popularity both on the public internet and on corporate intranets. The increasing pervasion of concepts such as ‘Paperless Office’^[1] and ‘Document Workspace’^[2] emphasizes the dominance of digital documents in the workplace. The most common interfaces for sharing files in general are a form of browser-based content management systems. Investigating how documents are accessed and how user interfaces can be made more accessible will increase the productivity of all involved.

The urge to make the design more appealing for fully able users must not infringe on the ability for less able users to access the information or distract from the content of the page. The best example of an openly accessible repository for information was the early foundations of the public internet or World Wide Web (WWW). In the early days of the WWW, the pages were text-only or had few pictures, none of which were relevant to understanding or navigating the content. People with impaired vision could use screen readers to hear content from the pages. Impaired motor skills were not an issue since tabbing through text and links with a keyboard was a simple matter. This founding vision was completely semantic, with little in the way of presentation. It was designed for scientists to pass research notes across the world to colleagues in an instant. Recently, modern multimedia presentation has drawn the WWW away from free and equal access

to all people in the name of keeping the attention of the general public. Some text is hidden behind graphical interfaces or java menus; complex layout designs using tables utterly confuse screen readers or busy visitors who need to spot the information they want quickly. Some of the most fancy or media rich websites are unreachable to people without keen eyesight and prowess with the computer mouse. Sometimes the increased prominence of style over substance can frustrate even the most capable of users as they try in vain to access the information they seek. Increasingly, we turn to the web as one of our most readily available research sources or as a dynamic way to pass information among office workers. Some points of reference have been set in order to determine what makes a page accessible and what is required to provide accessibility to certain barriers both physical and environmental. These benchmarks also aim to improve the comfort of individuals who are not impaired. Two such benchmarks are provided by parts of Section 508 of the federal Rehabilitation Act (Section 508) and the Web Content Accessibility Guidelines (WCAG).

In 1998, the U.S. Congress enacted Section 508 of the Rehabilitation Act which states that all federal agencies must develop, procure, maintain, or use electronic and information technology in such a way as to provide disabled employees and members of the public access to information that is comparable to the access available to others. This law only affects U.S. government agencies and is designed for that specific community. The benchmark set by Section 508 is to meet sixteen requirements concerning website design and code. This is the minimum which must be implemented so that the greatest percentage of users can access the website with only modest difficulty. Many government agencies can retrofit their websites with relative ease and continuing to

produce Section 508 compliant pages requires only a slight increase in the strictness of code. ^[3]

For websites in general, there is another accessibility guide. The primary organization that develops and recommends internet standards, the World Wide Web Consortium (W3C), started the WCAG as one of three pillars of its Web Accessibility Initiative (WAI). The WCAG's stated goal is to develop standards of compliance for differing levels of accessibility and work out standard methodologies such as aural style sheets (a way for the author to control how a page is audibly conveyed) to provide ways to improve accessibility. In the WCAG specification, there are several checkpoints which address a specific disability issue. Each checkpoint is given a priority rating. Priority One checkpoints eliminate severe barriers to access which otherwise prevent some groups of people to view a site. Priority Two checkpoints address barriers that can affect any visitor to different degrees and improves the access provided to those helped by Priority One guidelines. Priority Three checkpoints attempt to ease the usability of a website for all visitors. A website is given a conformance level from A – AAA based on the number and type of priorities addressed. ^[4]

Access to information is a concern on social, technical, and legal grounds. Socially, improved internet technologies allow greater numbers of people the chance to improve their knowledge or contribute to the workforce regardless of potential disability. On a technical level, many of the guidelines for improving accessibility have the side effect of unifying the design of a website, reducing bandwidth needs, and being more adaptable to the latest browser and language technologies. Of increasing importance is the legal factor; as some governments are beginning to require rudimentary accessibility

requirements.^[5] As the web is developing and new technologies for displaying information evolve, there needs to be a look at how information is being accessed and how that access could be improved in order to increase productivity and efficiency at work and at home. As barriers to access on the internet are removed for those with special circumstances, the positive effects will be felt by all users of the World Wide Web as the design and layout of websites become more efficient and usable.

I

Guidelines for Determining Accessibility

1

Governance

The public internet descended from the Cold War systems developed by the US. It initially only linked major universities and conveyed email. Then one of the researchers in Europe developed a system for creating static pages of text which could be freely accessed by any network user. This open system was allowed to expand without much restriction into a global community in the pursuit of free knowledge. There is officially no ruling body for the Internet.^[6] There have been attempts by the US to regulate content developed by US sources, but these laws have no bearing on content originated elsewhere. Likewise, the European Union (EU) and various Asian countries are left to self-regulate the contributions made from inside their borders. However, there is an advisory body which is charged with overseeing the continued development of standards and protocols which power the Internet. The development of regulations

concerning web documents in the future need to continue to receive accessibility attention in order for the use of web documents and web applications as efficient and inclusive paradigms for transmitting information to continue to benefit all types of users and user environments.

2

World Wide Web Consortium

The World Wide Web Consortium (W3C) is a collection of various agencies from multiple countries founded by the inventor of the World Wide Web (WWW), Tim Burners-Lee. The stated goal of the consortium is the interoperability of fundamental web technologies with each other and across hardware. Burners-Lee created the core structures of the WWW - the server, the client, and the document formatting language - while at the European Organization for Nuclear Research (CERN). He established the W3C in October 1994 at the Massachusetts Institute of Technology (MIT), Laboratory for Computer Science in association with CERN and support from the U.S. Defense Advanced Research Project Agency (DARPA), which created the infrastructure of what is now called the Internet, and the EU. Three main entities and fourteen smaller regional offices host the consortium on three continents: Europe (European Research Consortium for Informatics and Mathematics [ERCIM]), Asia (Keio University of Japan), and North America (MIT). Many organizations, both private and public, are members of the W3C and contribute to the design of web technologies which will become a standard for developers. The W3C has no legislative power, but its recommendations can influence corporate and governmental policy. The US and the EU model their accessibility policies based on the papers issued by the W3C. ^[7]

Web Accessibility Initiative

Because the ability of users to operate all functions of a website is a concern for websites worldwide, the W3C developed the Web Accessibility Initiative (WAI). WAI has three groupings of guidelines that address: the coding standards, the authoring software, and the browser itself.^[8] The Web Content Accessibility Guidelines (WCAG) set rules for the structure and appearance of websites to increase information flow and compatibility with assistive technologies. These guidelines do not create a new hypertext language, but rather explain how Hypertext Mark-up Language (HTML) elements and attributes can be used to code for accessibility.^[9] The Authoring Tool Accessibility Guidelines (ATAG) tells how website creation software or converters should code their pages to create websites that conform to WCAG.^[10] Finally, the User Agent Accessibility Guidelines (UAAG) set rules for how browser technology should interpret and display WCAG compliant code and what assistive features should be built into the interface of such software to benefit disabled users.^[11]

The WCAG specification has three priority levels for its many checkpoints. This allows developers to adequately triage their accessibility weaknesses and address the most critical problems first.^[12] Priority 1 checkpoints attend to basic requirements for some users to use the site at all, such as requiring every non-text element to have an embedded text equivalent. HTML addresses this with the use of the “alt” attribute of the Image tag. Priority 2 checkpoints remove common significant barriers to access and comprehension, therefore making the experience somewhat easier. An example would be using Cascading Style Sheets (CSS) or Math Markup Language (MathML) instead of images, which decreases the file size of the page and makes the page easier to scale up to

be read in low visibility. For instance, using links that jump to section headings in the content bypasses repetitive navigation menus and saves users of page readers from listening to the same links each time they visit a new page.

4

Federal Standards

Standard directives concerning accessibility requirements for specific aspects of any government website are stated in the 1998 amendments to Section 508 of the Rehabilitation Act of 1973; the listing of the directives is found in §1194.22 “Web-based intranet and internet information and applications”. This section applies to all content which appears in hypertext format published on internal or external web servers. These guidelines are in accordance with similar guides for software and workplace stated in Sections 504 and 508 of the Rehabilitation Act of 1973. Currently, this law is only intended for United States government agencies and as such only concerns possible content befitting an agency website. Other subsections of Section 508 deal with additional areas of information technology such as software and operating systems (§1194.21), telecommunications (§1194.23), multimedia (§1194.24), self-contained digital products (§1194.25), and computers (§1194.26). ^[13]

There are sixteen checkpoints in the Section 508 law that cover every possible accommodation to recognized disabilities while being an integrated part of the design for non-disabled users. The goal is to make online government information accessible by disabled users, while also making access easier for everyone. Some of the recommended adaptations are intended to blend smoothly into existing structures, usually just adding additional metadata to describe the content or function of web elements. Design considerations are mostly aesthetic and benefit everyone. These include color

considerations, organization of content, redundant links for server-side image maps, limitation or removal of flashing elements, and ability to skip to specific areas of content. Accessibility enhancements which are near invisible to the able user include text labels to describe images, links, and other non-text elements; transcripts of multimedia clips; client-side image maps; identifiers for table headers and associations between header and data cells; and assistive attributes for elements in forms. Finally, there are directives which are separate from or non-invasive to the able user's experience: text-only pages when required, frames given appropriate identifiers for their content, plug-ins or applets required to meet Section 508 guidelines for software, duplicate text of any information given by scripted content, and request for more time for timed responses. ^[14]

5

Differences between Section 508 and WAI

Remember that Section 508 is a United States federal law; it assumes that page language is in English, forms may be provided and filled out online, and the organization of content is set by the standards of each agency. Section 508 has a greater scope, but has general requirements for each area. The Section 508 guidelines include all but three of the WCAG Priority 1 checkpoints and two of the three involve differing assumptions concerning websites. For instance, Section 508 assumes all relevant documents are authored in English. The WCAG requires the language of the document be identified so text reader or translation software can better interpret the document. Because Section 508 is directed toward governmental documents, it is assumed the content is authored in clear wording with a specific audience in mind. The WCAG, being more public in intention, explicitly recommends the use of clear and simple language in web documents; this is much like the considerations in style that journalists use for newspaper or magazine

articles. The only WCAG Priority 1 checkpoint not addressed by the Section 508 guidelines is the audible readout of visual multimedia. For example, captions in a video must be audibly presented in synchronization with the text. Section 508 deems some things more important than WCAG and requires three additional conditions, which are covered by a Priority 3 checkpoint or unaddressed by WCAG. For instance, Section 508 checkpoints require that the user be able to skip repetitive links; this is a Priority 3 issue for the WCAG. Another Section 508 checkpoint requires that forms filled out online must be compatible with assistive technology. This is not addressed anywhere in the WCAG. Also unaddressed in WCAG is the Section 508 checkpoint requiring that timed inputs display a dialog asking if the user requires more time before the page expires.

So far, the United Nations has not taken jurisdiction over the Internet. Thus, the W3C is the only global body tasked with the ability to create standards as to how the web should operate. The recommendations and objectives passed by this institution form the core of many regional policies concerning the use of the internet, especially in the U.S. While the mandates of Section 508 are currently directed only toward U.S. Government entities, future expansions of policy could expand to other sectors such as education and commerce. The WCAG is intended for all websites and the idea of universal design is to make the internet and its applications easier to access and quicker to use for anyone in the world.

History of Disability Standards and Legislation

Early Legislation

The first major federal law dealing with disabilities was the Architectural Barriers Act of 1968. It required all buildings of workplace or public leisure to be reconstructed to provide access to people with disabilities. Section 504 of the federal Rehabilitation Act of 1973 was the first sweeping law defining civil rights for people with disabilities. However, it was not until the passage of section 505 of the same act in 1977, that there were any actual regulations to enforce. The Education for Handicapped Children Act of 1975 was enacted to force schools to accept children with special needs. The act has since been renamed the Individuals with Disabilities Education Act. The Americans with Disabilities Act of 1990 (ADA) was one of the most sweeping series of regulations on this issue. It granted, for the first time, the treatment of full and complete citizenship and all the rights thereof to disabled Americans. In the statement of purpose for the legislation, Congress states the need “to invoke the sweep of congressional authority, including the power to enforce the fourteenth amendment^[15] and to regulate commerce, in order to address the major areas of discrimination faced day-to-day by people with disabilities.”^[16] It was also the first to touch on making aspects of daily living available to all Americans.^[17] It is under this law that curb cuts were made, at least one car per train be made wheelchair accessible, disabled Americans are given equal access to employment, and that telecommunications devices for the deaf (TDD) and closed-captioning must be provided. In addition, no previously established regulations concerning disabilities were infringed. Religious organizations, transvestites, and current illegal drug users are the sole exemptions to any portion of this act.^[18] Many of the

provisions provided here first were expanded upon and strengthened in later Acts. The general public also received fringe benefits from the ADA. Baby Strollers, shopping carts, and bicycles make use of wheelchair curb cuts. Closed captioning helps viewers “hear” a television program in a noisy house or public place.

2

Recent Legislation

The Telecommunications Act of 1996 was the first disability legislation strictly concerning telecommunications. A few regulations in this Act were originally regulated in the ADA, and were updated to address developing advances in technology. Five sections of this Act dealt directly with services for the disabled. Sections 225, 255, and 713 mandated different methods of adaptation for hearing and speech impairments. Sections 251 and 256 state respectively that future service must not remove or impair telecommunications access and future services must provide for access by people with disabilities. ^[19] This legislation expanded telecommunications services^[20] to guarantee access in schools, classrooms, health care facilities, and libraries for public benefit.

In 1998, President William J. Clinton signed into law amendments to Section 508 of the federal Rehabilitation Act of 1973. These amendments were part of a larger workplace package, the Workforce Investment Act of 1998. The stated intent of these amendments is thus:

When federal agencies develop, procure, maintain, or use electronic and information technology, they shall ensure that the electronic and information technology allows federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by federal employees who are not individuals with disabilities, unless an undue burden would be imposed on the agency.

In addition to in-house information retrieval, the amendments also state that publicly accessible information must follow the same accessibility requirements as set in this section. The policies outlined in the amended Section 508 went into effect on February 20, 2001, with enforcement starting on June 21 of that year. ^[21]

3

Critical Definitions

The federal definition of disability differs slightly depending on how the term is being applied and is intentionally ambiguous to allow a claimant to be included under disability laws according to the judgment of the agency. In terms of the Americans with Disabilities Act of 1990 (ADA), a disabled person is defined as “a physical or mental impairment that substantially limits one or more of the major life activities of such individual, a record of such an impairment, or being regarded as having such impairment”. ^[22] For employment concerns, a qualified applicant with disability, as classified by the ADA, is “an individual with a disability who, with or without reasonable accommodation, can perform the essential functions of the employment position that such individual holds or desires”. ^[23] For social security benefits, a claimant must suffer from severe impairment(s) that lasted or is expected to last more than a year, thus preventing gainful levels of activity. ^[24]

The United States Government considers software accessible if a required feature can be observed or activated by only a single ability or sense. However, lenience is shown to base programs that are compatible with add-on software that makes the base program accessible. Examples of non-accessible software would be a program that has audio prompts with no accompanying text. This same program would be potentially

accessible if a separate piece of software worked with that program to display the needed text.

A few definitions are important to Section 508 regulations. Subpart 1194.4 lists these definitions, which include the following:

Assistive Technology – “Any item, piece of equipment, or system, whether acquired commercially, modified, or customized, that is commonly used to increase, maintain, or improve functional capabilities of individuals with disabilities.”

Alternate Formats – “Alternate formats usable by people with disabilities may include, but are not limited to, Braille, ASCII text, large print, recorded audio, and electronic formats that comply with this part.”

Undue Burden – “A significant difficulty or expense.”

All three of these terms are significant in discussing the purpose and usage of technology related disability regulations and guidelines.^[25]

In addition to the above definitions, this thesis looks at disability as a temporary or permanent loss of one or more faculties which hinders the person’s ability to reach information on the WWW that can be aided by the use of assistive technology and alternate formats.

4

WAI History and Media Coverage

The W3C announced the development of a proposal to extend the reach of the World Wide Web to people with disabilities. The Web Accessibility Initiative was publicly announced April 7, 1997 with the blessings of the White House and W3C Member organizations. Its primary focus was to improve the protocols and data

structures that drive the web. Tim Berners-Lee, Director of the W3C and inventor of the WWW, proclaimed at the launch ceremonies:

“Worldwide, there are more than 750 million people with disabilities. As we move towards a highly connected world, it is critical that the Web be usable by anyone, regardless of individual capabilities and disabilities. The W3C is committed to removing accessibility barriers for all people with disabilities - including the deaf, blind, physically challenged, and cognitive or visually impaired. We plan to work aggressively with government, industry, and community leaders to establish and attain Web accessibility goals.”^[26]

With this venture, the W3C became the international point of contact for the advancement of accessibility goals and disability advocacy towards content providers.

Business Wire was among the first to realize the significance of the announcement by the W3C of their commitment to website functionality across mediums and abilities. The endorsement and funding by U.S. and other governments as well as member commercial and non-profit agencies give this endeavor a wide reach and deep pockets for research, promotion, and education. They also noted the creation of an International Program Office (IPO) to oversee the development and execution of the accessibility goals envisioned in the WAI. The WAI will also hold standards issued by the W3C, such as HTML and XML, to meet accessibility goals.^[27] *Business Wire* broke the news on the establishment of the IPO in October 1997, again remarking on the list of major organizations involved in the project. Some initial members included IBM/Lotus Development Corporation, Microsoft Corporation, Apple Computer, Inc., IEEE Computer Society, Netscape Communications, and various universities worldwide.^[28] It is the hope of many of these institutions that developments here will translate to easier and more productive ways to transmit information regardless of methods of access used.

These technologies will also benefit an aging population as more things are moved to electronic media and the need to easily read a document online becomes more of a requirement in order to stay informed.

In 1998 before formal standards of accessibility were published, the municipality of San Jose, CA garnered acclaim for being among the first cities to launch an accessibly designed website before published standards for doing so were written. This was in response to feelings of empathy with blind citizens who were being excluded from this progressive, new information exchange.^[29] Developing universally accessible websites and web applications is gradually becoming more of a practical design consideration for all users. The San Jose website still develops its layouts to be freely accessible and easy to use for its citizens, unless they use a PDA.^[30] The pages are also Google has also made strides to open the internet to more people. Google Accessible Search, under development in Google labs (labs.google.com), produces results that would be of greater benefit to users requiring assistive technologies. It is also helpful for users with smaller monitors or handheld computers.^[31] PDA users can also use Google Mobile Search^[32] but the results returned may not be viewable in the PDA's browser.

The WAI authored the first Working Draft, WAI Accessibility Guidelines: Page Authoring, on February 03, 1998. This specification was renamed WCAG 1.0 before its official release. The Working Draft called for complete implementations of HTML 4.0 and CSS2 in major browsers.^[33] The WCAG 1.0 guidelines became an official W3C Recommendation May 5, 1999. This final status designated the document as closed and endorsed by the international community. The provisions balanced developing web technology support with graceful degradation for legacy browsers and provide a

reference by which all accessibility policies should be checked.^[34] An effort to improve the wording and application of the guidelines was started in April 2003 with the release of the WCAG 2.0 Working Draft. As of October 2006, these updates are in the “Last Call” phase of development and the WCAG Working Group hopes that work on the comments gathered will be complete in early 2007. The revised specification should be finalized in late 2007 and will emphasize techniques for implementing each guideline in general cases and in platform-specific cases.^[35]

III

Explanation OF SECTION 508 Guidelines^[36]

1

Introduction

The Architectural and Transportation Barriers Compliance Board (Access Board) released the final standards of compliance with Section 508 of the Rehabilitation Act Amendments of 1998, in the *Federal Register* with annotations, December 21, 2000. §1194.22 specifically targets Internet and Intranet pages and applications used by federal agencies. The section does not reference the W3C WCAG 1.0; instead, more enforceable language was chosen using guidance from W3C and a committee formed by the Access Board to review the proposed rules. Subsections (a)-(k) are similar in intent to guidelines found in Priority One of the WCAG. Subsections (l)-(p) have no counterpart in the WCAG. Four WCAG Priority One checkpoints were not included in this rule. Section

508 addresses a variety of features, including text equivalents, styles, images, tables, page structure, and timed responses.

The requirements in Section 508 are based on the US government's understanding of internet technologies and upcoming developments in 1998. Some of these still need better browser implementations that were expected. Others show how mandates intended for a minority population have a wider benefit as technologies progress and the accessibility paradigm becomes more mainstream.

2

Text Equivalents

(a) A text equivalent for every non-text element shall be provided

A non-text element is defined as any media presentation, be it graphic, audio clip, video clip, or other similar presentational media that convey information. These elements can be invisible to some browsers which cater to users with disabilities. As such, equivalent textual information must be provided. Text can be rendered in some way by any assistive technology, by either reading aurally or displaying on a Braille touchpad. Text can also have its size and color dynamically shifted for ease of reading. This provision in no way expects the designer to make text-only pages; only those pages that degrade well to text-only when necessary.

This rule uses the language and examples recommended by WCAG checkpoint 1.1. An additional attribute to the image tag, 'alt', provides alternative text for browsers that do not display images, have images disabled, or employ a speech synthesizer. The text provided with the 'alt' attribute should be chosen to adequately deliver the content of the image it replaces. For complex images such as charts and graphs, the 'longdesc' attribute provides a link to a longer description on a separate page. Alternative text

descriptors should be unique, because repetitive descriptors convey no useful information and aggravate the user. In addition, decorative graphics should have empty 'alt' attributes. This will make the browser skip over them entirely, rather than filling the page with word clutter. Also, transcripts of audio/video presentations allow the viewer to follow along with the speaker, or access content they may otherwise be denied. ^[37]

Proper implementation of alternate methods allows the programmer to distinguish in code between a caption for the content and a summary of the content and its caption. When defining a style for printing, it may be beneficial to disable images and print the text-equivalent to save on paper and ink. Also, those users with limited bandwidth connections such as dial-up or mobile wireless still may use the web in text-only mode.

(b) Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation

When multimedia presentations are captioned, the captions must display in coordination with the audiovisual content being described. Any user viewing the captioned presentation must be able to associate the text with what is currently being displayed on screen. To comply, the webmaster must use caption capable streams, which are available from many vendors such as Real Networks and Microsoft. In this case the video is assumed to be visible to the user but the audio part is unavailable due to hearing deficiency or lack of speakers.

§1194.21(b) follows checkpoint 1.4 of WCAG. ^[38] Until web browsers have the ability to extract audible subtitles imbedded in video, an external text scroller must be available in sync with the subtitles. This guideline is to allow audio content to be reference able and to allow visitors with hearing impairments to follow along using a

separate transcript or by reading synchronized captions. Imbedded captioning is not sufficient unless an external transcript is provided until browsers can extract the content of imbedded captions. ^[39]

In the annotations for this subsection, there is concern over the captioning of live broadcasts. Technology for real-time captioning by Real Networks is mentioned in the response. Posting a transcript after the fact is technically allowed under the rule, but the delay is undesirable. ^[40] The nonprofit group Web Accessibility in Mind (WebAIM) has a page which addresses the captioning problem and lists solutions such as stenographers and better speech-to-text software. ^[41]

3

Style Considerations

(c) Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup

Color can only be used to enhance the visual experience for able users, not convey any information in and of itself. In addition, foreground and background colors lacking sufficient contrast will not be distinguishable on monochrome displays. While oriented towards users with color-vision impairments, this provision creates pages that put less strain on able users as well.

Basic compliance dictates not directing the user to “press the green button to continue”, without providing some way to know that this button is the green button. If the author decides to make emphasized words in a text red, the word should also be surrounded in *tags, which tell the browser that this word is emphasized. The colors red and green are of special concern because these are the affected hues in the most common forms of color blindness. An additional compliance measure would be to allow the user*

to change the style sheet to a less colorful or a higher contrast version. The easiest way to check page compliance for this section is to view the page on a monochrome format.

In the comments to §1194.22 (c) as initially proposed, the WAI requested that the use of markup over color for be explicitly stated. The clause “for example from context or markup” was added to the final rule.^[42] This appeal to markup also helps with the next paragraph concerning style as it allows the meaning of a section or word to be independent of its display.

(d) Documents shall be organized so they are readable without requiring an associated style sheet

Because use of CSS2 styles can alter drastically the presentation of content from what would be rendered by markup alone, the non-styled layout must still be presented in a logical order. Additionally, when styles are used to make text show against a background, the background should disappear when CSS is disabled or not supported, or else the text will become invisible. Finally, do not use CSS as a substitute for contextual markup. Use heading and emphasis tags when you make a heading or emphasized word. Then use CSS to change the display of the heading or emphasis, with the document content intact. Besides, users can apply a custom tailored style sheet to all the pages they visit, overriding styles defined in the page. This is an option found in the browser settings that allow a user to override fonts and colors used on a website. Thus, webpages must transcend style changes gracefully. The WCAG concedes this to be a Priority Two guideline.^[43]

Use of style sheets is not prohibited as it is a great accessibility tool. Rather, the programmer should exercise caution in the use of CSS positioning and reliance on a

specific set of style rules as the users can override style rules to their benefit.^[44] When style sheets are unavailable, the page must still retain a logical layout and appropriate contrast maintained. The use of CSS can be one of the best tools in a programmer's toolbox. It allows content to be kept separate from presentation and allows the ability to provide different "skins" for a site to personalize the visitor's experience, to reduce to bare content for assistive technologies, or serve a presentation tailored to the type of output device being used (monitor, printer, PDA, screen reader, etc).

4

Image Maps

(e) Redundant text links shall be provided for each active region of a server-side image map

Server-side image maps should be avoided and are considered a deprecated technology. When such maps cannot be avoided, redundant textual equivalents must be provided. Server-side image maps do not allow for alternative text within the map and no browser can identify the URL^[45] being linked to, as the processing is done entirely on the server. This poses a major accessibility issue for those who cannot see the image. There is currently no way to make server-side image maps accessible, thus the mandate for redundant textual links. The rule uses language taken from WCAG checkpoint 1.2.^[46]

(f) Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape

Client-side image maps are more preferable to its server-side counterpart due to the map coordinates being translated on the client. This allows the URL of the imbedded links to be known to the client and alternative text can be provided for those links. A client-side image map also can be navigated using input devices other than a mouse.

This kind of image map is marked up using a parent tag and several child tags. This is because the parent tag, map, which defines the areas of the image that are clickable, uses a separate child tag for each linked coordinate area. Each of these can be treated simply as normal anchor tags by alternative browsing systems. The rule uses language taken from WCAG checkpoint 9.1. ^[47]

This type of image map allows individual hotspots on the map to stand as a separate anchor tag. This allows the links to be accessed without a mouse, freeing the other hand for jotting notes or holding a phone.

5

Data Tables

(g) Row and column headers shall be identified for data tables

and

(h) Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers

Tables which are not being used for layout are required to identify their column and row labels with markup denoting their purpose. For column labels, the tag is used with the scope attribute set to “col”. There is no special tag for row labels, so only the scope attribute set to “row” designates the purpose of those cells. This special markup allows alternative browsing systems to emphasize those cells appropriately, so that the user understands the data in the table. Using the pre tag to lay out table-like data is expressly forbidden. Table grouping tags such as , , and group sections of related cells in rows. Tags such as and define related cells in columns. These grouping tags convey to the browsing agent how the data is related to each other and to their respective row

and column labels as required in provision g, when the table has more than four data cells. This prevents the user who can see only one cell at a time from getting lost in dozens of data cells, and forgetting which column or row conveys what information. ^[48] *A properly marked up table being used to display tabular data helps all visitors to the site view lists of data easily, and using proper grouping tags allow for easy style transforms for the programmer.*

The use of table markup for layout purposes is not expressly forbidden in these rules. The WAI admonishes the use of tables for layout purposes because of the linear disconnect that can be caused when viewed with user agents that cannot perceive spatial elements. The use of CSS2 positioning is recommended, but the base page should be rendered in a linear format. ^[49]

6

Page Structure

(i) Frames shall be titled with text that facilitates frame identification and navigation

Frames can be a useful navigational tool that typically provides a stable frame, which displays a banner or a navigational list. However, frames must be distinctly labeled or disabled users may not know in which frame they are reading. This can be done by describing each frame on the frameset page using the 'title' attribute. ^[50]

Currently, this directive only benefits blind users navigating aurally. However, advances in areas of speech recognition would make this more useful to the rest of the community.

(j) Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz

Users with photosensitive epilepsy are at risk of seizure when viewing flickering lights. web designers should be concerned with the flicker that may occur in animated objects such as animated gif's or Java applets. The high and low numbers in this provision correspond to the frequency range deemed to be at risk of causing epileptic seizures. This provision is one that has little to do with actual code (except for IE page transitions) and mostly raises concern over animated Flash™ and graphics. The size of the flickering object is not specified and therefore applies equally to an 80x15 pixel animated web button as it does to full-screen page transitions employed by an IE specific active-x coding technique. An easy way to comply with this technique is to not have any animated content, but a more rational solution is to make transitions between animation frames more fluid and not jump back and forth between contrasting frames.

The final rule uses language in the spirit of WCAG checkpoint 7.1, but with more regulatory enforceable phrasing by setting the bounds that elements are allowed to flicker. The wording of the WCAG checkpoint could be misconstrued as banning any movement. ^[51] This is also an aesthetic improvement for regular visitors to not be distracted by flashing lights.

(k) A text-only page, with equivalent information or functionality, shall be provided to make a web site comply with the provisions of these standards, when compliance cannot be accomplished in any other way. The content of the text-only page shall be updated whenever the primary page changes

This mostly antiquated provision today was crucial and popular back in 1998. If a website cannot make its pages Section 508 compliant due to lack of time or skilled manpower, then a mirror page, which will contain only text, must be hosted for every

non-compliant page. The mirror page must be updated whenever the primary page is updated. This provision is a general catchall for sites that are unable to bring their content up to specifications. Unfortunately, it also creates a redundancy of effort that can and should be avoided by updating content and code to comply with the regulations.

This paragraph is a restatement of WCAG 11.4 using regulatory enforceable phrasing and is intended to be a type of programming tourniquet. It should only be used if there is no way to make the page Section 508 compliant without undue hardship on the department. However, this puts added pressure of updating both pages within reasonable intervals of each other. ^[52]

All users of a website receive more of a benefit from smarter code and the application of the other mandates than from the continued maintenance of a site for abled users and a site for disabled persons. In the digital realm as in the world of brick and mortar, separate is not equal.

(l) When pages utilize scripting languages to display content, or to create interface elements, the information provided by the script shall be identified with functional text that can be read by assistive technology

Today it is more common now in coding is to use JavaScript functions to popup a menu or window, start or stop scrolling text, or write text into a window. Any information that appears as the result of a script must have alternative access for visitors without access to scripts. JavaScript functions used in conjunction with anchor tags around images become problematic because there is no information being conveyed as to what the link does. This is easily solved by employing the title attribute of the anchor tag and the alt attribute of the image tag to describe what the function does. Special care needs

to be given when writing text to the status bar that important information is not displayed there, since no alternative browser agent has access to that content. In addition, because support for event handlers^[53] is spotty among the alternative browser agents their use must not be tied to any critical content or navigational element. ^[54]

This provision mirrors WCAG checkpoints 6.2 and 6.3. ^[55]The WAI recommends the use of the 'noscript' tag to provide alternative content or links. Testing a page with JavaScript disabled is recommended to find usability or navigation gaps when scripted events are absent. Using JavaScript for menus and other display elements looks great until a page with scrolling text needs to be printed or a visitor is chasing a menu option that keeps collapsing on him. Also, PDA's have limited support for Dynamic HTML.

(m) When a web page requires that an applet, plug-in or other application be present on the client system to interpret page content, the page must provide a link to a plug-in or applet that complies with §1194.21(a) through (l)

This provision underscores earlier discussion concerning browser plug-ins for commonly used resources such as document types (PDF), animation (Flash™), and MathML (Math Player). Whenever content is provided that require any such plug-in a link to download that plug-in must be provided on the same page as the content.

Webmasters must take caution when relying on such outside software, ensuring that it complies with the provisions outlined in Section 508 §1194.21 Software Applications and Operating Systems.^[56] This is becoming less of a worry as all of the major vendors are providing software which is compliant with those provisions. Webmasters can also employ a detection script that detects the presence of plug-ins and directs the user to a download page or alternative content. According to the annotations of the rule, the

responsibility is on the webmaster to check that a specific plug-in is compliant with §1194.21. ^[57]

Adobe has also committed to have its products conform to the mandates set for Section 508 compatibility. Documents prepared in PDF can fulfill all applicable Section 508 checkpoints; it is up to the author, however, not to include multimedia and scripting elements that would decrease the accessibility of the document. Adobe Acrobat Reader® software and Adobe Acrobat® software, products that read and write PDF respectively, are fully text-to-speech compatible and have numerous keyboard shortcuts for navigation. ^[58] PDF documents are the standard for archival quality documentation in a device independent and resolution independent fixed-layout format. They can be easily searched, zoomed, aurally projected, and secured. They also make great alternatives to code based web forms.

Adobe Flash® software has several ways of embedding content for alternative viewing. It can assign text equivalents for visual elements, control reading order, caption audio content (manually in the movie or with a third party component), disable or let the user control animation, and provide keyboard access to all controls. Shockwave™ content is created with Adobe Director® software. It is primarily used for total user interface design, versus small animations. As such, Adobe Director® software has many of the accessibility features of Adobe Flash® software, plus advanced text-to-speech and web viewer capabilities. ^[59]

Before MathML, in order to put mathematical equations on the web accurately one had to use graphics. Unfortunately, graphics have no text-equivalent. MathML allows any equation or formula to be rendered as text and can be read aloud by screen

reader software or enlarged to be seen better just as normal text can. Currently, Mozilla based browsers display MathML natively with few problems. IE6 needs a plug-in, such as MathPlayer, to render MathML properly. IE7 can render natively but with mixed results. Testing was done using the W3C MathML test suite.^[60] MathPlayer is fully accessible and has built in math-to-speech compatibility, so even those who do not use screen readers can have the math problems spoken to them for better comprehension.^[61]

The use of standardized plug-ins on webpages increases the likelihood that the visitor has the plug-ins preinstalled and can readily access the material. Even if it is a common plug-in, having a link to the download page for the application is a courtesy that lets the visitor retrieve the necessary software to properly render the website's content quickly. If a less common plug-in is required, providing an installation link is even more necessary as the visitor should not be expected to know where to find the software.

(n) When electronic forms are designed to be completed on-line, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form, including all directions and cues

The first problem is relating form labels and their elements. While visually the connection is usually obvious, due to proximity of label and element, when displayed in alternative format the connection can be lost. The solution is to enclose the label in label tags and use the "for" attribute to connect the label to the ID attribute of the element. Also, when using table layout with forms, do not place the label and its element in separate cells, as the label becomes distant from its element in the tabular order. Again,

do not rely solely on event handlers for the displaying of directions or cues and that the form can be easily and logically tabbed through without a mouse.

In part due to the Government Paperwork Elimination Act of 1998, web forms have increasing importance on government websites. Every element in a form must be checked for logical tab order and label association. Some forms may use plug-ins or other scripts for validation. These are allowed under the rule as long as they do not infringe on the use of the form.^[62] The primary improvement for every user in this mandate is the tabular order. It takes additional time to have to grab the mouse after every form field to reach the next logical field. Also, when laying out in an editor the default tab order may not be the most logical, when filling out an address a user is accustomed to city, state, zip order. The form focus jumping from city to zip will only aggravate the user.

(o) A method shall be provided that permits users to skip repetitive navigation links

This is the most ambiguous of all the provisions concerning webpages. It addresses the ability of an able user's ability to scroll directly to content. Alternative browsing agents do not have this feature and the page must be viewed in its entirety in order until a link is clicked. Therefore using anchor tags to jump blocks of content on a page is recommended. The link should allow disabled users to completely bypass navigation links when the user does not want to peruse them. However, the provision does not consider long swaths of grouped links, a design popular on governmental websites. The ability to jump from one link block to the next is found on a few sites but unfortunately is not required.^[63]

PDA users benefit the most from this mandate as scrolling is a major barrier in mobile browsing. What can fit on one page on a desktop monitor may take three or more on a PDA depending on orientation of the device.

7

Timed Responses

(p) When a timed response is required, the user shall be alerted and given sufficient time to indicate that more time is required

Some webpages are designed to expire or refresh after a fixed amount of time. Many disabled users may not be finished with the page before this occurs and if they are filling out a form their form entries are usually reset. Therefore, a notification must be displayed asking the user if they require additional time.^[64]

In an office environment, a visitor may be called away at random times. Or an elderly person may take more time to read and type a response in a form field. This is just a courtesy for users that a prompt for more time is provided before resetting the entire form.

8

Missing WCAG checkpoints in Section 508

WCAG Checkpoint 4.1 addresses language changes in a document. The WAI is a global body and addresses the possibility that more than one language may reside in a single page; thus at each change in language, markup should denote the change.^[65] The WAI remarked that the statement “the following is in German” actually in the text would not satisfy the guideline. This is because assistive technologies need some kind of cue of which language to change into and recommended use of the ‘lang’ attribute in HTML and XML. The Access Board decided not to enforce this rule because of a lack of support by screen readers at the time for the ‘lang’ attribute. WCAG Checkpoint 14.1 asks that

webpage content use simple language appropriate to the audience. This was disregarded in the Section 508 regulations because it was deemed unenforceable. WCAG Checkpoint 1.3 addresses multimedia captioning and is very closely related to WCAG Checkpoint 1.4 which is addressed by §1194.22(b). The Access Board deemed this checkpoint more appropriate to §1194.24. WCAG Checkpoint 6.2 which states that equivalents for dynamic content change when the dynamic content changes. This was removed from the final rule because of ambiguity about the meaning of the checkpoint. ¹⁶⁶¹

IV

Barriers to Access

The world is growing ever more interconnected through the internet; its ubiquity allows for speedier communications and extended access to information. Unfortunately, there is a developing access gap between “ideal user” and “average user”. Websites constructed with a specific demographic in mind; such as 18-65 year old , healthy American citizen, viewing at 1024x768 resolution ¹⁶⁷¹ with a broadband connection, using Microsoft Internet Explorer® ¹⁶⁸¹; are in danger of inadvertently creating barriers to access for anyone outside that group. Coding a website for a 20% minority can still leave four in five visitors with a bad user experience.

Accessibility standards which were published in the late 1990’s still leave many usability difficulties unaddressed. A half-decade later, organizations are reevaluating

their accessibility policies in light of new technologies, better standards support, and greater awareness of difficulties in accessing information. Some of these barriers can be addressed by greater code support in modern browsers. Others require changes to the browser itself or a look at what type of browser is viewing the page (i.e. PDA or Aural). However, no support in the code base or in the software will matter if the programmer does not use or enable these support mechanisms in the underlying page code.

1

Age-related problems

Coding for an average age demographic can lead to problems being encountered by Baby Boomers visiting the website. In a February 2004 survey by the non-profit Pew Internet & American Life Project, 22% of Americans age 65 or older reported using the Internet. This percentage jumped by 47% between 2000 and 2004. The study also showed 58% of Americans age 50-64 used the Internet.^[69] A later survey in December 2006 showed the percentages still rising with one in three seniors 65+ having occasional internet use and the 50-64 age bracket growing to a 70% usage share.^[70]

Aging is a natural process that affects everyone regardless of socio-economic or lifestyle factors and has inevitable symptoms that can only be slightly mitigated by modern medicine. Age-associated impairments are likely to be less serious than those addressed by assisted technology hardware, and at the same time, there are correlations among impairments. For instance, an older person with macular degeneration may also have poorer motor control and some minor memory impairment.^[71] Age-related problems such as macular degeneration and decrease of fine motor control can be programmatically addressed with proper code and understanding of browser features by both the user and programmer.

Code barriers that affect eyesight include font attributes and color contrast. The first concern for addressing eyesight problems is to make all text on the page dynamically scalable^[72], using CSS properties to set relative sizes for fonts.^[73] It is important that relative sizes be set or the text will not scale at all in Internet Explorer using browser font-size controls, unless a special box is checked deep under browser options. Mozilla based browsers can override fixed-size settings but that also can cause pixilation of the font. Also, having a set pixel size for fonts forces readers with high resolutions to resize your text for every page. Font-style is also a concern. Using a sans-serif font style and high contrast between text and background will help with legibility of the content. Serif or Script style fonts are harder for eyes to focus on and insufficient contrast between text and background can make word/letter contours less distinct. The W3C provides algorithms to determine an objective value for the brightness difference and the hue difference between the background and foreground.^[74] Another set of algorithms show the objective values for brightness and hue as affected by three different types of color deficiency.^[75]

Another major change caused by aging is decreased motor functioning. Many people who have grown up with computers may view the mouse and keyboard as a natural extension of their fingers. We forget the baby boomer generation and older may have trouble adapting to these new motor skills. Using the mouse involves multiple hand-eye coordination movements, sometimes involving fine control. To click an icon on the screen, the user must translate the physical mouse movement with the virtual cursor on-screen. Then the user must hold the cursor steady over the icon, while simultaneously pressing the correct mouse button with the appropriate finger. Overly jerky movements

can move the cursor off of the intended target, frustrating the user.^[76] Dynamic menus created using scripting techniques can also cause difficulties if fine mouse control is required. A badly coded menu will have even those most proficient at using the mouse chasing collapsing menus. Pop-up menus will be addressed by the WAI in upcoming standards, due to the disconnect of the menu from any semantic information defining it as such in the code.^[77] There are creative programmers who market dynamic menu applets which meet published accessibility requirements, such as “Ultimate Drop-down Menu”^[78] and Dreamweaver plug-ins which cost between 40-80USD. The notion that complex web applets must be designed to create an accessible menu underscores the need for additional language level semantic structures and warns web developers to be wary in their use of dynamic menus.

Age related problems on the other end of the scale, small children, are less of an issue. Because of the Children's Online Privacy Protection Act of 1998, web designers need not worry about making websites understandable to a child under the age of thirteen.^[79] Children under thirteen years of age should have adult supervision when using the internet and the responsible guardian can assist with any usability problems encountered by the child.

2

Temporary Impairments

People who do not have a long-term legal disability can also benefit from accessible design on the Internet. Users in a situation of temporary impairment due to a hand being injured or occupied, the misplacing of reading glasses, or using a laptop in direct light can benefit in some way by alternative access or presentation adjustments on a website.^[80] Organizing content on a page to be scanned quickly helps visitors that are

at work or otherwise cannot be bothered to hunt for the correct link. Making the website keyboard navigable helps note takers keep one hand on the writing implement. Laptop users may need to adjust their resolution or increase font size to compensate for glare.

3

Language

Because the regulations in Section 508 are United States federal guidelines, there is the assumption that the visitor's primary language is English. Some federal agencies which are expected to have high traffic from immigrants do have mirror versions of the website in Spanish. The Social Security Administration's website is an exception by having content provided in fourteen other languages besides English and Spanish.^[81] The multi-lingual European Union web portal supports twenty-three member languages.^[82]

WCAG Checkpoints 4.3 and 11.3 recommend that a page's language be stated in markup and that the visitor be given the option of multiple views based on preferences such as language. These features are giving a Priority 3 rating by the WAI.^[83] Having alternative language options often puts undue burden on a webmaster unless absolutely required by the nature of the website. Increasing progress in translation software is beginning to eliminate this barrier by translating page text into the user's language.^[84]

According to the CIA World Factbook, the top five languages by percentage of native speakers are Mandarin Chinese (13.69%), Spanish (5.05%), English (4.84%), Hindi (2.82%), and Portuguese (2.77%).^[85] However, 29.9% of total Internet users speak English.^[86]

4

Screen Size

In the business world and among technophiles, small-screen web devices are increasing in popularity as people strive to be connected all the time. However, these devices currently pose their own usability problems. Websites designed for larger resolutions can break down when viewed on small screens. A webpage renders very differently on a PDA or web-enabled phone. UI elements use more screen real estate and page content is condensed into a tighter aspect ratio. Also, the methods of interaction and device capabilities differ and bandwidth is more limited. ^[87]

The CSS specification provides a way to deliver different presentations of content based on device type. This allows web developers to deliver one design to desktops/laptops and a streamlined design for PDA.

5

Web Browser

There are also features of the web browsers themselves that must be considered because a website coded to eliminate access barriers can be thwarted by a browser that ignores or improperly renders the code. Microsoft, Mozilla, and Apple have long been members of the W3C and have an interest in their browsers being compatible with the standards. Microsoft has the disadvantage of having gone its own path with proprietary standards and now having to slowly introduce W3C standards without “breaking-the-web”. Mozilla long ago dropped the old Navigator® code base and has been built from the beginning with standards compliance in mind. Apple’s Safari® browser also has strong standards support. Currently, no browser is 100% compliant with every published standard, but developers should be aware of the web content standards as the browsers implement them as per the User Agent Accessibility Guidelines. ^[88]

Microsoft strives to promote accessibility in its Internet Explorer® (IE) browser and offers features such as increasing and decreasing the base font-size of a page to adjust for low vision, user specified style sheets that make the page more readable to that user, and replacing images with their text equivalents. In addition, multimedia can be disabled, consequently decreasing load time by not loading elements that cannot be seen or heard by the user. IE also supports custom tab order and access keys in webpages that implement these checkpoints to speed through navigation.^[89] ^[90] However, many of these features are buried deep within menus and dialog boxes where average users will not find them or know they exist. For this reason, accessible code must be compatible with the browser and notify the visitor to the page of these features. ^[91] Access keys, when imbedded in a webpage, are often listed in the accessibility policy of the website. Tab order, while not necessarily prompted, is demonstrated when the visitor tabs through a form in a logical order. In IE, the text size menu is located under the view menu in IE version 6 and the page menu in version 7. Unfortunately, this feature is broken if the page employs fixed-size fonts and the user only has five size choices from which to choose. Because IE is integrated with Windows™ OS, the application receives benefit from text-to-speech and screen reader software made for Windows™. This integration also prevents its portability in a workplace environment. A disabled worker needing small modifications or a Type A worker who likes his workspace “just so” will be tied to wherever the company IS department allows their user profiles to roam.

Mozilla based browsers are also gaining ground in the browser market. Browsers such as Netscape and Firefox are developed on this open-source engine. These browsers are easier to customize and allow more modular design. A user can quickly

change base font size or choose from multiple imbedded stylesheets in a page from the view menu. The font size control will override fixed size settings in the page and scales by percentage up and down. A very plain, simple options dialog shows settings to disable pop-ups, images, JavaScript, and Java entirely or set restrictions on what types of behavior are allowed. A setting to toggle caret browsing is also readily visible. A more advanced user can further customize the look of the application interface, set the rate that blinking elements blink (if not disabled) and marquee elements scroll (if not disabled), and set a base stylesheet for all webpages.^[92] Since version 7 of IE and every version of Firefox, extensions have been available to further modularize the base application. These extensions can be used to install extra toolbars or other features that make accessibility options easier to find.

Even the demographically “ideal users” can encounter barriers to their access of information due to environmental or hardware conditions in the field. The elderly and the injured also have just as much right to information access as the young or careful. Web programmers need to remember, and remind their bosses, that the majority of visitors to a website will not be supermen, but merely people who have shortcomings and distractions. Coding for the least common denominator can still allow for an aesthetically pleasing page, but it will allow anyone to enjoy it.

Public Internet History

In March 1989, Tim Berners-Lee, had the idea to develop a platform for sharing data in the Internet using hypertext. Together with Robert Cailliau, the first browser, editor, and hypertext language were announced in May 1990.^[93] The software and technical protocols were distributed to computing centers around the globe. By 1992 a few preliminary web servers existed in places like University of Illinois, where the National Center for Supercomputing Applications (NCSA) is located. This is where Marc Andreessen helped to improve the web browser into a freely distributable package for personal computers and Apple Macintoshes.^[94] The first commercial web browser, Mosaic, was introduced by NCSA in February 1993.^[95] On April 30, 1993, CERN announced that the WWW would be public domain.^[96] This announcement released the intellectual properties associated with the WWW. This allowed private companies to form to gather funding to continue research and development in the hopes of expanding the use of the WWW. The first two browsers to gain commercial popularity used Mosaic source code, Navigator® and Internet Explorer®. Netscape Communications released Navigator® v1.0 in December 1994. Microsoft released Internet Explorer® v1.0 as part of its Windows95® operating system.^[97]

The Internet archive project, dubbed “The Wayback Machine”, is a non-profit effort to preserve web history.^[98] The project began in 1996 and it trolls the web, archiving pages it finds. Not all websites in the archive for a certain date are complete, but it gives a reasonable idea of the site contents. Any versions appearing before the creation of the archive would have been nothing but text and links.^[99]

Website Audits

Despite the existence of Section 508, government websites differ considerably in the degree of compliance with the law and WCAG priority 1. These criteria are the bare minimum to be accessibility compliant, however some sites go farther by adding Spanish translation, accessibility keys, and in-site text magnification. Use of WCAG priority 2 and 3 recommendations further enhances the visitor's experience. Assessments are based on discrete snapshots which encapsulate the overall history of the website. Accessibility compliance is checked using hermish.com^[100] and [Cynthia Says](http://CynthiaSays.com)TM.^[101] Hermish.com is a UK based company which provides tools for checking compliance with WCAG 1.0 in for UK developers complying with the Disability Discrimination Act and Section 508 compliance for American developers. [Cynthia Says](http://CynthiaSays.com)TM is a product of [HiSoftware](http://HiSoftware.com) for the validation of website accessibility under WCAG and Section 508. When a guideline is flagged as failed or warning by the automated checks, a manual inspection will determine the final pass/fail of a website layout. Additional consideration will also be given to navigation, appearance on PDA screens, and screen reader compatibility. In doing these audits, pages that meet published guidelines may still be unusable to a segment of the community or detract from the experience of the visitor. Current accessibility guidelines absolutely demonstrate a net positive for internet users when applied with the proper intent, but what are the real life results on the pages formally required to implement accessibility guidelines?

whitehouse.gov

The White House website is a well-known government website for the President of the United States. The earliest archived version of the site (December 27, 1996) has only

a search engine for government documents that had been digitized at that point, mostly speeches and declarations. The page is text only and is very simple. ^[102]

The first archived instance of a full whitehouse.gov website (December 02, 1998) also has a text-only version, which simply removes what few graphics were present on the main page. The text-only link was prominently displayed in the upper left hand corner, so it is the first object seen by screen readers. Unfortunately, the text-only pages can be long and provided no methods to quickly skip to the next section. The main site was little better. The heading “Welcome to the White House” vanished when images were disabled. Simply adding alternative text to the image header would have replaced the image with the proper text and been more helpful to visitors using dial-up connections who had graphics disabled in their browsers. There was a page which lists several focused search engines to locate published government documents. The forms fail to support any non-visual method of access. This whitehouse.gov layout passes automated Section 508 validation but fails manual checks. ^[103] *Section 508 law had been passed, but formal guidelines for compliance with the had not been issued leaving federal webmasters to decide what coding paradigms complied with the new law.*

Between September 14, 1999 and July 11, 2000 the text-only link vanishes. There may have been a new layout between July 11, 2000 and February 02, 2001, but it renders as text only in the archive instead of the graphical pages. ^[104] *Even though “The Wayback Machine” is capable of displaying graphics, because its user agent did not identify as Netscape or Internet Explorer, it was fed the text-only version. A look at the accessibility policy explained that user agents^[105] identified as text-only automatically receive textual content. As for the actual accessibility provided, there was still no way to*

skip content. The navigational links are at the bottom, which is a blessing since one does not have to read them again, every time a link is pressed, before reading the content.

On February 02, 2001, a new administration brought a sweeping new layout and many firsts. It was the first version to be built under Section 508 law and formal compliance guidelines. For the first time on whitehouse.gov, the navigation menus used graphical rollovers, which also mark the first use of JavaScript^[106]. It is the first to use pictures of events to illustrate articles. The text-only version is still present, and badly needed for the first time. Nearly all the images contain alternative text, but most are repetitive with no useful information and should disappear when graphics are disabled. These are stripped from the text-only page, but the link to the page is buried several objects down. There is still no way to skip around a page and the pages could be very long. Forms are still inaccessible. This layout passes Section 508 validation and achieves a WAI 'A' rating, but still poses major difficulties on the visitor in terms of its navigation interface and reliance of low bandwidth users on the "lesser" text-only page.^[107] Some strides were made in the summer of 2001 with some articles having Spanish translations and an accessibility policy link added on July 12, 2001.^[108]

Another redesign of whitehouse.gov in September 2001 included major leaps in accessibility features, more than satisfying Section 508 law and taking account of WCAG. This design featured content skip links hidden behind images so they are only seen when images were disabled. "Skip to content" was the first link to be seen and each section header of the navigation bar sports a skip link. This was by far the most graphical version, but proves that it is possible to scale down gracefully to textual accessibility-minded content. A text-only link is the second link encountered. The text-

only versions reduce the amount of content, remove extraneous graphics and give text where important graphics were, move the right hand navigation bar to the bottom, and only have the section headings present in the navigation links. This was the first version to prominently offer audio, video, and Spanish versions of speeches. The use of style markup is very conservative. The website has a link to its accessibility policy on its bottom navigation bar. ^[109] Other than aesthetic change in graphics and order of information, this general layout has remained relatively unchanged from September 2001 to September 2006. This whitehouse.gov layout passes Section 508 validation and achieves a WAI 'AA' rating. ^{[110] [111]}

Redundancy in website design should be avoided due to the probability of the secondary page not being updated as frequently as the primary page. One of the problems that kept reoccurring in the history of whitehouse.gov is the tendency to overload the home page with the latest presentational technologies and offer a text-only page to those who cannot use the home page. The Spanish language version is treated as a separate website written in Spanish with different articles geared toward the different audience. Also, there is a distinct lack of header tags to denote article titles or any other way to skip around a webpage other than the mouse. There is also a lack of style support for printers and mobile devices. The rush to introduce new internet technologies is admirable but the needs of the visitors are also important and show that published accessibility guidelines are not sufficient to keep the web user friendly.

4

dol.gov

The Department of Labor (DoL) website is the nation's source for information concerning economic health, labor related federal agencies, and workplace related

laws. The oldest archived design (November 3, 1996) has a graphical heading with navigation picture links to areas of the website and a server-side image map to meta-info^[112] concerning the site. Only two of the image links had alternative text links and the image map vanished when graphics were disabled. This resulted in the navigational elements disappearing completely, leaving the visitor stranded on the home page. After the home page, succeeding menu pages are very terse and direct the visitor to increasingly specific content. The deep imbedding of content can be undesirable to typical users that do not tend to venture more a few levels deep into a site to find the desired content.^[113] If visitors with graphics disabled or using speech to text could get to deeper pages, their experience would be relatively pleasant. The actual articles themselves were lengthy, but navigation was simply a “back to home” link and a “back to top of page” link at the bottom of each page that did not bloat the page with unnecessary or repetitious content. Visitors were still without a way to navigate within the pages easily. This layout fails both Section 508 and WAI verification.^[114]

The DoL website’s next major redesign (July 17, 1998) appeared with a more graphical aesthetic. Some accessibility consideration was shown by providing a text-only copy of the site. The text alternative for the first two levels of the site places all the navigation links at the bottom. Beyond that, pages either only have a banner graphic at the top and a few navigation links at the bottom that sandwich a list of links, or are an article. Some awareness of Section 508 was shown, as it was signed in this same month. This dol.gov layout passes Section 508 validation and achieves a WAI ‘A’ rating.^[115]

The current layout (October 12, 2001) is difficult for typical users to navigate and is nearly impossible for disabled users. On the homepage, there is a “skip to content”

link hidden at the top of the page, which supposes to skip the navigational menu. Instead, it skips only the heading and places the visitor directly at the menu. Other intra-page navigational anchors are present, but have no corresponding link to activate them. The majority of the pages are long lists of text and links. In addition, the most popular screen reader programs allow skipping to each header tag and can use that feature to skip sections of a webpage, yet no header tags are used. An extended search of the site found no accessibility policy at all. The site does pass automated verification for Section 508 and garners a WAI “A” rating. Technically, all the content is available and can be accessed by anyone; however, the access provided is difficult for any visitor. ^[116]

This website historically is a perfect example of why automated checklist testing is only a starting point. Visual checks are necessary to reveal that useful navigational skips, required label markup on search forms, and markup relationships between header and data cells in a table are all absent. It also demonstrates the strain put on visitors when no thought is put into how the page is accessed and how efficiently can “Average Joe” find the content he needs. While the Department of Labor’s own website is extremely inaccessible, it is responsible for maintaining the ultra-accessible, inter-agency disabilityinfo.gov website.

5

usdoj.gov

The oldest archived version of the United States Department of Justice (DoJ) website (December 10, 1997) was just text and links. It was very barren; lacking any colors or graphics. Its sole purpose seems to be little more than an explanation of what the DoJ is and where to find documents it has published. This simple design readily

validates for Section 508 and comes close (missing document type) to garnering a WAI 'AA' rating. ^[117]

The rather dull layout was eventually (May 29, 1998) given a splash of color and graphics. The menus were now completely graphical and the homepage as well as several subpages comprised solely of a large graphic stating the section title with a section menu above. Visitors followed links until desired content is reached, which can be four or more levels deep. The deep linking could have been reduced by eliminating pages with just a graphical title, allowing visitors quicker access to information and not requiring low bandwidth users to download a large, unnecessary graphic. ^[118] *Each page is generally very small and reads quickly, requiring no need for intra-page jumps. All images have alternative text, which is helpful and meaningful. Yet, it still offers a text-only version. The mirror site is not necessary and detracts from the overall accessibility of the site; due to its redundancy, a break between respective contents can occur. Unfortunately, a check with reasonable accuracy as to when the text-only pages were updated in relation to the main site was is not possible because of gaps in the archive. This is a decent example of how graphics-heavy webpages can still be made compliant; the site validates Section 508 and WAI- 'A' after manual checks.* ^[119]

The next redesign (October 18, 2000) of usdoj.gov front loads many links to sub-content. The long swaths of links offer no way to skip sections by anchor or header tags. Visually, the links were arranged and grouped to allow the visitor to quickly scan the page. There was a "skip to content" anchor at the top that only skipped the header at the top of every page and brought the visitor to the start of a seemingly endless list of links. When images were blocked, the alternative text in the header area was unreadable. Also,

there was frequent use of alternate text to describe decorations such as bullet points and horizontal rules. Like dol.gov at that time, the content on usdoj.gov was available to all visitors, but the quality of access was extremely frustrating unless viewed on a desktop computer with a mouse. The site validates for Section 508 and WAI 'A'. ^[120]

The current layout (first seen: October 13, 2005) makes progress in having a "skip to content" link that brings the visitor past the navigation menus, directly to the first news story. Unfortunately, there is no way to skip sections within the body of the page. The site is extremely graphical and could use more CSS techniques to cut out some of the graphics, increase page load time, and view better on small screens. The site fails Section 508 validation for having images without the alt attribute, a search form on the home page without an associated label, and a JavaScript text box which obscures body content when scripting is disabled. ^[121] The only notable change since October 2005 has been the removal of the offending text box. ^[122]

Although most of the visual effects provided by the images can now be done with CSS markup, this was not an option in 1998 due to lack of browser compliance with the CSS1 specification or with each other. This has been improving over the last decade and CSS1 visual effects now can be expected to render properly across all browsers. ^[123] ^[124] CSS2 positioning effects are still experiencing cross-browser rendering issues. ^[125] Also, a happy balance needs to be reached between compartmentalizing too much and having large swaths of links to content that a visitor in which a visitor can get lost. Using JavaScript to hide links until the group header is selected is a way to keep a homepage tidy while keeping the number of links high. Putting the group header in a header tag in

the page code will also maintain accessibility compliance without hurting the overall user experience.

6

ssa.gov

The website for the Social Security Administration (SSA) is historically user conscious. Throughout the archive from June 1997 to January 2004 and onward to present, access has been a feature of this website.

The oldest archived version (June 13, 1997) uses graphical menus with alternate text, short page sizes, and Spanish translation. The navigational button bar on the side uses a client-side image map, but has a redundant textual navigation bar at the bottom of the page. The website collapses well to text only format and avoids unnecessarily wordy or repetitive alternative text. The pages are just lists of links until the articles are reached. The site passes a Section 508 check and would have a WAI 'AA' rating if it had a document type declaration; however these declarations were not commonplace at that time. ^[126]

It is hard to identify any major layout changes between February 1998 and April 2003 in the archive, but several significant, gradual adjustments to layout and usability were seen. In Feb. 1998, the image map sidebar was moved to the top and each area of the image map given alternative text. In addition, a new textual sidebar and main column article briefs were displayed for the first time on ssa.gov according to the archive. ^[127] Later, in this period, the navigational image map was replaced with text links and a secondary image map lacking individual alternate text replacement was added to promote various SSA services online. In February 1999, the sidebar was increased in size, making the page take longer to browse. ^[128] This usability detriment was corrected

in May 2002, when hidden links were added to skip sections of navigation links on the sidebar. A hidden link was also added at the top of the pages to skip directly to the content. ^[129] *This site has also recognized that non-English users are frequent visitors to the site. Information has always been provided in Spanish, and the link gained more prominence as the layout was adjusted. Support for multiple languages was added on June 20, 2001.* ^[130] *The Spanish version link was copied to the header of the homepage in February 2003; however the multi-language portal still resides in the sidebar.* ^[131] *The changes to the site during this period seem to reflect general confusion over what was considered accessible and how to properly comply with Section 508 while improving the visual aesthetic at the same time. A validation of the February 17, 2003 layout fails Section 508 due to errors with image map alternate text.*

The snapshot (April 25, 2003) reflecting layout still in use contains several substantial improvements, but one glaring usability hit. There is now a scrolling message script in the top left corner of the homepage; however, a link to a page listing the messages is displayed when JavaScript is disabled. JavaScript is also used to generate random pictures of people as decoration and to email the page to a friend. There is no loss of navigation in having JavaScript disabled and messages display detailing what functionality is lost. Concerning layout, the Spanish language content link still has a prominent position on the homepage header and sub-pages are compact and easy to browse. The one problem with the homepage is that the ability to skip blocks of links on the homepage is gone, so every link, and the list is long, has to be read by users with small screens or browsing aurally. ^[132]

Since April 2003, a link to enable a plug-in to magnify text on a page and a link to more language translations has been given prominence in the header next to the Spanish language link. A validation check on the ssa.gov website (February 27, 2007) fails to comply with the guideline that the page still is readable with out associated style markup. The page became a cluttered mess with the style sheet disabled so it fails Section 508 and WAI guidelines on that point. ^[133]

I think that the social security administration has some good ideas in how to present information on a desktop or laptop monitor, but any resolution smaller than 800x600 and the page gets illegibly scrunched up. The number of initially visible links on the home page should also be reduced in order to facilitate quicker scanning of the page. The Spanish version is much clearer to read and greatly improves access for its users. The Multilanguage portal is simply a repository for documents translated into supported languages and is not intended to replace the entire site, like the Spanish version does.

7

medicare.gov

The official government source for Medicare news and documents is medicare.gov. The oldest archived version (December 5, 1998) had a very prominent link to a page with all the Spanish language documents currently available. The site itself was not translated. The site also boasted simple short navigational menus that focused the visitor to the content they sought. All content pages were broken into sections with links to each section at the top of the page, allowing the visitor to jump directly to the particular topic of interest. The navigational graphics on the home page had alternate text, and other graphics were merely for aesthetic purposes and were not

necessary for site interpretation. The page fails Section 508 validation due to a missing label on the search form. ^[134]

The next layout change (May 10, 2000) touted a touted a mirror site optimized for screen readers, a printer-friendly layout, and links to Spanish and Asian language content. Surprisingly, while the Spanish portal was written in Spanish, the Asian portal was still in English. Publications are offered in PDF and a link to the adobe.com PDF to HTML converter was provided for those who prefer that format. There were only moderate content shifts on this theme through April 2006. ^[135]

The current medicare.gov website (February 27, 2007), completely breaks down when viewed on a PDA or without the associated style sheet. There is a link to a style preset for screen readers which linearizes the page, but provides no way to skip sections. The Spanish portal remains, but the Asian portal seems to have vanished. The home page is overly cluttered and it takes several passes to find the link to desired content. There is also a JavaScript popup submenu that appears for several items on the sidebar, but users can visit an intermediary page if scripting is disabled. Publications are still downloadable in PDF but the option to view as HTML in the browser is no longer present. The site fails Section 508 validation due to several images missing the alt attribute. ^[136]

The medicare.gov website seems more content driven then access driven. There is a large amount of information that needs to be disseminated and making that information easy to find seems to be less of a priority. The site also seems to be superficial in its aims for better access by providing helpful features such as different styles for the page, but not really looking at how those styles actually help the visitor. The “screen reader” style

helps when viewing on a PDA, but still has problems navigating content. The site could benefit from a navigational standardization that groups content into a unified, logical menu.

8

disabilityinfo.gov

Disabilityinfo.gov is the official government portal for people with disabilities to access government information. It was created as part of President George W. Bush's New Freedom Initiative to remove barriers to access for this segment of the community. DisabilityInfo.gov streamlines access to U.S. government-sponsored programs relevant to the daily lives of people with disabilities.

The website launched in October 23, 2002 by Executive Memorandum signed by President George W. Bush. It has maintained the same basic design since its launch, only moving a few items around over its first full year. Because of its intended audience, this site goes farther than any other federal agency website, with the sole exception of section508.gov itself. The website makes use of style sheet switching and accessibility keys, as well as full compliance with Section 508 specifications. The ability to skip directly to various parts of a page is the function of the first links encountered by a screen reader. Accessibility keys^[137] are clearly labeled on the accessibility statement page, along with several universal keyboard commands for controlling the browser without a mouse or with a screen reader. This is also one of the only federal websites to make use of the header tag to markup sections of content, a feature some assistive technology looks for when trying to navigate a page.^[138] ^[139] This site implements every Section 508 guideline fully and creatively. It is still a bit graphics heavy, but uses proper

markup to make that not a usability issue. The WAI validation passes with a 'AA' rating.
[140]

In March 2004, the layout became fully CSS based and the number of style sheet choices increased from two to four, with "low graphics" and "no graphics" joining "full graphics" and "high contrast". These options allow for a fuller range of access, each of which is targeted to specific visibility needs. The user's style sheet choice is stored in a cookie for future reference so that that style is preloaded by default on future visits. *[141]*

The February 27, 2007 layout of disabilityinfo.gov shows some new graphics and moves some menu items around, but still embodies the same design philosophy and attention to accessible markup as the day it launched. It also proudly displays icons at the bottom of the page denoting its status as Section 508 compliant, WAI 'AA' rated, uses PDF for published documents, and is compatible with Microsoft Reader®. *[142]*

This is the example of how the proper implementation of accessibility guidelines forces the programmer to look at multiple ways that the site may be accessed. This site is designed to be as efficient, and uncomplicated as possible. Information is presented in a clear manner with a menu structure that stands out and uses logical progression to navigate content. The "no graphics" style linearizes the content for use by PDA. It is a testament to the guidelines and to the programmers who worked on this site that the most disability accessible site is also the most accessible for all people.

Conclusions

As the internet becomes more integrated in people's lives and their workplaces, the accessibility of documents by anyone at anytime is increasingly important. The internet was originally designed to be used as a tool to share information easily to any interested party regardless of physical ability or geographical location. In those early days, what would become the WWW was a collection of text and links accessible from major universities and research locations globally. As the WWW became more commercialized web programmers and web browser creators have experimented with code that has favored presentation over usability. This shift away from universal accessibility is currently being addressed by the W3C and various governments.

The WCAG and Section 508 standards are useful as a base for web developers to begin addressing barriers in their websites that may not have been considered. However, WCAG was published in May 1999 and the standards of compliance with Section 508 were published in December 2000, eighteen months after the law was signed. Over the last decade developers have seemed to ignore accessibility issues as too burdensome and not having an effect on the general public. This thesis clearly proves otherwise. The standards already published and browser compatibility with the code required is already sufficient to address all the barriers covered here. With baby boomers gathering online and mobile devices taking the web out of offices and homes, new access problems are developing and need to be addressed. As more companies turn to their own intranets to share data, making those web applications more efficient helps keep productivity high. There is always room for improvement in any coding project, and with websites, the trend needs to turn towards how they are accessed and used instead of how they look.

By improving the way users access and interact with internet content, we can improve workplace productivity and better include average users in modern life. Unfortunately, there are still access barriers being introduced by developing technologies and coding methodologies. The use of mechanisms such as PDA's or Rich Media still need to be accessible and need their access methods accessible from development instead of requiring retrofits at a future date. The US Government and other world bodies are looking to the W3C to release WCAG 2.0 with clearer guidelines and support for the current generation of barriers which did not exist when the guidelines were first published. Even before clearer directives are given, web developers need to take a careful look at their websites now and demonstrate that they can be used without undue difficulty on multiple platforms and by multiple demographics. The content needs to finally be separate from presentation, and be displayed without any styling. The more time people spend online, the more important for the developer that their website provides as smooth experience for every visitor.

VII

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- ^[13] <http://www.access-board.gov/sec508/summary.htm>
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- ^[31] <http://labs.google.com/accessible/faq.html>
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- ^[38] *WCAG1.0 Guideline 1*
- ^[39] *Web Content Accessibility Guidelines 1.0 “Checkpoint 1”*
- ^[40] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(b)*
- ^[41] <http://www.webaim.org/techniques/captions/realtime.php>
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- ^[43] *Web Content Accessibility Guidelines 1.0 “Checkpoint 3”*
- ^[44] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(d)*
- ^[45] *Uniform Resource Locator: The web address of a page.*
- ^[46] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(e)*
- ^[47] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(f)*
- ^[48] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(g)&(h)*
- ^[49] *Web Content Accessibility Guidelines 1.0 “Checkpoint 5”*
- ^[50] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(i)*
- ^[51] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(j)*
- ^[52] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.22(k)*
- ^[53] *A catch, which detects browsing events such as clicking, selecting, and typing, that calls a command or function when the particular event condition is met.*

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- ^[55] *Web Content Accessibility Guidelines 1.0 “Checkpoint 6”*
- ^[56] *Federal Register. Electronic and Information Technology Accessibility Standards; Final Rule. §1194.21*
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- ^[82] <http://europa.eu/>
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- ^[84] http://www.altavista.com/help/free/free_searchbox_transl
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- ^[100] http://www.hermish.com/check_accessibility_form.cfm
- ^[101] <http://www.contentquality.com/>
- ^[102] <http://web.archive.org/web/19961227062541/http://www3.whitehouse.gov/>
- ^[103] <http://web.archive.org/web/19981202165238/www.whitehouse.gov/WH/Welcome-nt.html>

- [104] <http://web.archive.org/web/20000815194610/http://www.whitehouse.gov/index.html>
- [105] String which identifies the browser to the web server, often used to restrict certain browsers from accessing websites or for delivering different content to specific browser(s) versus the default content.
- [106] JavaScript is a popular scripting technology for making dynamic webpages.
- [107] <http://web.archive.org/web/20010224174157/http://www.whitehouse.gov/>
- [108] <http://web.archive.org/web/20010712205609/http://www.whitehouse.gov/>
- [109] <http://web.archive.org/web/20010913035103/http://www.whitehouse.gov/>
- [110] <http://web.archive.org/web/20060919223906/http://www.whitehouse.gov/index.html>
- [111] <http://www.whitehouse.gov/> (February 5, 2007)
- [112] About this site, what's new, and intra-website search
- [113] Tiller EW, Green P. "How to make your website fast and usable"
- [114] <http://web.archive.org/web/19961102063843/http://www.dol.gov/>
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- [122] <http://www.usdoj.gov>
- [123] <http://www.w3.org/Style/CSS/#browsers>
- [124] <http://www.quirksmode.org/css/quirksmode.html>
- [125] <http://www.webstandards.org/action/acid2/guide/>
- [126] <http://web.archive.org/web/19970613172422/http://www.ssa.gov/>
- [127] <http://web.archive.org/web/19981212033011/http://www.ssa.gov/>
- [128] <http://web.archive.org/web/19990222110700/http://ssa.gov/>
- [129] <http://web.archive.org/web/20020525083639/http://www.ssa.gov/>
- [130] <http://web.archive.org/web/20010620235538/http://www.ssa.gov/>
- [131] <http://web.archive.org/web/20030217082606/http://www.ssa.gov/>
- [132] <http://web.archive.org/web/20030425213422/http://www.ssa.gov/>
- [133] www.ssa.gov
- [134] <http://web.archive.org/web/19981205084904/http://www.medicare.gov/>
- [135] <http://web.archive.org/web/20000510060417/http://www.medicare.gov/>

[136] <http://www.medicare.gov>

[137] *Accessibility Keys are a programmed shortcuts for document navigation consisting of ALT+ on most windows browsers (Firefox 2.0 uses SHIFT+ALT+) and CMD+ on Safari.*

[138] <http://www.webaim.org/resources/shortcuts/jaws.php>

[139] <http://www.webaim.org/techniques/screenreader/#headings>

[140] <http://web.archive.org/web/20021023165758/http://www.disabilityinfo.gov/>

[141] <http://web.archive.org/web/20040322071028/www.disabilityinfo.gov/>

[142] <http://www.diabilityinfo.gov>