

Web Accessibility and Usability of the Homepages from Academy of Human Resource Development Members' Institutions

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Human resource development programs in various institutions communicate with their constituencies including persons with disabilities through websites. Web sites need to be accessible for legal, economic and ethical reasons. We used an automated web usability evaluation tool, aDesigner, to evaluate 205 home pages from the organizations of AHRD members. We found that there were large numbers of usability barriers to persons with disabilities existing on these homepages.

Keywords: Web Evaluation, Web Accessibility, Web Usability

The host institutions of the members of the Academy of Human Resource Development (AHRD) have to communicate with a diverse group of people. Some institutions provide degree programs and must recruit students while others are stand alone for profit businesses that seek clients and others serve as a department within a larger organization whose communication requirements may be primarily internal. Regardless of the orientation, information related to the mission, purpose, and scope of service as well as requirements for admission or access, applicable fees, outcomes and other information is made available to a wide audience. Traditionally, communication has taken place through face to face contacts, print materials, television or other audio-visual formats. With the development of the Internet and the World Wide Web, AHRD members' host institutions have developed webpages as another medium of communication. The type of information and the purpose of communication have not changed, but rather the medium. Because these webpages are available for viewing by the public or employees, who may have a disability, the institution needs to develop and maintain an accessible website.

The reasons for establishing and maintaining an accessible webpage are threefold: legal, economic and ethical. Legally, the Americans with Disabilities Act (ADA) and if the institution receives Federal funds, has a Federal contract or conducts interstate commerce, Section 508 of the Rehabilitation Act of 1973 generally require organizations to "provide qualified individuals with disabilities equal access to their programs, services, or activities, unless doing so would fundamentally alter the nature of their programs, services, or activities or would impose an undue burden" (US Department of Justice, 2003, p. 1). General access applies to webpages. Economically, the business case is articulated by Yonaitis (2002) when he suggests; build an audience of potential customers for the website; become a leader in the business; save money—the cost of retrofitting is higher than initial development of an accessible site; and "it is the right thing to do at a minimal cost" (p. 15). Ethically, advocating for access is a fit with the AHRD's *Standards on Ethics and Integrity* (1999) when it states that "HRD professionals accord appropriate respect to the fundamental rights, dignity, and worth of all people" (p. 2). Certainly a fundamental right to access communication via a webpage extends to persons with disabilities.

Background and Significance

Host institutions need to provide accessible webpages for their audiences, including persons with disabilities. Billingsley, Knauss, and Oehlers (2002) stated that the issue of website accessibility for people with disabilities "is becoming as important as architectural accessibility" (p. 66). Persons with disabilities often use various devices or assistive technology (AT) such as screen reading programs with speech output or text magnification, modified workstations, mouse alternatives, one-handed keyboards or voice input systems to access webpages (Center for Assistive Technology and Environmental Access, 2007). During the formative years of the Internet, AT for persons with disabilities worked fairly well. However, the Web has quickly developed from a primarily text based medium to a platform laden with multimedia and demanding interactions. This poses a challenge to web users with disabilities, especially those who are blind or have low vision (US Department of Justice, 2000). They need to rely not only on the assistive technologies but also accessible content from web developers. Web content accessibility involves providing the information on the webpage to all users, especially persons with disabilities.

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Evaluation Tools

There are several different website evaluation guidelines and tools (World Wide Web Consortium, 2007b). Many website accessibility evaluations have used Watchfire Bobby, which is an on-line evaluation tool, to detect violations of Web Content Accessibility Guidelines (WCAG) (Center for Applied Special Technology, 2006). The World Wide Web Consortium (W3C) is an international organization that also develops standards for the Web and Web related technologies, including accessibility (World Wide Web Consortium, 2007a). The two principles that guide Web accessibility criteria are these: websites should be able to transform gracefully across various devices, e.g., from computer screen to screen reading assistive technology, and they should be understandable and navigable. Based on these two principles, W3C recommends 14 general guidelines with 66 associated specific checkpoints for evaluating a website's level of accessibility. The W3C published the first version of the WCAG in 1999 (World Wide Web Consortium, 1999). Section 508 of the Rehabilitation Act of 1973 (amended 1998) also contains 16 technical rules for website construction, which were incorporated in the WCAG and W3W evaluations.

The aDesigner is an evaluation tool that Web authors can use to ensure that the webpages they create are accessible to individuals who are blind or visually impaired (Fukuda, Saito, Takagi, & Asakawa, 2005; Takagi, Asakawa, Fukuda, & Maeda, 2004). Voice browsers, such as IBM Home Page Reader, or screen readers, such as JAWS, read aloud the text on Web pages and are used by people with visual impairments. These devices have reduced effectiveness with certain types of content, including highly graphical material, which is difficult for Web content developers to test the accessibility and usability of their webpages. aDesigner is a tool for the web content developer to inspect visually the accessibility and usability of webpages for individuals who are blind or have low vision. The tool also checks the page's compliance with accessibility guidelines including WCAG and section 508. More importantly, aDesigner looks at such usability elements as the degree of color contrast on the page, the ability of the user to change the font size, the appropriateness of alternate text for images, time to reach the end of the webpage and the availability of links in the page to promote navigability. The result of this analysis is a report that lists the problems that would prevent accessibility and usability by users with visual impairments. In addition, each page is given an overall score so evaluators can compare the level of accessibility and usability of different webpages. With this information, Web content developers receive immediate feedback and can make the necessary modifications to address identified obstacles before the content is published.

To assist web developers with an evaluation of the webpages they created, aDesigner provides three usability-oriented features. First is *Visualization and Simulation*, which helps the web page developers to visualize the problems the webpage may present to users who are blind or have low vision. These are:

- Blind usability visualization: the aDesigner has a mode to simulate the problems a person who is blind using screen readers may encounter when reading a webpage. Such visualization includes syntax check, existence of navigation shortcuts for screen readers, and the organization of various elements on a webpage (see Figure 1); and
- Low vision simulation: the aDesigner simulates the perceived webpage from the eyes of a web user with low vision (see Figure 2). The elements included in low vision simulation are color contrast between the text and background and color used in images.

The blind usability visualization of aDesigner gives 100 point scores on three dimensions: compliance, listenability and navigability. Compliance indicates the extent to which the homepage is compliant with published standards. Listenability indicates how easy the website is for persons who are blind that use a screen reader. Navigability quantifies the extent to which a screen reader is able to navigate intra- and inter- webpages. Both blind usability visualization and low vision simulation of aDesigner provide a three star ranking system: 0 star means bad; 1 star means poor; 2 stars means good; and 3 stars means excellent. If the webpage has a compliance error, the rating is no star (bad). If the web page does not have a compliance error and the scores of each evaluation metrics are greater than 90, the rating is 3 stars (excellent). If the scores of each evaluation metrics are between 80 and 100 the rating is 2 stars (good). If the scores of each evaluation metrics are between 60 and 79, the rating is 1 star. All other conditions will be evaluated as no star (bad).

The second feature is *Automatic Accessibility Guideline Checking*, in which aDesigner examines the compliance of webpages with various guidelines. These guidelines include: 1) Web Content Accessibility Guidelines from W3C; 2) Section 508 of the Rehabilitation Act; 3) Japanese Industrial Standard (JIS) X8341-3; and 4) IBM Web Accessibility Checklist. The third feature is *Usability Checking for Specific User Groups*, which involves the use of heuristics to assess the level of webpage usability that was previously evaluated manually. For people who are blind, aDesigner examines inappropriate image ALT attributes (e.g., "spacer") and reach time to each element. For users who have low vision, aDesigner examines fixed-size font and image color problems. When the evaluation is complete, aDesigner provides an overall rating (see Figure 3).



Figure 1. Simulation of a News Website for a Person who is Blind



Figure 2. Simulation of a Newspaper Website for a Person with Low Vision.

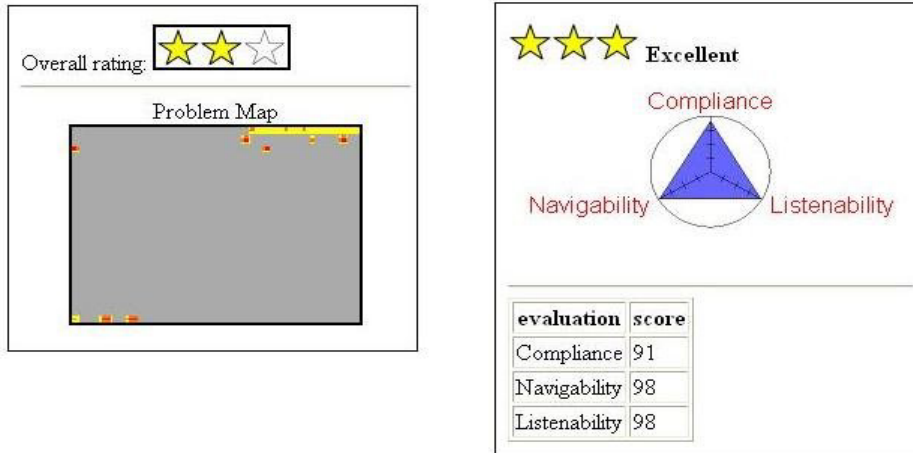


Figure 3. Examples of the Overall rating pane in the low vision mode (left) and in the blind mode (right)

Website Evaluations

There has not been an evaluation of HRD host institution web sites. However, there have been evaluations of other institutional sites including state and federal government, libraries, colleges and universities. These evaluations may serve as a context for our evaluation.

Jackson-Sanborn, Odess-Harnish and Warren (2002) six categories that included 100 college sites that were selected based on the most frequently visited sites and 100 randomly selected Federal government sites. Using the evaluation tool Bobby, they found that 60% of the government sites passed and that 43% of the colleges passed with out priority one errors. West (2006) conducted a comprehensive longitudinal study, *State and Federal E-Government in the United States*, that evaluated 1620 websites (1559 state government, 48 federal government and executive sites and 13 federal court sites) for a variety of factors, including access for persons with disabilities. West found an increase of about 3% per year in the number of accessible state government websites from 33% in 2003 to 43% in 2006. Gant and Gant (2002) conducted a study of 50 state government Web portals, using four dimensions, customization, openness, transparency and usability (accessibility was part of usability), as a framework for analysis. They found that 34 states had accessible websites and 16 failed to provide reasonable access. Schmetzke (2001) evaluated the accessibility of 1051 community college websites and found that 29% of the pages were free of access barriers. An evaluation of webpages of 51 liberal arts colleges and universities nationally ranked by the U.S. News and World Report yielded only three (6%) of the schools passed the accessibility evaluation (Irwin & Gerke, 2004).

In a related area, considerable attention has been paid to the accessibility of library websites. One source of information was found at the Web Accessibility Survey Site that is maintained by the University of Wisconsin-Stevens Point's (UW-SP) library. Alex Schmetzke, librarian, has collected and posted information on 108 surveys, evaluations and related information of mostly library websites (Schmetzke, 2006). For example, one review posted on UW-SP of 19 research studies on library-related web access, Schmetzke (2002) found that accessibility ranged from 19% to 75% with accessibility higher at university libraries than public ones. We reviewed 26 surveys from the UW-SP list and found no library or institution website was completely accessible.

Similar results were found in an evaluation of 89 special education websites: only 27% were accessible and the remaining 73% were found to have problems though the authors noted that most of the errors were readily solvable (Flowers, Bray, & Algozzine, 1999). Ritchie & Blanck (2003) evaluated 200 Centers for Independent Living (CIL) websites and found that only 46% of the 199 sites that generated a Bobby report passed.

Finally, Hackett, Parmanto, & Zeng (2005) examined the relationship between accessibility and complexity for the years 1997-2002 by conducting a retrospective analysis of general and government websites. Their findings indicate that as websites became more complex, they became less accessible. Additionally, they found that government websites could increase in complexity and still maintain good accessibility by limiting the number of scripts in the web design. None of the websites in the study were able to maintain zero violations of Web

accessibility standards, that is to have perfect accessibility. Clearly, these studies demonstrate that persons with disabilities have problems accessing the web.

Purpose

The purpose of this evaluation therefore was to evaluate the level of accessibility for persons with disabilities of the home pages of host institutions of HRD programs or services. We totally understand that members of AHRD may not have controls of web design at their institution. Our intention is to bring the awareness of web accessibility to AHRD members and consequently to their home institutions. Questions that directed the study were these: 1) What is the current status of the accessibility and usability of websites from AHRD members' home organization? and 2) Is there any difference between different types of organizations (i.e., government, business, education and non-commercial organizations)?

Methods

Sample

We obtained the list of current members from AHRD 2007 conference proceedings. The list contains the contact information of 651 members registered to the AHRD international conference of the year. We excluded 171 members from outside United States. We also deleted 21 members from the list due to untraceable contact information or no functioning website for their home organization. We identified 205 unique organizations from the rest of the members. We only selected the topmost organizations as the members' home organization. For example, if there were two members from two different departments within the same institution, only the institutional site was selected. The reason for selection of the institution's home page was because web users, especially first time users, typically visit individual departments from the links on the homepage of the host institution. Based on the postfixes of the URL (Universal Resource Locator), we assigned the organizations into four categories: 1) government (with .gov or state within the URL); 2) Business (.com as the postfix); 3) education (.edu as the postfix); and 4) non commercial organization (with .org in the postfix). All the websites were retrieved in July and August in 2007.

Assessment

We used aDesigner to assess automatically the web content accessibility and usability of the homepages. Each homepage was evaluated using the blind visualization and low vision simulation. The scores for compliance, navigability and listenability of each homepage in the blind visualization were recorded. We also recorded total level of web accessibility and usability that are represented as number of stars (three stars: excellent; two stars: good; one star: satisfactory; no star: unsatisfactory). The number of stars was also recorded in the low vision simulation. There is no point system used in the low vision simulation.

Analysis

Descriptive statistics were performed on each recorded variable. Means of the three continuous variables (navigability, listenability, and compliance) were calculated for each organization category. The frequencies of the ordinal variable (number of stars) were also calculated for each organization category. SPSS 15.0 was used to calculate all the statistics.

Results

There are 205 unique organizations included in our sample. Among them, 55 are for profit companies, 6 are government websites, and 22 are non-for-profit organizations. The majority of the websites (122) are from universities. This is in line with the member compositions of AHRD.

The mean scores for compliance, listenability and navigability are 84.47, 84.14 and 83.60 respectively. The frequencies for the four levels of satisfactory are 162 (74.3) of the websites earned no star, 3 with one star, 11 with two stars and 29 with the maximum three stars. From the perspective of low vision overall rating, 34 websites had no star, 37 websites had one star, 59 websites had two stars, and 74 websites had the best rating of three stars.

Table 1 lists average compliance, listenability and navigability scores by organization category. For compliance, government websites received the best score (92.17) and the non commercial organizations received the lowest score (70.68).

Table 1. *Average compliance, listenability and navigability scores by organization category*

Organization Type	Compliance	Listenability	Navigability
Company	81.67	81.47	91.45
Government	92.17	92.00	70.00
Non commercial Organization	70.68	68.86	79.09
University	87.71	87.71	81.55
Total	84.47	84.14	83.60

Table 2 lists the frequency and percentage of each blind visualization satisfactory level for each organizational category. We found that non-commercial organizations have the highest percentage falling in the category of unsatisfactory. They also did not have any organization achieve the three stars level. Overall, almost four fifths of the total organizations scored zero stars. In other words, most of the homepages have at least one type of severe web accessibility or usability violation.

Table 2. *Frequency of blind visualization satisfactory level by organization category*

Satisfactory level	0 star (%)	1 star (%)	2 stars (%)	3 stars (%)	Total
Company	44 (80)	0 (0)	3 (5.4)	8 (14.5)	55
Government	5 (83.3)	0 (0)	0 (0)	1 (16.7)	6
Non-commercial organization	21(95.5)	0 (0)	1 (4.5)	0 (0)	22
University	92 (75.4)	3 (2.5)	7 (5.7)	20 (16.4)	122
Total	162 (79.0)	3 (1.5)	11(5.4)	29 (15.1)	205

We also calculated the frequency of low vision simulation overall rating level (0 to 3 stars) by organizational category (Table 3). Overall, 36.1% of the organization achieved three stars status in low vision simulation. Non-commercial organizations had the best performance in this assessment. Two fifths of the organizations had a three stars status. In addition, only 16.6% of the organizations obtained a zero star status in this assessment.

Table 3. *Frequency of low vision simulation overall rating level by organization category*

Low vision	0 star (%)	1 star (%)	2 stars (%)	3 stars (%)	Total
Company	10 (18.2)	10 (18.2)	15 (27.3)	20 (36.3)	55
Government	2 (33.3)	0 (0)	3 (50)	1 (16.7)	6
Non-commercial organization	3 (13.6)	6 (27.3)	4 (18.2)	9 (40.9)	22
University	19 (15.6)	21 (17.2)	38 (31.1)	44 (36.1)	122
Total	34 (16.6)	37 (18.0)	60 (29.3)	74 (36.1)	205

Discussion and Next Steps

We conducted the study to introduce and promote the concepts of web accessibility and usability within the community of human resource development. Overall, only 15.1% of the organizations we evaluated achieved the excellent level in blind user simulation and 36.1% of them achieved the same level in low vision visualization. Web design for persons with disabilities is apparently still in a dire situation despite the various standards and regulations in place. The existence of these barriers may be attributed to many reasons such as lack of training, tools, understanding, or awareness.

We compared the usability scores across various categories of the home organizations of AHRD members. One surprise finding is that the non-commercial organizations consistently scored near the bottom on each usability

measurement. Its compliance with the accessibility guidelines and listenability scores are the lowest among all the organizations and the navigability score is the second lowest. The frequency distribution of blind visualization satisfactory level also supports such observation in the usability scores. Non-commercial organizations may not have a strong incentive or sufficient resources to mitigate the accessibility and usability issues. Many of the non-commercial organizations on the AHRD member list appeared to be small or midsize.

The frequency distribution of low vision overall rating was better than that of blind satisfactory level. More organizations had a three star level in the low vision overall rating and fewer had a zero star score. Although we should be cautious to compare these two different assessments because they measure a different usability subcategory, we can conclude that most of the homepages have more severe barriers for blind users. It might be because website design for low vision users is relatively easier than it is for blind users. The web developers could visualize their websites during the design while it may be hard for them to understand how users who are blind might process the webpages. This is why tools like aDesigner are so important to assist web designers to visualize how a user who is blind may experience the webpage.

There are several limitations of the study. First, because we have an unbalanced sample size of each category (e.g., only six government websites were included), the power of the statistical analysis was limited so we did not perform any inferential statistical analysis when comparing different categories. The difference of the blind visualization satisfactory level and the low vision overall rating might not be statistically significant. Second, we only used the automated tool to evaluate web accessibility and usability. Although it is a necessary first step to improve web accessibility and usability, web designers need to apply various design principles and go through rigorous testing in order to make their website accessible and usable to end users. Relying only on an automated tool might discount such effort.

We expect this study will introduce AHRD members to the issues of web accessibility and usability for better services in human resource development. With increased awareness, AHRD members can then work with their web designers to promote accessibility for persons with disabilities. One topic for discussion may be the use of design principles like those found at usability.gov., which is a federally sponsored web site, that provides a step by step guide to construct “useable and useful Web sites” (US Department of Health and Human Services, 2007). Our next step will be to obtain a more balanced sample size with an equal number of organizations in each category. We will also concentrate not only on the host institution but also on the homepages of the departments that provide HRD.

Accessibility of webpages is clearly an important issue as evidenced by international guidelines (such as the WCAG) laws and legal guidelines in the U.S. (ADA and Section 508). Accessibility provides an opportunity to expand customer base and meet both the letter and spirit of the AHRD ethical standards. It is not sufficient to say access is important: it is time to walk the talk. Specifically, the AHRD website should be accessible. The AHRD score on September 2, 2007 was unsatisfactory for blind user visualization (compliance score=80, listenability=90 and navigability=70) and excellent for low vision simulation (3 stars). Members need to become advocates and request or require websites at the departmental or institutional level be accessible. Accessibility also spills into online courses, podcasts, and other interactions.

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