Are American College Homepages Accessible? Does It Matter?

Robert M. Siegfried[1], Joseph J. DiLallo[2], Patrick J. Breitwieser[2], Merry Christien Enriquez[2], Robert A. Stoll[2]

Department of Mathematics and Computer Science, Adelphi University, Garden City, NY 11530, USA

[1]siegfrie@adelphi.edu

[2]{josephdilallo, patrickbreitwieser, merrychristienenriquez, robertstoll}@mail.adelphi.edu

Abstract **-** *With computational tools becoming more integrated into the education experience, the accessibility of college website homepages is becoming increasingly important for several reasons. Additionally, it has become more important to teach students why and how to create accessible software, including accessible websites. This article presents a first study of the accessibility of approximately 98% of U.S. College homepages. The methodology for assessing the websites and the measurement of accessibility is presented, including experimental results and data on over 3000 sites. Finally, these results are analyzed, some conclusions drawn and some future work is outlined.*

Keywords: Accessibility, World Wide Web, WCAG

1 Introduction

The Internet and the World Wide Web have become increasingly important since the early 1990s. Currently, 72% of the United States population has Internet access [1]. A survey by Netcraft found over 206 million websites as of January 2010 [2]. It is hard to imagine a major corporation, a government agency or a college without its own website.

There has been interest in making the World Wide Web universally accessible for over a decade. The first version of the Web Content and Accessibility Guidelines (WCAG) was released in May 1999 [3] and version 2 was released in December 2008 [4]. There have been several automated tools developed that appear on the World Wide Web Consortium's website [5].

This interest is not just academic; several court cases have been filed against the owners of various websites. However, there has been no clear precedent set obligating a private concern to ensure that its website meets accessibility standards. In February 2006, the National Federation of the Blind (NFB) filed a lawsuit against the Target Corporation over its website (http://target.com), alleging inaccessibility for the blind. There were many issues with Target's website, including difficulties that the blind encountered in navigating the page, the inability of screen readers to read parts of the website (including the weekly specials) and an inability of the blind to match a product with its price [6]. The Target Corporation settled the case after Judge Marilyn Patel ruled that it could be liable under the Americans with Disabilities Act because of "the nexus between its site and its brick and mortar stores [7]." Priceline and Ramada Hotels made the navigation of their websites (http://priceline.com and http://ramada.com, respectively) easier for the blind to navigate as a result of a settlement with the State of New York [8]. Southwest Airlines was able to avoid litigation when U. S. District Court Judge Patricia Seitz ruled that the Americans with Disabilities Act only applied to physical places and not to the Internet [9]. But the Australian Human Rights and Equal Opportunities Commission (HREOC) found that the Sydney Organizing Committee for the Olympic Games (SOCOG) had discriminated against the blind. HREOC ruled that SOCOG had to pay $20,000 AUD to the plaintiff [10]. And Article 21a of the United Nations Convention on the Rights of Persons with Disabilities has been interpreted to include a right to equal access to information on the Internet [11].

Additionally, the Individuals with Disabilities Education Act (IDEA) requires that disabled students must be granted access to educational resources; this has been interpreted to include online resources [12]. And research suggests that disabled people rely on the World Wide Web more than the mainstream population. Bonner [13] states that many people with disabilities find that the Web "makes a difference between living and just existing." Gristock [14] suggested that "often, a computer is a link to the outside world where a disabled person can perform as an equal to a non-disabled person". Thus, ensuring accessibility must become an integral part of web content development from its earliest stages.

Determining the accessibility of college and university websites seems to be a particularly reasonable concern for several reasons. IDEA has generally considered the online sites to be education resources to which the disabled has a legal right to access. And this access is necessary: many professors use their websites to make class materials

available or use services such as Blackboard and Moodle either to support in-class activities or to teach the class online. Erickson et al. found that a majority of community colleges in the United States have important student services online, with many other schools planning to follow suit [15]. And college students tend to be technologically savvy, using computers and the World Wide Web as much as any other demographic group.

Accessibility has become a more pressing concern over the past decade, even in video games [16]. But for the move toward accessible design to succeed, it is imperative that it be taught on the college and university level. This requires that it will be introduced to undergraduates in their computer science curricula and that colleges and universities practice it as well as teach it. For this reason, as well as to satisfy legal obligations under IDEA, it becomes important that college and university websites be accessible to the disabled.

This study is a follow-up to an earlier study of the homepages for all 202 college and university homepages in New York State [17], in which it was determined that the homepages failed to meet basic Priority Level 1 checkpoints specified in the WCAG [3]; these specific requirements ***must*** be met for a web page or one or more groups of users may be unable to use the site [18]. This study looks at 3117 United States college and university homepages using the software described in the earlier study as well as a manual examination of a sample of 261 of these homepages.

The accessibility was limited to homepages because they are the gateway through which most people enter a website. They are usually representative of the design used throughout a college's website, usually employing the same overall design and the same style sheets as the rest of the website. Lazar et al. made this same choice because the homepage "reflects more on the organization than any other page." Similarly, if there is an accessibility problem on the homepage, a disabled user will rarely be able to access content on other pages of the website [18].

The WCAG version 1 remains the most common standard for determining the accessibility of websites. It is organized into fourteen guidelines, each of which is divided into various checkpoints [18]. The definitions of these checkpoints explain how these guidelines are applied to various web page designs. The checkpoints are categorized and belong to one of three different priority levels:

- Priority level 1 checkpoints must be satisfied or one or more groups of users will be unable to access the page.
- Priority level 2 checkpoints should be satisfied or these groups will have difficulty accessing the page.
- Priority level 3 checkpoints may be satisfied or these groups may experience some difficulty in accessing the page.

Several countries have adapted their own guidelines for web accessibility, including Section 508 of the Rehabilitation Act, which mandates that the websites of all U. S. governmental agencies meet the standards outlined in the law [19]. Similar laws have been passed in Australia [20], Ireland [21] and the United Kingdom [22].

Given the number of studies (see below) performed on the accessibility of websites, one might wonder why there is a need for one more study. While there have been studies conducted on academic websites, few have covered a wide sample of college sites in the United States, few have covered so many, and there has not been such a study over the past few years. Given that two years can seem like a long time on the Internet, the older studies may no longer reflect the current reality.

2 Prior Work

Several earlier studies have examined the accessibility of different selections of web pages over the past several years.

Sullivan and Matson [23] examined 50 popular websites, checking for accessibility and usability. They found that there is a spectrum of accessibility and a weak connection between usability and accessibility. Stowers found that a majority of the 148 federal web pages examined violated accessibility standards [24]. Fagan and Fagan examined state legislature websites and found results similar to Stowers' results while also finding an effort to improve compliance [25].

Lazar et al. analyzed 50 mid-Atlantic homepages and found that IT firms and web designers had the largest number of accessibility issues on their homepages [18]. Jackson-Sanborn et al. looked at education, governmental and shopping sites and found about half of education and governmental sites and none of the shopping sites were accessible [26]. Jaeger evaluated 10 governmental sites to determine their compliance with Section 508 web accessibility requirements. He found that there was a large variation in compliance among the agencies whose websites he examined and that the agencies' perception of their accessibility of their sites was not always accurate [27].

Schmetzke found that only 29% of community college websites examined were free of major barriers [28]. Diaper and Worman [29] found that British university homepages were largely free of accessibility barriers. However, Dey Alexander studied the accessibility of Australian university websites, examining four different web pages on each site in 2003, and found that 98% of the sites failed to comply with Priority Level 1 checkpoints [30]. A follow-up study in 2007 found that all the sites failed to comply, although 7 % of the pages examined did pass these checkpoints. This represents a worsening of accessibility on Australian university homepages over the four year period between

TABLE I
THE RATING SCALE FOR ACCURACY OF IMAGE DESCRIPTIONS

Score	Desciptions	Images in this category (%)
1	Text in the ALT attribute is an accurate description	37.6
2	Text adjacent to the image is an accurate description	5.4
3	Text in the ALT attribute is a somewhat accurate description	5.0
4	Text in the ALT attribute is not an accurate description.	52.1

studies. Kane et al. examined the homepages of the top 100 international universities. The Australian universities had the fewest accessibility errors and the Asian universities had the largest number of such problems [31].

An examination of the literature did not reveal any other studies of the accessibility of college websites within the past two years.

3 Methodology

This study used an accessibility evaluation tool under development called WAAP (Web Accessibility Audit Program) which is previously described [17]. It reads a list of URLs and the names of these pages from an input file and creates a web accessibility summary for each webpage. It also provides a summary of the data for all the pages examined. The criteria that WAAP uses come primarily from the Web Accessibility Initiative's Quick Tips for Making Accessible Web Content. The Quick Tips "summarize key concepts of accessible Web design" [32]. Most of these concerns involve Priority Level 1 accessibility checkpoints. However, there are Priority Level 2 checkpoints that are addressed by the Ten Quick Tips, and tests for a few additional Priority Level 1 checkpoints were added.

WAAP was used earlier to study the accessibility of 200 of the 202 college homepages in New York State [17]. In the current, more comprehensive, study, a list of 3144 college and university names and homepage URLs was taken from the University of Texas website [33], the most complete list of American colleges that was available. The site contained 27 sites that did not respond to WAAP; their results were excluded from the study.

In addition to the automated tests, two manual tests were performed as well on a sample of 261 homepages chosen at random. These pages were downloaded and saved. In the first test, every image on these pages was labeled and the alternate text in the image tags' alt attribute was examined to see if it was an accurate description of the image. A four-point scale was used and is described in table I. Each page was examined and rated on this scale by two examiners. Where they did not agree, a third examiner served as an arbitrator, choosing which of the two ratings was more correct.

While WAAP checked to see if the pages used a style sheet, determining whether the page was readable without the style sheet required manual inspection. This was done offline after the pages had been saved.

The tests that were described above were all performed to determine whether the homepages conformed to various WCAG checkpoints. But frequently, design concerns can be a large source of frustration. One example of this is when there is a large number of navigation links at the top of the page. This can be extremely frustrating for blind users who may need to have their screen readers work their way through all these links before finding the text that they seek [34]. For this reason, the selected pages were viewed using the text-oriented web browser Lynx on the University's Linux-based system using a standard terminal window using the terminal emulator software PuTTY. The goal was to determine how many screens of titles and navigation links had to be read before the text on that page appeared.

4 Results

The results of WAAP's evaluations appear in Table II. Most accessibility errors involved image tags that had either no ALT attributes or empty ALT attributes. In total, over 71% of the sites had inaccessible images. These percentages here do not add up correctly because many pages had multiple images, where some had no ALT attributes and others had empty ALT attributes. This was the most common accessibility error by a large margin.

Frames and the accessibility errors that can be attributed to them were uncommon; all of the frame-related errors were detected on less than 1% of the pages. This is probably due to the declining popularity of frames. Similarly, image maps without ALT text or with empty ALT attributes accounted for less than 9% of the pages. Also, there were very few problems associated with tables.

Approximately 7% of the pages had no style sheets. This is a potential concern because it may indicate that these pages contain formatting within the HTML tags; this can prevent a user's browser from changing the formatting to make it easier to read. Yet the use of a style sheet by itself does not mean that formatting creates an accessibility barrier. Checkpoint 6.1 requires that a page can be read without the style sheet. Of the 261 pages manually evaluated, 22.3% were not readable without the style sheet, in many cases because of text superimposed on other text.

TABLE II
RESULTS OF WAAP'S EVALUATION

Checkpoint	Description of Test	Test Failures (%)
1.1	***Provide a text equivalent for every non-text element***	
	IMG tag – empty ALT	43.31
	IMG tag – no ALT	51.84
	IMG tag – empty ALT and/or no ALT	71.80
	FRAME tag – empty NAME	0.03
	FRAME tag – no NAME	0.00
	FRAMESET tag – empty TITLE	0.00
	FRAME tag – no TITLE	0.32
	IMG map area tags – empty ALT	1.48
	IMG map area tags – no ALT	7.44
	OBJECT tag – no ALT	22.14
5.1	***For data tables, identify row and column headers***	
	Table HEADER tags – empty ID	0.83
	Table HEADER tags – no ID	2.98
	Table ID tags – empty headers	0.00
	Table ID tags – no headers	1.32
	Tables – missing headers	0.00
6.1	***Organize documents so they may be read without style sheets***	
	No style sheets	6.64
9.1	***Provide client-side image maps instead of server-side image maps except where the regions cannot be defined with an available geometric shape***	
	Server-side image map	0.26
12.1	***Title each frame to facilitate frame identification and navigation***	
	FRAMESET tag – empty title	0.00
	FRAMESET tag – no title	0.32

Of the images manually checked (see Table I), 52.1% did not have alternative text that provided an accurate description of the image; however, 37.6% were described correctly. 5.2% had an accurate description next to the image and 5.0% had a somewhat accurate description in the ALT attribute.

When the pages were viewed using Lynx, the reader had to read through as many as 28 screens before reaching the text of the page. This was unusual; on average, the reader had to read through 2.9 screens before reaching the page's text, which is still a lot of text for the blind to traverse.

5 Discussion

A cursory examination of the data makes it clear that not all errors are equal: the lack of alternative text for images, or the lack of an accurate description of these images, seems to be the most common problem on the homepages that were examined. But they were not the only significant problem that was commonplace: more than one fifth of the homepages examined had objects of one sort or another that lacked alternative text, making it difficult for one class of disabled users or another to make sense of them. And the manner in which style sheets were used – or were not used – make it difficult if not impossible for other users to read the page. These findings coincide with what was found on other studies: Lazar found that checkpoint 1.1 was almost universally violated [18] and Alexander and Rippon found images to be the largest of source of accessibility issues [35].

Are homepages necessarily representative of the rest of a website? In many instances, it is: web designers usually design a common "look and feel" for a website and consequently, the homepage represents this "look and feel" as much as any other webpage, although not necessarily as more so. This type of consistency is frequently enforced by the style sheet, which dictates layout, typeface and other formatting issues that appear on a webpage using that style sheet. But even where the homepage is decidedly different, it is usually the gateway to the rest of the website, as Lazar pointed out. If the homepage is not accessible, it is far less likely that the disabled user will find the other, possibly more accessible pages.

WAAP only tested for 5 of the 17 Priority Level 1 checkpoints for two reasons: (1) the tool is still under development and (2) not all these checkpoints can be

accurately determined by automated tests. There is a fair amount of evidence that indicates that automated testing has severe limitations. Jackson-Sanborn et al. found it the least reliable of six different genres of accessibility testing [26]. Jaeger considered it unreliable enough that he dismissed its use out of hand [27]. Ivory evaluated several tools and found that while they were less effective than skilled web designers in spotting accessibility problems, they picked up errors that humans missed [36]. While there is no reason to believe that there are not other accessibility problems undetected by WAAP, it would be very difficult to collect data from as many homepages without an automated approach. And it is useful in helping novice web designers, such as undergraduates, avoid problems that would otherwise show up on their websites. The number of problems that WAAP spotted on these pages suggests that for all its limitations, there is a purpose to be served by programs such as this.

WCAG version 2 was not formally recommended until December 2008, after most of the current development of the WAAP was completed. Of the checkpoints evaluated by WAAP, only 1.1 is present in approximately the same form in version of the guidelines. A more complete analysis of the new guidelines is necessary.

Compliance with the guidelines does not guarantee that a webpage is completely accessible to the disabled user. Frequently, there are design issues that are not addressed directly by the guidelines that can impede a user's ability to access it. For example, Lazar et al. found that having a large number of navigational links at the top of a webpage is a common source of frustration for blind users [34]. And it is clear that design issues, as well as compliance with the guidelines remains a source of frustration for disabled web surfers.

6 References

[1] International Telecommunication Union, "Internet users per 100 people", *International Telecommunication Union*, 2010. [Online]. Available: http://datafinder.worldbank.org/internet-users?cid=GPD_44. [Accessed: Feb. 19, 2010].

[2] Netcraft Ltd., "January 2010 web server survey", Netcraft, Ltd, .2010. [Online]. Available: http://news.netcraft.com/archives/2010/01/07/january_2010_web_server_survey.html. [Accessed: Feb. 19, 2010].

[3] W3C, "Web content accessibility guidelines 1.0", World Wide Web Consortium, 1999. [Online]. http://www.w3.org/TR/WCAG10. [Accessed: Feb. 19, 2010].

[4] W3C, "Web content accessibility guidelines 2.0", World Wide Web Consortium, 2008. [Online]. http://www.w3.org/TR/WCAG20. [Accessed: Feb. 19, 2010].

[5] W3C, "Complete list of web accessibility evaluation tools", 2006. [Online]. http://www.w3.org/WAI/ER/tools/complete. [Accessed Mar. 1, 2010].

[6] C. Sliwa, "Accessibility issue comes to a head", *Computerworld*, p. 1, May 8, 2006.

[7] L. Parker, "National Federation of the Blind files Target lawsuit", USA *Today*, p. 2A, Oct. 26, 2006.

[8] M. Meyers, "Blind patrons sue Target for site inaccessibility", *CNET News.com*, 2006. [Online]. Available: http://news.com.com/Blind+patrons+sue+Target+for+site+inaccessibility/2100-1030_3-6038123.html. [Accessed Jun. 5, 2009].

[9] D. McCullagh, "Judge: disabilities act doesn't cover web", CNET News, October 21, 2002. [Online]. Available: http://news.cnet.com/2100-1023-962761.html [Accessed: Feb. 19. 2010].

[10] W3C, "A cautionary tale of inaccessibility: Sydney Olympics website", World Wide Web Consortium. [Online]. Available: http://www.w3.org/WAI/bcase/socog-case-study [Accessed: Feb. 19, 2010].

[11] O. Ball and D. Sweeney, "Is your website violating human rights?", in *Activating Human Rights and Peace: Universal Responsibility Conference 2008 Conference Proceedings,* 2008, p. 167-173.

[12] Individuals with Disabilities Education Act Amendments of 1997, Pub. L. 105-17.

[13] P. Bonner, "And Websites for All", *PC Magazine*, p. IP01, May 7, 2002.

[14] M. Gristock, "Accessibility on the web". The International Center for Disability Resource on the Internet, 2003. [Online]. Available: http://www.icdri.org/WebAccess/accessibility_and_web_JKD.htm [Accessed: Feb. 19, 2010].

[15] W. Erickson, S Trerise, C. Lee, S.Van Looy, and S. Bruyère, "Web based student processes at community colleges: Removing barriers to access." Cornell University Employment and Disability Institute, 2007. [Online]. Available: http://digitalcommons.ilr.cornell.edu/edicollect/1241. [Accessed: Feb. 15, 2010].

[16] D. Grammenos, A. Savidis And C. Stephanidis, “Designing universally accessible games”, 2009. ACM Comput. Entertain. 7, 1, Article 8 (February 2009), 29 pages.

[17] J. J. DiLallo and R. M. Siegfried , "The accessibility of college and university homepages in the state of New York", *Journal of Information Systems Applied Research 2(4)*, http://jisar.org/2/4 . *ISSN: 1946-1836*, 2009.

[18] J. Lazar, P. Beere, K.-D. Greenidge and Y. Nagappa, “Web accessibility in the mid-atlantic United States: A study of 50 homepages”, *Universal Access in the Information Society*, Vol. 2 No. 4, p.331-341, 2003.

[19] Section 508. [Online]. Available: http://www.section508.gov/index.cfm?FuseAction=Content&ID=3 [Accessed: Feb. 23, 2010].

[20] Disability Discrimination Act 1992 (Australia). [Online]. Available: http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan004021.pdf . [Accessed: Feb.23, 2010].

[21] Disability Act 2005 (Ireland). [Online]. Available: http://www.oireachtas.ie/documents/bills28/acts/2005/a1405.pdf [Accessed: Feb. 23, 2010].

[22] Disability Discrimination Act 1995 (United Kingdom). [Online]. http://www.statutelaw.gov.uk/content.aspx?activeTextDocId=3330327 [Accessed: Feb. 23, 2010].

[23] T. Sullivan and R. Matson, “Barriers to use: usability and content accessibility on the web’s most popular sites”, *Proceedings on the 2000 conference on Universal Usability* , p.139-144, 2000.

[24] G. Stowers, “The state of federal websites: the pursuit of excellence”. *The PricewaterhouseCoopers Endowment For The Business Of Government*. [Online]. Available: http://www.businessofgovernment.org/pdfs/StowersReport0802.pdf. [Accessed: Mar. 1, 2010].

[25] J. C. Fagan and B. Fagan, “An accessibility study of state legislature websites,” *Government Information Quarterly 21*, p. 65-85, 2004.

[26] E. Jackson-Sanborn, K. Odess-Harnish, and N. Warren, “Website accessibility: a study of six genres”, *Library Hi Tech* Vol. 20 Iss.3, p. 308-317, 2002.

[27] P. T. Jaeger, “Accessing section 508 compliance on federal e-government websites: a multi-method, user-centered evaluation of accessibility for persons with disabilities” *Government Information Quarterly* 23, p. 169-190, 2006.

[28] A. Schmetzke, “Accessibility of the homepages of the nation’s community colleges”, University of Wisconsin, Stevens Point, 2001. [Online]. Available: http://library.uwsp.edu/aschmetz/Accessible/nationwide/CC_Survey2001/summary_CCC.htm. [Accessed Jul. 15, 2008].

[29] D. Diaper and L. Worman, "Two falls out of three in the automated accessibility assessment of world wide websites: A-Prompt v. Bobby", *People and Computers XVII - Designing for Society: Proceedings of HCI 2003*, Eamonn O'Neill, Philippe Palanque, and Peter Johnson, eds., Springer, New York, p. 349-364, 2003.

[30] D. Alexander, “How usable are university websites? a report on a study of the prospective student experience”. In A. Treloar & A. Ellis (Eds.), *AusWeb03: Changing the way we work: Proceedings of AusWeb03*, *the Ninth AustralianWorldWideWeb Conference* (pp. 71-82), 2003. [Online]. Available: http://ausweb.scu.edu.au/aw03/papers/alexander3/paper.html [Accessed: Feb. 23, 2010].

[31] S. K. Kane, J. A. Shulman, and T. J. Shockley and R. E. Ladner, “A web accessibility report card for top international university websites”, *Proceedings of the 2007 international cross-disciplinary conference on Web accessibility (W4A)*, p. 148-156, 2007.

[32] W3C, “WAI quick tips to make accessible websites.” World Wide Web Consortium, 1999. [Online]. Available: http://www.w3.org/WAI /quicktips/. [Accessed: Jun. 7, 2007].

[33] University of Texas at Austin. *U. S. Universities By State*. [Online]. Available: http://www.utexas.edu/world/univ/state/. [Accessed: Jul. 1, 2009].

[34] J. Lazar, A. Allen, J. Kleinman, and C. Malarkey, “What frustrates screen reader users on the web: a study of 100 blind users”, *International Journal of Human – Computer Interaction*, 22(3), p. 247-269, 2007.

[35] D. Alexander and S. Rippon, “University website accessibility revisited”, Proceedings of AusWeb07, 2007. [Online]. Available: http://ausweb.scu.edu.au/aw07/papers/refereed/alexander/paper.html. [Accessed: Feb. 16, 2010].

[36] M. Y. Ivory and A. Chevalier, “A study of automated website evaluation tools”, *Technical Report UW-CSE-02-10-01*, 2002. [Online]. Available: ftp://ftp.cs.washington.edu/tr/2002/10/UW-CSE-02-10-01.pdf [Accessed: Feb. 4, 2010].