Library Hi Tech

Emerald Article: Web accessibility at university libraries and library schools

Axel Schmetzke

Other articles

Web accessibility at university libraries and library schools

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Abstract

The Americans with Disabilities Act (ADA) mandates that library programs and services must be accessible to people with disabilities. In an era in which much information resides in digitalized form on the WWW, the ADA's mandate must be interpreted as applying not only to physical space but also to cyberspace. Just as in the physical world, proper design is a crucial issue. Only accessibly designed Web pages ensure that all people, including those with print disabilities, have access to Web-based information. Previous studies indicate that a large proportion of campus and university library Web pages are not accessible. This study looks at the universities that, according to *US News & World Report*, have the nation's 24 most highly ranked schools of library and information science (SLIS). The findings give cause for concern. It is reasonable to assume that low Web page accessibility at the nation's leading library schools reflects a lack of awareness about this issue among the leaders and trainers in the library profession.

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Introduction

About 20 per cent of the US population, some 54 million individuals, have some level of disability. For 26 million Americans, the disability is severe (McNeil, 1997). In 1997-1998, an estimated 428,280 students with disabilities were enrolled at two- and four-year postsecondary educational institutions (Lewis and Farris, 1999). Enrollment figures for people with the types of disabilities particularly pertinent in the context of this article vary from study to study: 29-46 per cent of people with disabilities have a learning disability, 4-16 per cent are blind or visually impaired, and 14-23 per cent have mobility or orthopedic impairments (Horn and Berktold, 1999; Lewis and Farris, 1999). Despite recent increases in enrollment, people with disabilities are underrepresented in postsecondary education. Longitudinal data indicate that those with high-school diplomas are less likely to enroll in public four-year colleges, and that those who do enroll are less likely to graduate (Horn and Berktold, 1999). As Gadbow and Du Bois (1998) point out, the large majority of people under the age of 65 have the intellectual capacity to succeed in postsecondary education, yet most have not attended institutions of higher learning.

With close to half a million students with disabilities enrolled in US colleges, and with many more that could benefit from postsecondary schooling, accessibility to campus and library resources is an important issue. Prodded by landmark laws such as Section 504 of the Rehabilitation Act of 1973, and the 1990 Americans with Disabilities Act (ADA, 1990), institutions of higher learning have worked hard to make their campuses physically accessible. Architectural barriers have been removed, assistive technology provided to those in need, and a broad range of accommodations put in place where deemed reasonable. The burgeoning library literature on the ADA in the early 1990s (Mendle, 1995) reflects the vigor with which the library community sought to comply with this new law.

Recent developments in telecommunication – particularly the coming of age of the Internet – have had a strong impact on our universities, including our university libraries. Over the past decade, the way information is disseminated in

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the campus environment has undergone drastic changes. Increasingly, print-based information is being substituted with its digital equivalent. Today, the Web, along with e-mail, provides the main, if not the sole, channel for a variety of education-supporting resources: official campus Web pages with crucial administrative information, class syllabi, course readings, and Web-mediated distance education programs. In the midst of this digital revolution, libraries, whose purpose is to store and provide access to information, are the most affected. The shift from the physical to the virtual permeates almost any aspect of its operation. There is hardly a single library resource category that has not shifted, to at least some extent, to a digitized, Web-based format. Online catalogs, indexes and full-text article databases, encyclopedias and other reference works, reserve materials as well as information about the library itself (schedules, people contacts, library tutorials, and help screen) are now commonly accessed through library Web sites.

With the growing importance of digitized, Web-based information, the issue of access to information is no longer limited to the physical realm. Just as there are enabling and disabling conditions in the physical environment, so are there conditions in cyberspace (particularly the Web) that result in the inclusion or exclusion of people. To some extent, the ability to access Web-based information is a question of the proper assistive technology, such as a modified computer keyboard, an enlarged screen display, or a properly configured screen-reading program. But assistive technology alone cannot overcome the barriers that are created at a more basic level: the format in which content is presented. If not properly formatted, or designed, Web pages are not accessible to people with certain disabilities – no matter how much assistive technology they may have.

The shift towards electronic information presents tremendous opportunities for a large segment of people with disabilities – those with "print disabilities" (Coombs, 2000). With the help of screen readers, digitized text is, at least potentially, accessible to those who are unable to see print or who have difficulty reading it: people who are blind or visually impaired and people with certain learning disabilities (Mace, 1996; Sreenivasan, 1996). With suitably accommodated input devices, many individuals who cannot hold books or turn pages because of motor impairments are able to navigate through pages and pages of electronic text. Ironically, the very technology that has opened the doors to unprecedented access is now at risk of closing them again. With the evolution of the World Wide Web into a complex and glamorous multimedia entity, designers, who are often ignorant of principles of accessible design, are likely to create access barriers that are insurmountable even with the most sophisticated screen reader, and that leave people with print disabilities stranded. As Courtney Deines-Jones (1996) puts it:

> ... [m]any multimedia sites ... are nightmares. Setting up a home page is quite simple, and many developers were so impressed with the visual possibilities that they built in pretty wallpaper, fancy fonts, and audiovisual clips galore. People with disabilities quickly realized that many of these sites were difficult, if not impossible, to negotiate (pp. 61-62).

In 1994, the World Wide Web Consortium (W3C), an international standard-setting industry body, was founded to develop common protocols for the evolution of the Web. In 1996, this group sponsored the Web Accessibility Initiative (WAI). The guidelines and checklist developed by this group reflect the input of many players and must be considered to be the most authoritative source on the subject[1,2]. Its "Quick Tips", which introduce the key concepts of accessible design, include, among others, the following recommendations: use the ALT tag to describe the function of images and animations; use client-side image maps and provide text for hot-spots; for hypertext, use text that is meaningful by itself; use headers, lists, and consistent page organization; summarize graphs and charts, or use the LONGDESC attribute; give meaningful titles to frames, and use NOFRAMES[3].

Legal mandate for accessible Web design

Of the different federal civil-rights statutes that have some bearing on electronic and information technology, Section 508 of the Rehabilitation Act Amendments of 1998 and the Americans with Disabilities Act (ADA) of

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1990 are likely to be the most relevant. Section 508 requires federal agencies to implement guidelines for procuring, developing, maintaining and using information technology that is accessible to people with disabilities. Included in Section 508 is a mandate for accessible Web site design. As of this writing, it is unclear to which extent, if any, Section 508 may reach beyond federal agencies and may affect states and, possibly, educational institutions. While Section 508 speaks about "requirements for Federal department and agencies"[4], the US Department of Education asserts that "states which receive Federal funds under the Technology Related Assistance for Individuals with Disabilities Act of 1988, are required by that Act to comply with Section 508"[5].

Title II of the ADA (1990), which applies to public entities, requires that universities make their programs and facilities – and this includes information technology – accessible to people with disabilities by stipulating, in general terms, that:

> . . . no qualified individual with a disability shall, by reason of such disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any such entity (Section 202).

Other sections of the ADA, including those that apply to the private sector, include requirements for "effective communication", "reasonable accommodations" and "auxiliary aids and services".

When Congress passed the ADA in 1990, the World Wide Web, as we know it today, did not exist. Most electronic information existed in text format, which is easily read with screen readers. The potential barriers created by poor Web design were certainly beyond the horizon of legislators and federal administrators. Thus, it does not come as a surprise that the ADA, while mandating equal access to an institution's resources and while recognizing auxiliary aids and services as necessary means to make communication effective for all people, does not specifically address the design of electronic documents themselves.

In September 1996, the Civil Rights Division of the Department of Justice (DOJ) issued an opinion statement (letter no. 204) which directly addressed the issue of Web accessibility. States and local governments as well as places of public accommodation are required to:

> . . . provide effective communication, regardless of whether they generally communicate through print media, audio media, or computerized media such as the Internet. Covered entities that use the Internet for communications regarding their programs, goods, or services must be prepared to offer those communications through accessible means as well[6].

The letter then points out several means of ensuring Web page accessibility, including Lynx-compatible design and the provision of alternative text for information presented in a graphical format. Some people have criticized the DOJ for not taking a more adamant, proactive stance and for failing to provide guidance on Web accessibility (see Waddell, 1999). Also, despite the DOJ opinion statement, some controversy remains as to whether the ADA should apply to Web site design (Committee on the Judiciary, 2000).

Perhaps the strongest support for the ADA's applicability to accessible Web design is provided by the US Department of Education, California Office of Civil Rights (OCR), in its letters issued in connection with a statewide ADA compliance review involving Californian colleges. Particular instructive are the letters addressed to the Chancellor of California Community Colleges. One of the major concerns addressed in these letters pertains to the acquisition of technology and expansion into distance education, including the Internet. The OCR criticizes that the practice of providing more and more information electronically, through the Internet or campus LANs, is often not accompanied by considerations for the barrier-free design of Web pages that contain the information. As a remedy, the OCR suggests the development of access guidelines for distance learning and campus Web pages:

> If guidelines to ensure access are made available to colleges now, such information on how to structure distance learning programs and campus WebPages will not only ensure that colleges meet their legal obligations but will also enable colleges to save significant expense over the later cost of "retrofitting" these programs after substantial investment has been made in inaccessible structures[7].

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Many, if not most, institutions of higher education have developed Web policies for their campuses. However, little is known about how many of these include accessible Web guidelines. If my extensive Web search is any indication, accessible Web design guidelines or policies are, at the present, the exception rather than the rule. Campuses with accessible Web policies include San Jose State University, MIT, Regis University, California Community Colleges and the University of Wisconsin. "San Jose State University World Wide Web Policies and Guidelines", drafted two years ago, recommend that "Webmasters phase in access as soon as possible, especially as Web pages are revised and redesigned"[8]. MIT's policy, noticeably stronger in tone, requires that "all Web pages associated with administration and services, courses of instruction, departmental programs, and institute sponsored activities, *must* conform to the Web accessibility principles" (emphasis added)[9]. Similarly, Regis University's "Web Accessibility Policy" emphasizes principles of universal design and mandates that all Web pages associated with the institution must conform to its Web accessibility guidelines[10]. California Community Colleges' recent "Guidelines for producing instructional and other printed materials in alternate media for persons with disabilities", contain a section that deals specifically with "Considerations for formatting e-text and designing software and Webpages"[11]. The University of Wisconsin system operates under the recommendations developed by its Committee on Access to Technology for Individuals with Disabilities, and three of its campuses (UW-Madison, UW-Whitewater and UW-Stevens Point) have put in place their own ADA-compliant Web design policies[12].

To the extent that the findings in a recent survey involving predominantly smaller college and university libraries can be generalized to all types of libraries, accessibility guidelines are not likely to be included in library Web policies: while about half of the responding libraries reported having Web policies or guidelines in place, none of the guidelines, standards and policy manuals submitted specifically address the need for barrier-free design. "The use/standardization of headers and footers, navigational elements, data files updated, format/type of information to include, [and] indication of page authorship" were reported to be the most typical design and content issues addressed (Traw, 2000, p. 4). A thorough Web search confirms the above survey results. Yale University Library's guidelines on "Services for persons with disabilities", which include several pages on Web accessibility, along with its concomitant policy that calls for compliance with the W3C Web Accessibility (WAI) Guidelines, stand out as a clear exception [13,14].

Literature review

The concept of barrier-free, or universal, design has been around for at least several decades; to varying degrees, it has become codified in various building guidelines and regulations[15]. Its original focus – the removal of architectural barriers preventing wheelchair users from entering buildings and using their physical facilities – has evolved over the years into the broader notion of universal design which extends into all design disciplines (architecture, exterior and interior design, product development, and communications) and which seeks to design environmental elements in such a way that they work well for all people.

> Universal design attempts to meet the needs of all people, and includes those of all ages, physical abilities, sensory abilities, and cognitive skills. Universal design is the design methodology most appropriate for a true democracy, since it includes all types of people in the design process. Even though the resultant product may not be usable by absolutely everyone, they are usable by as many people as possible. Abilities are emphasized, and disabilities are de-emphasized. A single solution instead of multiple ones is the goal (Anders and Fechtner, 1992, p. 10).

While the notion of universal design has been discussed extensively in the architectural and exterior/interior design literature (Branson, 1991; Lebovich, 1993; Peloquin, 1994; Wilkoff and Abed, 1994), its application to the electronic environment was, until a few years ago, rarely addressed in traditional print media. Instead, the theme was mainly carried by a rather tightly knit network of dedicated people who gathered at disability- and Web-related conferences and shared their insights in form of

presentations, white papers and Web-posted articles. At the 1995 WWW4 conference, for example, papers on topics such as "Making the Web accessible for the blind and visually impaired" and "World Wide Web accessibility for people with disabilities. A usability perspective" were presented[16]. Papers delivered in 1996 at the 11th Annual Technology and Persons with Disabilities Conference, sponsored by the Center on Disability at the California State University-Northridge (CSUN), included the following topics: "Design considerations for software and Web pages to allow access for people with physical disabilities", "Libraries without walls", "Accessing the World Wide Web (WWW) for people who are not sighted", "Accessibility to the electronic highway: government policy and the right of all Americans to communicate" and "Increasing access to World Wide Web sites for blind and visually impaired computer users".

With a few exceptions (e.g. Brittain, 1995), accessible Web design did not begin to receive coverage as a theme in the library literature until five years ago. While numerous authors addressed the question of access to electronic resources by people with disabilities, their focus was mainly on adaptive technology (e.g. Roatch, 1992; Lazzaro, 1993; Lucas Walling and Irwin, 1995), not on design-related accessibility of content. This is not particularly surprising. After all, the pre-Web electronic environment was mainly text-based and did not pose the design issues associated with Web pages. It must be noted, though, that after the Web had gained some momentum the library literature dealing specifically with Web design, with a few exceptions (e.g. Metz and Junion-Metz, 1996), did not address the issue of accessible design. For example, Kovacs and Kovacs (1997), in their *Cybrarian's Guide to Developing Successful Internet Programs and Services*, expressed concern for access issues mainly in terms of Internet connectivity. When they urged the reader to consider for whom the information is provided, they did not think of people with various abilities, but of end users with a "particular level of Internet connectivity" for which the provision of highly graphical information may, or may not, be suitable. Another case in point is Garlock and Piontek's (1996) book entitled, *Building the Service-Based Library Web Site*. Nowhere in this manual were people with disabilities considered as potential users. Published by the American Library Association, this book is likely to have influenced the design of many library Web sites.

Starting in 1996, accessible Web design emerged as an issue in the professional library literature. A trail-blazing special issue, co-published by *Library Hi Tech* and *Information Technology and Disabilities* and dedicated to "libraries and the empowerment of persons with disabilities", covered in much depth the subject of access to digital information sources. Dixon's (1996) article, in particular, focuses on the creation of accessible Web pages. Paciello (1996a, 1996b), who was instrumental in launching the W3C's Web Accessibility Initiative, published two articles on accessible Web design in *Florida Libraries*. Two articles in *Choice* addressed the need to design libraries for accessibility and spelled out major principles of universal Web design (Burgstahler *et al.*, 1997; Fraser *et al.*, 1998). In 1997, Oryx Press published, *Information Access and Adaptive Technology* (Cunningham and Coombs). Chapter 11 included a detailed discussion of the Web-access problems faced by people with disabilities, as well as guidelines for accessible design. *The Chronicle of Higher Education*, widely read in all academic circles, included an article that stressed the similarity between physical access hurdles and barriers imposed by poorly designed Web pages (Young, 1998). The past two years have seen a noticeable increase in library-related journal publications that seek to raise awareness concerning the need for accessible Web design and provide practical tips (e.g. Kautzman, 1998; Casey, 1999; Rouse, 1999; Hansen, 1999; Minow, 1999; Oppenheimer *et al.*, 1999; Blake, 2000; Jobe, 2000; Grimaldi *et al.*, 1999; Lescher, 2000; Coombs, 2000).

Since 1999, the American Library Association (ALA) has published several works that emphasize accessible Web design: McNulty's (1999) book, entitled *Accessible Libraries on Campus. A Practical Guide for the Creation of Disability-friendly Libraries*, which includes two articles on the creation of accessible Web design (Dixon, 1999; McNulty and Stedfeld, 1999); Mates' (2000) work, *Adaptive Technology for the Internet: Making Electronic Resources Accessible to All*; and Garlock

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and Piontek's (1999) advanced guide to *Designing Web Interfaces to Library Services and Resources*, which, unlike the authors' earlier publication in 1996, now includes a chapter on accessible design. Recently, the ALA also took over the distribution of a multimedia package containing presentation materials on "Universal access: electronic resources in libraries", prepared by Burgstahler *et al.* (1996) for the DO-IT project (Disabilities, Opportunities, Internetworking, Technology).

Web page accessibility research

It appears that the gradually emerging awareness about the need for accessible Web design, as reflected in the recent library literature, has not yet manifested itself in the actual design of library Web pages. Schmetzke (1999), who studied the Web accessibility of campus and library Web pages at the 13 four-year campuses within the University of Wisconsin system, found that, on the average, only 31 per cent of the libraries' top level pages (homepages plus the next layer of library pages linked to them) were free of major accessibility problems. A follow-up study, a year later, revealed a mild increase in the percentage of accessible pages to 40 per cent (Schmetzke, 2000). The data varied dramatically from campus to campus: at four of the libraries included in the 2000 study, no Web page was free of major accessibility problems; only one library had a Web site with more than 80 per cent of its pages devoid of major access barriers. Examining the colleges and universities on Yahoo's list of "America's 100 most wired colleges", Lilly and Van Fleet (1999) discovered that only 40 per cent of the library home pages were accessible. They reported that two types of errors occurred most frequently: failure to provide alternative text for images and the lack of alternative text for image map hot-spots. Similar results were also revealed by a British study. Craven (2000) reported that 38 of the 103 tested university library home pages received Bobby approval, and that the majority of problems involved missing or inappropriately used alternative text.

Studies on the accessibility of other (non-library) academic Web pages barely paint a rosier picture: Rowland and Smith (1999), who collected accessibility data from a random sample of colleges, universities and online learning institutions from all 50 states (n = 400), found only 22 per cent of the home pages to be accessible. In a follow-up study, Walden *et al.* (2000) focused on Web pages that served as "entry points" for distance-education students. In tune with their previous findings, a mere 24 per cent of these pages were void of access barriers. A study within the University of Wisconsin-Madison revealed that only 38 per cent of the 101 departmental homepages evaluated with Bobby, an automated accessibility checker, were free of accessibility problems. After an additional, more stringent manual assessment, only a mere 14 per cent passed as barrier-free (*Learning Technology and Distance Education*, 2000). Flowers *et al.* (1999), who evaluated the homepages of 89 special-education programs for accessibility, reported that a mere 27 per cent of these did not contain any accessibility problems, and that most of the problems found constituted major access barriers. They also discovered that the vast majority of accessibility errors (83 per cent) were easy to correct. That Web sites cannot be assumed to be accessible simply because of their disability-related content, or because the people who maintain it have disabilities themselves, was further confirmed by two other studies: Rowland (1999) reported that only 45 per cent of University Affiliated Program (UAP) homepages were barrier-free – despite the fact that UAP's mission involves, among others, service, technical assistance and information dissemination to the disability community. Similarly, a study by the National Center for the Dissemination of Disability Research (1998), involving the Web sites of 213 programs funded by this agency, showed that only 43 per cent of the homepages were accessible.

Research focus of this study

The accessibility data available at present indicate that Web sites tend to be fraught with access barriers. At the very best, the average accessibility of Web pages per site was found to be 45 per cent. The findings by Schmetzke (1999; 2000), which show a mild increase in the

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accessibility of Wisconsin's campus libraries, point to the possibility that data that are one or two years old may have outlived their currency. With the rapid changes taking place in Web technology, and with the recent wave of awareness-generating library literature on accessible Web design, Web accessibility in American libraries nationwide may differ from what the data suggested just a year ago.

While currency and nationwide coverage were the initial reasons for this study, other, at least equally important, considerations contributed to its final design: the sites selected for this study were not randomly chosen, but they were taken from the list of campuses with the nation's 24 most highly ranked library schools, as published by *US News & World Report* in its 1999 guide to *America's Best Graduate Schools*. This selection permits a wider, more interesting scope of research questions. Assuming that a library school's Web design reflects awareness about accessibility issues among its faculty, one can gauge what prospective librarians are likely to learn about accessible design, and to which extent they are prone to implement accessible design principles once they have entered the profession. The collection of accessibility data pertaining to both libraries and library schools also makes it possible to examine the current connection between the accessibility of library Web sites and library school Web sites. This said, let me summarize my research questions:

- How accessible are the Web pages of the nation's leading library schools?
- Is there a correlation between library schools' rank and their Web site accessibility?
- How accessible are the Web pages of the major library Web sites on the same campuses?
- Is there a correlation between the Web accessibility of library sites and library school sites?
- Which types of accessibility barriers occur most frequently?

Research methodology

Terminological clarification

In response to recent developments in the realm of information and library science, many of the traditional library schools have redefined their identity and reorganized their linkage to other academic disciplines. While most library schools call themselves "Schools of Library and Information Science", some have adopted new names, such as the "College of Information Science and Technology" at Drexel University and the "School of Communication, Information and Library Studies" at Rutgers University. For for the sake of convenience, I use, in this article, the terms "library school", "school of library and information science" and the latter's acronym "SLIS", interchangeably – no matter what the organizational unit (college, school, department) and the exact name of a particular "library school" may be.

Scope and variables of study

For each of the 24 campuses on the *US News & World Report* list of the nation's most highly ranked library schools, Web page accessibility for both the main library Website and the SLIS Web site was determined with the help of Bobby (further described below). For each site, Bobby was set to check the homepage and the next layer of hyperlinked pages (on the same site) for accessibility errors. Only pages without any major ("priority 1") accessibility problems were rated Bobby-approved. The percentage of Bobby-approved pages was then used as an indicator of a site's overall accessibility. With two sites studied per campus, and with an average of approximately 21 examined pages per site, a total of about 1,013 Web pages were checked by Bobby.

The reason for limiting the scope of tested Web pages to only one link layer down from the homepages was not arbitrary. Bobby could have been easily set to look at all pages within the domain. In that case, some catalog and periodical indexes pages would have been included. In my opinion, this would have been undesirable. While the accessibility of online catalogs and periodical indexes certainly needs to be studied (see further below), this issue would be better investigated separately.

Evaluation tool

Site accessibility was determined with the downloadable version of Bobby 3.1.1, the most current version at the time. Bobby is an accessibility validator created by the Center for

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Applied Special Technology, and it was created to assist people in checking the accessibility of their Web pages[17]. The downloadable version of Bobby, which runs as an application on a personal computer, is capable of testing larger sets of Web pages on a given Web site. As Bobby's creators point out, "it is ideal for large scale accessibility testing"[18]. For each page checked, Bobby provides information pertaining to the type, number, and location of accessibility errors – both minor and major ones. Bobby also issues a summary report for each set of Web pages. Web pages that contain any major ("priority 1") error do not receive Bobby's approval.

As Bobby's creators freely admit, their product is not a perfect tool. While Bobby checks for compliance with the W3C-WAI's Web Content Accessibility Guidelines[19] and Techniques[20] for html documents, it automatically checks for compliance with only a subset of these. For the features not included in its automatic test, Bobby prompts the user to perform a "manual" check. Bobby is also unable to check for the accessibility of script (such as Javascript) or script-generated content. Some features can only be partially checked with Bobby. When encountering images, for example, Bobby will not report an error as long as some alternative text is provided – no matter how meaningless or non-descriptive this text may be. Thus, for various reasons, reliance on Bobby's automatic checking facility alone is prone to produce some falsely positive (error-free) findings.

In addition to falsely positive results, Bobby, on occasion, also produces falsely negative results (reported errors where none exist), as I found out during my earlier studies. For example, pages that, at the very beginning, provide a "text-only version" link may not pass Bobby's muster. Bobby simply checks the graphics versions for violation of accessible design principles. If it discovers a violation, Bobby considers this page to be inaccessible – regardless of how perfectly accessible the text-only version may be. In order to eliminate this particular type of false result, each homepage was checked for a "text-only" version. Where a link to a text-only version was provided close to the top of the graphical homepage version, the text-only homepage was used as the starting point for the Bobby test. In cases where the text-only homepage contained a link back to the graphical homepage, the test results reported by Bobby were adjusted so that they would not reflect the latter's accessibility errors.

Another problematic feature of Bobby is its inability to distinguish between degrees of impact between different manifestations of the same error. For example, a bullet icon without alternative text registers as equal in status (i.e. as being a "priority 1" error) to that of an image (also without the ALT tag) that is packed with crucial information. Similarly, Bobby may classify different types of accessibility errors as equal in severity even if the barriers they constitute differ to a significant degree. For example, the lack of alternative text associated with a purely decorative image registers as an error equal in need of correction to the lack of frame labels in multi-frame pages.

Despite its shortcomings, Bobby is a good evaluation tool in studies like this, where the accessibility of hundreds or thousands of individual Web pages needs to be evaluated and a rough measure of accessibility suffices. In fact, all but two of the accessibility studies listed in the previous section rely exclusively on Bobby's automatically generated data. Only two small-scale investigations, the study of the departmental homepages on the University of Wisconsin-Madison campus (n = 101) and the British study of library homepages (n = 103), employ Bobby's automated checking capability as well as manual assessment (human judgment).

Statistical methods

Since the goal of this study is primarily to gauge certain aspects of Web accessibility at the campuses with the most highly ranked library schools (all of which are included in this study), only methods of descriptive statistics are employed. Specifically, the following statistical measures are provided: average percentage of Bobby-approved Web pages per data set (library sites, library school sites); range of the percentages in each set; relative frequency of specific accessibility errors; Spearman's rank correlation coefficient for the association between SLIS ranking and SLIS Web site accessibility; and Pearson's product-moment correlation coefficient for the relationship

between SLIS Web site accessibility and library Web site accessibility. Percentages and correlation coefficients were calculated with the help of a spreadsheet (Microsoft Excel, 2000) and the respective functions provided therein.

Results

The percentage of Bobby-approved pages per Web site averages 59 per cent for libraries and 23 per cent for schools of library and information science. For both categories, there is much variation among sites: the standard deviation for the library data was 33 and that for the SLIS data was 31. Within both categories, site accessibility (in terms of percentage of Bobby-approved pages) ranges from 0 per cent to 100 per cent. As Table I reveals, four of the 24 library Web sites were 100 per cent accessible, while only one SLIS Web site (at Florida State University) received complete Bobby approval. Seven library sites, in contrast to only one SLIS site, had pages of which at least 80 per cent were accessible. On the low end, the difference in accessibility between the two sets is even more striking: at only one library site were all the pages inaccessible, whereas eight SLIS sites (one third of the studied sites) had 0 per cent accessibility. Four of the library sites, compared to 16 of the SLIS sites, had an accessibility score of 20 per cent or less.

As Table II shows, the vast majority of accessibility errors detected by the automated Bobby checker fall into two categories: images without alternative text and image map hotspots without alternative text. Errors in the former category occurred most frequently (close to 78 per cent in the combined set of examined SLIS and library Web pages). About each fifth error detected by Bobby in the combined set fell into the latter category.

Table I SLIS ranks as well as percentages of Bobby-approved SLIS and library Web pages, by university

University	Rank of "library schools" (SLIS) acc. to US News (1999)	Bobby-approved SLIS pages (%)	Bobby-approved library pages (%)
University of Illinois-Urbana-Champaigne	1	0	77
University of North Carolina-Chapel Hill	1	20	100
Syracuse University (NY)	3	0	33
University of Michigan-Ann Arbor	3	6	76
University of Pittsburgh	3	13	3
Indiana University	6	29	100
Rutgers State University-New Brunswick	6	60	82
University of Winconsin-Madison	8	0	73
Drexel University (PA)	9	0	100
University of California-Los Angeles	10	8	94
University of Texas-Austin	10	13	61
Florida State University	12	100	62
Simmons College (MA)	12	0	0
University of Maryland-College Park	14	19	67
SUNY-Albany	15	11	100
University of North Texas	15	83	37
University of South Carolina-Columbia	15	0	59
SUNY-Buffalo	18	0	10
University of Washington	18	9	73
Kent State University (OH)	20	39	32
Texas Woman's University	20	94	22
University of Tennessee-Knoxville	20	29	80
University of Wisconsin-Milwaukee	20	20	72
Wayne State University (MI)	20	0	8

Table II Relative frequency of errors by type and by site category

Error type	Library schools (%)	Libraries (%)	Combined (%)
Images without alternative text	83.45	62.26	77.79
Image map hot-spots without alternative text	16.09	34.23	20.94
Frame without title	0.40	2.63	0.99
Page not readable or usable without frames	0.03	0.00	0.02
No redundant text link for server-side image-map hot-spot	0.03	0.73	0.21
Image-type button in form without alternative text	0.00	0.07	0.02
Applet without alternative text	0.00	0.07	0.02

With a Spearman rank-order correlation coefficient of 0.23, the association between *US News & World Report* SLIS ranks and SLIS Web accessibility is low. There is a mild tendency for the Web pages of the more highly ranked schools of library and information science to be more accessible. With a Pearson product-moment correlation coefficient of –0.07, the relationship between SLIS Web accessibility and library Web accessibility is so low that it can, for all practical purposes, be considered to be non-existent.

Discussion

Two findings come as a surprise:

(1) Average Web site accessibility (in terms of error-free pages per site) at the campus library sites included in this study was relatively high: 59 per cent. While the comparison of Schmetzke's data in his 1999 and 2000 study of Wisconsin campus libraries suggested the possibility that Web accessibility at libraries may be on the increase (from 31 per cent to 40 per cent), none of the accessibility data previously reported came close to the 59 per cent Bobby-approval rate. The closest figures (45 per cent and 43 per cent), found by Rowland (1999) and the National Center for the Dissemination of Disability Research (1998), involved Web sites concerned with disability-related issues.

    There may be two explanations for the comparatively high average accessibility average of library Web sites. It could be sheer coincidence that the campuses included happen to be more accessible than the national average. Since the sites were selected because of their inclusion in the *US News & World Report* list of the most highly ranked library schools, they do not constitute a random sample from which some more general conclusions about campus libraries nationwide could be drawn. Alternatively, it may be that the particular nature of the libraries makes a decisive difference: the libraries included in this study tend to serve rather large campuses with a significant population of graduate students and researchers. Support for this possible explanation can be found in the fact that the library Web sites at the two largest, more research oriented campuses within the University of Wisconsin system, had Bobby approval rates in the low-70 per cent range and were thus far more accessible than most of the library Web sites at the smaller, second-tier universities (see Schmetzke, 2000).

(2) By far the biggest surprise was the low accessibility of the 24 SLIS Web sites, a selection that constitutes 43 per cent of all the 56 master's granting institutions in the USA (American Library Association, 2000). With an average Bobby-approval rate of only 23 per cent, SLIS Web sites are not paradigms of virtue as far as accessibility is concerned. It is reasonable to assume that such common disregard for accessible Web design reflects not only the attitude of Web designers, but also that of the SLIS staff and faculty in general, who hire the designers and give them directions. One can thus further assume that schools of library and information science are unlikely to teach principles of accessible Web design. To the extent that prospective librarians learn about Web page design in

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their home (SLIS) departments, as I did a few years ago, they are not likely to gain even an inkling of awareness that design matters for people with disabilities – on the Web not less than in the physical environment.

The Web inaccessibility at our nation's leading schools of library and information science has also another consequence. Students with print disabilities have a lower chance of successfully passing through SLIS programs. This does not only constitute sheer discrimination against the individuals involved, it also affects the future representation of people with disabilities in the library profession. As things stand now, library schools do not enjoy the reputation of having much of a diverse student population. If schools of library and information science continue to put more and more information that is crucial to the success of students on inaccessibly designed Web pages, the library profession will become even less diverse and inclusive. This, in turn, will distract from libraries becoming the type of places in which sensitivity to people with disabilities is likely to flourish.

The data show that there is no correlation between library and SLIS Web site accessibility. There are several possible explanations for this:

(1) SLIS graduates are likely to apply for positions all over the nation so that there is not much of a human-resources flow from the SLIS to the library on a given campus.
(2) As libraries began to put up their own Web sites in the mid-1990s, more technologically adept staff members jumped at the chance to get involved, and they may have been holding on to this responsibility ever since. Recent SLIS graduates may thus not have become much involved in the creation of libraries' Web pages. A recent library survey, which reveals that at 57 per cent of the responding institutions' Web site responsibility had not changed hands since site creation, gives some credibility to this explanation (Traw, 2000).
(3) Many library sites include elements (such as Javascript) that exceed the skill level of most SLIS graduates, even if they took a class in Web design. Libraries may therefore prefer to hire Web designers who received their training elsewhere.
(4) Unlike suggested above, few schools of library and information science teach Web design. Whatever knowledge SLIS graduates may have about Web design, they have picked it up elsewhere.

The data collected in this study do not permit ruling out one or the other possible explanation. The issue certainly raises some interesting questions for future research: who designs Web pages at campus libraries? Where did the designers receive their training? What do they know about accessible design principles? And what directions (supervisor's instruction, library policies, or job description) are they given for their work? I know of only one British study that has touched upon these type of questions. In her survey of British libraries, Craven (2000) found that 80 per cent of the respondents had received some kind of Web design training, but that only 20 per cent of them had received training specifically addressing accessibility issues.

No matter which set of data, the error analysis reveals similar results. Over 98 per cent of the barriers found in Web pages result from the designer's neglect to provide alternative text for images or image map hot-spots. This finding is relevant because these two types of error are easily fixed. It certainly would not require a major re-design of the Web page, or an advanced skill level in html, to insert the alternative text.

While the results of the error analysis in this study confirm the tendency reported by Flowers *et al.* as well as by Lilly and Van Fleet, the latter findings are not quite as high. Most likely, the reason for this lies in the way errors were counted. The other researchers counted the pages on which certain types of errors occurred, whereas I counted the number of times a certain error occurred. If, for example, a certain error occurred 30 times on the same page, Lilly and Van Fleet would state that one page was affected by this error, whereas I would record that it occurred 30 times.

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Conclusion

Many libraries have not taken proper action to ensure that their Web pages are freely accessible to people with print disabilities. Unawareness of the issue, time constraints and general techno-stress may be the reason for this neglect. Unfortunately, the institutions which are training the next generation of librarians do not appear to instill the sensitivity and skills that would give hope for better times to come. Assuming that the dismal accessibility record of library schools' own Web sites reflects a lack of awareness among their faculty, their graduates are not likely to pay much attention to accessibility issues either. Perhaps, as the California example suggests, it will take further legal action – complaints to the Office for Civil Rights and suits of the kind recently filed by the National Federation of the Blind against AOL – to shake things up.

Where can people who wish to make their Web pages accessible turn for help? While, as I pointed out earlier, most problems are easily fixed, it still takes some skill to do so. Fortunately, a number of resources are available. Most authoritative, but probably not easy to digest for the novice, are the documents issued by the W3C's Web Accessibility Initiative (WAI), particularly this group's "Curriculum for Web Content Accessibility Guidelines"[21]. Perhaps a better choice, especially for the novice, would be Michael Paciello's fresh-out-of-the-press book, *Web Accessibility for People with Disabilities* (Paciello, 2000). This comprehensive volume discusses both philosophical and legal issues and provides practical guidance in accessible Web design. For those who prefer the interactive mode of a structured course, I highly recommend the EASI online workshop "Barrier-free Web Design", held by Dick Banks and Norm Coombs six times per year. Their four-week workshop consists of eight lessons that are "designed to demonstrate how to create Web pages that are both visually appealing and fully accessible to users with print disabilities"[22]. Two other online courses, "Universal Design and Web Access" and "Designing for Universal Accessibility", are offered by Paul Bohman through Blackboard.com[23] and by Kynn Bartlett respectively[24]. WebAble! Solutions also offers a series of different workshops and seminars on emerging technologies and accessible design[25]. For those who have less time to their avail, or who prefer to acquire knowledge in the area on their own, WebAIM provides a quick-tip page, a longer Web-based tutorial as well as links to various other tutorial-type resources[26]. Finally, as indicated in the literature review section, a number of published articles provide practical tips on accessible Web design (e.g. Coombs, 2000). A multitude of further resources on the subject can be accessed through any of the following portals: Trace Research & Development Center [27], NYISE Blindness Resource Center [28], Equal Access to Software and Information (EASI) [29], and my own resource page on Accessible Webpage Design[30].

Let me conclude with some recommendations about future research. Most of the library Web site accessibility studies reported earlier merely looked at home pages. A few studies, including my own, also investigated the next layer of linked pages. While all these investigations are important – they provide a snapshot of the current situation, may generate awareness, and might shake one or the other institution into action – they only reveal part of the overall picture of a fully accessible library Web site. True, it is important to find out whether the initial pages, which constitute the pathways to the major library resources, are free of barriers; but it is at least equally important to investigate the accessibility of the major resources themselves: library catalog, electronic indexes, full-text databases, online tutorials, e-books, and electronic reserves. To the best of my knowledge, no survey-type studies have been conducted in this area. Yet, judging from the responses I receive when broaching the subject with fellow librarians (not to mention the database vendors at the ALA 2000 conference), there is much need for such investigations. To many librarians, this question has never occurred, and those who are aware of it (myself included) rarely know the answer.

Notes

1 http://www.w3.org/TR/WAI-WEBCONTENT/
2 http://www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html

3 http://www.w3.org/WAI/References/QuickTips/
4 http://www.access-board.gov/about/Rehab%20Act%20Amend-508.htm
5 http://www.usdoj.gov/crt/508/deptofed.html
6 http://www.usdoj.gov/crt/foia/tal712.txt
7 http://www.janejarrow.com/public_library/ocr_lof/nussbaum.html
8 http://www.sjsu.edu/pubs/webpolicy/
9 http://web.mit.edu/ada/waccess.html
10 http://www.regis.edu/disability/webaccessibility.htm#accessibilitypolicy
11 http://www.htctu.fhda.edu/amguidelines/am33000.htm
12 http://library.uwsp.edu/aschmetz/Accessible/UW-Campuses/Survey2000/web_policies_April2000.htm
13 http://www.library.yale.edu/Administration/SQIC/spd2.html
14 http://www.library.yale.edu/Administration/SQIC/spd1.html
15 American National Standard for Buildings and Facilities – Providing Accessibility and Usability for Physically Handicapped People (ANSI A117.1 1961/1980/1986); Minimum Guidelines and Requirements for Accessible Design (MGRAD 1982); Uniform Federal Accessibility Standard (UFAS 194); and ADA Accessibility Guidelines for Buildings and Facilities (ADAAG 1992).
16 http://www.webable.com/w4papers.html
17 http://www.cast.org/bobby/
18 http://www.cast.org/bobby/docs.html
19 http://www.w3.org/TR/WCAG10/
20 http://www.w3.org/TR/1999/WAI-WEBCONTENT-TECHS-19990505/
21 http://www.w3.org/WAI/wcag-curric/
22 http://www.rit.edu/~easi/workshops/easiweb.htm
23 http://www.webaim.org/courses/
24 http://www.hwg.org/services/classes/d201.11.html
25 http://www.webable.com/workshops.html
26 http://webaim.org/tutorials/
27 http://trace.wisc.edu/world/web/index.html
28 http://www.nyise.org/blind.htm
29 http://www.rit.edu/~easi/
30 http://library.uwsp.edu/aschmetz/Accessible/pub_resources.htm

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