Technology Access in the Workplace and Higher Education for Persons with Visual Impairments

An Examination of Barriers and Discussion of Solutions

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Executive Summary

This paper is written for leaders in the workplace and education to help them address barriers which blind workers and students face with new technology—including technology associated with virtual work and learning. Some of the technologies which promise improved performance and greater efficiency for business and education will present significant barriers for workers and students with visual impairments. Much web content is graphically oriented, which challenges those who do not see or who have limited vision. Some document formats present compatibility problems for the hardware and software which blind or visually impaired people use to access and work with computer-based information. The use of "white boarding" and online group editing can be entirely inaccessible. Classroom and business presentations are often augmented with visual material and consideration must be given to how those with visual impairments can have the same access to that information. Message boards and chat rooms may also present barriers.

The paper begins with information providing a context for the discussion of barriers and solutions. There is information about virtual work and workplace technology, blindness, blind persons in the workforce and computer use by blind persons. Leaders will also benefit from a basic understanding of the laws and regulations which pertain to employment and education for persons with disabilities and this information is also provided.

There are solutions which can mitigate many of these barriers—if not eliminate them entirely. Web pages can be properly designed, alternate software or hardware can be used, adaptive technology can be provided for blind workers, and leaders can develop creative solutions with their teams. This paper covers barriers and solutions in some detail, including both technical and interpersonal. The appendices list resources which may be useful for leaders. The paper emphasizes creative approaches and the full involvement of blind workers and students in the crafting of solutions.

Finally, this paper also addresses barriers that require solutions beyond those that may be implemented by the manager or educator. There are some problems which may be solved only with better design of operating systems and applications, as well as proper web page design. These are identified and leaders are encouraged to add their voices to those advocating for improvements.

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I. Introduction

As I began this paper, it was my hope—my expectation—to provide an overview of barriers and solutions to virtual access issues for persons with visual impairments (which is still a key purpose of this paper) and to write about what these barriers mean to those users of workplace and education technology. I had planned to write about this in the words of students and workers, quoting from interviews and surveys, creating what I had hoped would be a compelling argument for improved access by showing how barriers to virtual work and learning frustrated and hampered blind workers and students. The barriers do exist—they're all too real—but few people with limited vision, or no vision, have even begun to work virtually. For most, virtual work just isn't "on the radar screen." Consequently, the scope of this paper is broader than originally anticipated. Despite this change in direction, there is much that can and should be written about technology barriers in the broader context of all work and educational settings and what is written will be directly applicable to virtual work. Many business web sites score low on access using commonly accepted access standards, which presents significant barriers to work and education. Power Point presentations, Portable Document Format files, online learning platforms, "white boarding," and instant messaging can also thwart effective access.

In higher education these barriers are being acknowledged more widely than has been the case in the workplace. This has probably occurred in large part because there exists a clear cut legal requirement that educational institutions make their programs and activities accessible to and readily usable by persons with disabilities--including persons who are blind or visually impaired. Unlike workplace access, where barrier removal takes place on an individual basis as part of the reasonable accommodation requirement of employment law, access to education is addressed systemically through program access requirements of disability rights legislation. Colleges, universities and secondary schools are beginning to give attention to access to internet sites and other electronic resources. Similarly, designers of online learning platforms have now made initial efforts at access, although with varying degrees of success.

There is a user perspective which veils some of the importance of this access issue: it appears people who are blind often "make do" with a lower level of access than coworkers or other students. In reviewing surveys and talking to workers, more than one has said something like, "Oh, I just get someone to read the Power Points to me," even though this means presenters sometimes gloss over details or leave out important information. Also, some seem to accept a larger share of the responsibility for access than is perhaps truly theirs, saying if they understood access technology better, they would then do better. While acknowledging a level of truth in this, a few argue the barriers are real and hinder effective performance by creating a situation where blind workers and students must work unnecessarily longer and harder than their colleagues. Certainly this speaks to the resilience and flexibility of many blind workers and students, but it may also be evidence of a level of resignation, a belief that little can be done to improve these

circumstances. This may be correlated to what researchers have described as low "technology optimism."

My investigation for this paper combines reporting with formal research. Along with a literature review, I conducted a survey of users (using a web-based survey tool) and also interviewed several national leaders and experts in the blindness community.

Even though this paper differs in scope from what I had originally planned, there are real access barriers for thousands of blind workers and students; I have attempted to describe these fully. For many of the barriers, managers or educators do have solutions at hand. This paper will describe those solutions. For other barriers, the solutions can only be addressed by technology developers. In these cases, educators, employers, students and workers will be forced to create "work around" solutions. Some of those "work arounds" are identified here. Even when barriers cannot be readily resolved by technology users, leaders in business and education, along with users themselves, can advocate change. This is another reason these more difficult issues are addressed.

This paper demonstrates how ubiquitous workplace technology has become. Being able to use business and education software, the Internet and other technology can make the difference between productive employment and unemployment that is, success or failure in education. Not having effective access locks workers and students out of what is surely the most important and dramatic change in work in decades, if not the past century.

II. Technology in the Workplace and Education

A. *Workplace Technology*

Computer use in the workplace, education and the home has increased over the past twenty years. Dependence upon other technologies, such as fax machines, voice mail, telecommunication networks, cell phones (Avery & Zabel, 2001), has also increased. Computers, however, remain at the heart of this change and have become indispensable on the job. In a National Science Foundation survey, one-fourth of those surveyed in 1983 reported using a computer at work; about one-third said they did in 1990; and 42 percent in 1999 (National Science Foundation, 2000) In September 2001, 72.3 million workers used a computer, which accounted for 53.5 percent of all employment (Hipple & Kosanovich, 2003). Twenty percent of those surveyed in 1999 had work e-mail addresses, up from 16 percent two years earlier (National Science Foundation, 2000). Leaders in the field predict that, "In the future, most workers' primary activities will involve information technology. Workers will have to gather, create, manipulate, store, and distribute information related to products, services, and customer needs. Computer networks will be interconnected with information systems that will affect all industries; workers who can step into the new job categories created by these networks and their implementation will be in strong demand (Challenger, 2000)"

B. Technology at Home

In 1983, eight percent of U.S. adults had computers in the home (National Science Foundation, 2000). This percentage rose steadily until 1999 when, for the first time, a majority of adults (54 percent) had at least one computer in their homes (National Science Foundation, 2000). In 2000, 46 percent of all adults had home Internet connections, up from 21 percent in 1995; 45 percent had CD-ROM readers, up from 14 percent in1995; 32 percent subscribed to an on-line service and had home e-mail addresses, up from 18 percent in 1997; 17 percent had more than one computer in their homes, up from 12 percent in 1997 (National Science Foundation, 2000).

C. Virtual Collaboration

Both large and small companies are collaborating more with one another and with academic institutions and government (Science and Engineering Indicators–2002, 2002). Many organizations have teams that only meet virtually (Duarte & Snyder, 2001). Information technology has enhanced the coordination of dispersed innovation activities and knowledge, and workers have gained access to a much wider range of knowledge bases (Science and Engineering Indicators–2002, 2002). Virtual collaborations facilitated through e-mail and the World Wide Web have become commonplace and advanced tools have emerged: Internet videoconferencing; shared access to databases, computer simulation; shared workspaces "white boards" which work like online drawing boards) (Science and Engineering Indicators–2002, 2002).

D. Virtual Work

Telecommuting is on the rise; 43 percent of human resource managers believe a mobile, telecommuting work force is the biggest workplace trend in the twenty-first century (Challenger, 2000). Telecommuting will benefit employees who want balance between work and family and will improve productivity (Challenger, 2000). Improvement in the telecommunications infrastructure has resulted in the development of high-speed data links between the home and office, while the growth of an information-based economy has created a large number of jobs suitable for telecommuting, at the same time that workers have become interested in telecommuting for a variety of reasons (Avery & Zabel, 2001). Eldib and Minoli (1995, cited in Avery & Zabel, 2001) identified several reasons for this employee interest in telecommuting: desire to become more productive, balance work and family life, reduce commuting time, have more flexible schedules, and the desire to become "one's own boss." Employer interest in telecommuting has evolved from interest primarily in the environment, cutting office space costs and lessening urban commute gridlock to strategies for recruiting and retaining a skilled, motivated workforce (Avery & Zabel, 2001).

E. Technology in Higher Education

Computers and the Internet have helped expand distance education. Although distance education is not new, information technology offers new tools which have made it a more attractive option for many students. Many schools are either establishing distance education programs for the first time or expanding existing programs; online courses are a key component of this change (Science and Engineering Indicators–2002, 2002). More colleges and universities

are offering distance education courses: 33 percent of all two-year and four-year schools offered distance courses in fall 1995; 44 percent did so in 1997-98 (Science and Engineering Indicators–2002, 2002). Online learning offers several new approaches: instructors e-mail or post lectures on a website; students submit assignments and communicate through e-mail or message boards with the instructor and other students; they participate in online "chat" discussions and audio and video lectures; and they use web-based readings." there is now a real opportunity to customize learning environments to meet the diverse needs of students in various blendings of campus-based, distance and open learning systems (Burns, 2002)." Furthermore, courses may be offered in a flexible system that can transcend regional and national boundaries (Burns, 2002).

F.   *Importance of Technology Access for Persons with Disabilities*

Clearly, work is changing and technology is driving that change. The computer has become a fixture in many homes. Work is increasingly conducted from many locations -- offices, homes, hotel rooms and other places. Education is also undergoing revolutionary change driven by technology. These facts make it imperative that blind and visually impaired students have an effective level and quality of access that is essential for full participation in new ways of work and learning.

This is a brief description of the population of blind and visually impaired people in the United States, the group likely to face technology-related barriers in the workplace and education. Because there is no national registry in the United States that gathers information about the blind and visually impaired population, constructing an accurate statistical portrait of this group is challenging (American Foundation for the Blind, 2004e). Doing so requires culling relevant figures from a variety of sources and interpreting the data (Kirchner, 2002).

The American Foundation for the Blind (AFB), a preeminent organization in the blindness field, has culled, synthesized and interpreted data from several sources; most of the information in this section comes from the AFB. Other information is drawn from U.S. Census Bureau surveys, a Disability Supplement to the U.S. National Center for Health Statistics annual Health Interview Survey (HIS) conducted in 1994-1995 and synthesized by AFB (Kirchner, 2002), and a study commissioned by the Microsoft Corporation.

III. Blindness and Visual Impairment in the United States

A.   *People with Visual Limitations in the United States*

To begin, here are definitions related to blindness and visual impairment as described by the American Foundation for the Blind. Legal blindness is clinically measured visual acuity of 20/200 in the better eye (with best correction, or a visual field of 20 degrees or less. Functional limitation is the consequence of different levels of visual ability in performing common activities such as reading. Functional limitation in seeing print is measured by surveys of persons with visual impairments or their proxies. Measurement is for two levels: people with severe functional limitation (those who said they "are unable" to see words and letters in ordinary print, even with their eyeglasses on) and people with Non-severe functional limitation in seeing (those who said

they "have difficulty" seeing words and letters in ordinary print, even with their eyeglasses on (American Foundation for the Blind, 2004d).

Approximately 10 million persons with visual impairments live in the United States (American Foundation for the Blind, 2004a). This includes persons categorized as having both severe and non-severe limitations. The following table shows estimates in age ranges (U.S. Census Bureau, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f). Note the definitions of severe and non-severe visual limitation above.

Table 1: Persons with Visual Impairments in the United States (In Thousands)

Age	Unable to See words and letters (Severe)	Difficulty seeing words and letters (Non-Severe)
Age 0 to 21	51	474
Age 22 to 44	191	1,475
Age 45 to 54	168	1,264
Age 55 to 64	208	1,246
Age 65 to 79	475	2,450
Age 80 years old and over	475	1,709
Total	1,568	8,618

Over 5 million elderly people are blind or visually impaired (see Table 1). There are 1.3 million people who are legally blind. There are about 55,200 legally blind children, and around 93,600 visually impaired or blind students are served in the special education programs in primary and secondary schools (American Foundation for the Blind, 2004a). From the data, it's reasonable to expect that at least those people categorized as having "severe" limitations would be in a group that would benefit from technology. The same is true for those identified as legally blind. Of course, not all are in the workplace or in the classroom.

B. *Employment of Persons with Visual Limitations*

Employment statistics are less precise. Most data come from a 1994-95 national survey conducted by the federal government's National Center for Health Statistics. That study provides details not available from other national studies. In 1994-95 there were between 2 and 3 million working age (18 through 69) blind or visually impaired people in the U.S., of whom 1 to 1.3 Million were working (American Foundation for the Blind, 2004b). About 40-45% of working age people who were blind or visually impaired were employed.

C. *Technology Use by Persons with Visual Limitations*

The number of people with visual limitations who are age 15 and older who use a computer regularly is just under 1 million; about 102,000 persons with a severe limitation use a computer on a regular basis. (See the definition of severe, page 4.) About 196,000 people with a "severe" limitation have access to the Internet (American Foundation for the Blind, 2004c). The National Science Foundation estimates people with disabilities are half as likely to have access to the Internet as those without disabilities. (21.6 percent compared with 42.1 percent) and people with visual impairments have lower rates of Internet access than people with other types of disabilities (Science and Engineering Indicators–2002, 2002).

In 2003, Microsoft Corporation commissioned Forrester Research to conduct a study of the use of and market for accessible technology in the United States (Microsoft Corporation, 2004a). This study focused on adults (ages 18 to 64) who are computer users, and found that "16% (27.4 million) of working-age adults have a mild visual difficulty or impairment, and 11% (18.5 million) of working-age adults have a severe visual difficulty or impairment. The group having severe visual difficulty includes individuals who reported having an impairment that limits employment. This includes "being blind" or having non-correctable vision problems that cause difficulty performing vision-related tasks. The study found this group is likely to benefit from specialty assistive technology software and hardware such as screen reader software (Microsoft Corporation, 2004d).

D. *Significance of Blindness Data for Leaders in Business and Education*

From information cited above, minimum estimates are that 1 to 1.3million working age persons with visual impairments are employed. In 1999 there were at least 1.5 million visually impaired computer users and similar numbers for Internet access by this group (Gerber & Kirchner, 2001). It is reasonable to infer that large numbers of these blind and visually impaired users require accessible technology. The Microsoft study shows significant need for technology accommodation. With the large numbers of older blind persons (see Table 1 above), the need for accessible technology will increase over the next decade (Microsoft Corporation, 2004b). Data in the **Error! Reference source not found.** section shows continued expansion of the use of echnology in both work and education. There may not be any specific estimates of future need for accessible technology in the workplace and education (none were located during research for this paper), but examination of the data which are available (and cited above) points to increased need.

IV. Legal Framework of Workplace and Education Access

People with disabilities have advocated for and secured the passage of legislation that offers some protections against discrimination in employment, public accommodations and the programs, activities and services of state, local and federal government. The following is a brief summary of applicable laws and, in very general terms, what they require of businesses and education with respect to technology access.

- Private employment is covered under Title I of the Americans with Disabilities Act (1990). Employers have an obligation to provide reasonable accommodations to employees. The access technology described in this paper can often be a reasonable accommodation. Qualified persons with disabilities are protected under this title. Qualified persons are those who meet the ADA definition of disability and who can perform the essential functions of the job. Blindness and many types and levels of visual impairment fall under the ADA definition of disability.

- Programs of colleges and universities are covered under Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act. Section 504 applies to recipients of federal funding and Title II covers all other entities of state and local government. The laws require that state and local governments, including most colleges and

universities because of their receipt of federal funds, 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.

- Technology access such as Worldwide Web sites operated by the federal government are covered under Section 508 of the Rehabilitation Act (Summary, 2001) This section of the law requires access to electronic and information technology provided by the federal government. This section applies to all federal agencies and covers development, procurement or use of electronic and information technology. Federal agencies must make this technology accessible to employees and others with disabilities.

- Business technology such as web sites are covered under Title III of the Americans with Disabilities Act. In a letter to U. S. Senator Tom Harkin, providing a clarification of Title III of the Americans with Disabilities Act, Deval Patrick of the U. S. Department of Justice wrote, "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" (Patrick, 1996). This is an important Department of Justice interpretation which is not widely publicized.

More detail on these requirements goes beyond the scope of this paper; however, a resource list of additional information is included in Appendix A of this paper.

V. Barriers in Work and Education

Computers can turn text into speech, enlarge print and translate text into Braille, opening the door to books, articles and data that have previously been available only at great expense and difficulty. As it has for the larger population, the Internet has created new opportunities for work and education. The Science and Engineering Indicators–2002 report states: "IT [the Internet] can make working from home more viable for people with limited mobility, turn written material into spoken language for visually impaired people, and turn speech into text for hearing-impaired people" (Science and Engineering Indicators–2002, 2002).

A. Surveys and Interviews with Technology Users

The web-based survey conducted for this paper shows that blind and visually impaired workers use screen readers, screen magnification, dictation devices, electronic files of documents (in lieu of printed documents), and informal assistance from others to perform work (see a copy of the questionnaire in Appendix B and completed surveys in Appendix C). The survey was announced on several electronic lists frequented by persons with visual impairments; despite this, the response rate was low, with nine surveys returned. None of the persons responding had experience in working in virtual teams. Two persons interviewed said they were unable to use graphically oriented features of Microsoft Net Meeting (Kutsch, 2004; Foersterling, 2004)and one interviewee said Net Meeting was less problematic for those using screen magnification (Presley, 2004). Several did exchange electronic documents with coworkers, primarily Microsoft Word files) and few reported problems. Two of those interviewed noted it was almost essential

that coworkers add comments within the main document, not using Track Changes or Comment features of Word, because the editing features were difficult to use (Kutsch, 2004; Foersterling, 2004). One respondent reported having some problems with Lotus Notes, an e-mail and information management application.

There are persistent rumors in the community of persons with visual impairments that visually impaired workers have lost jobs because employers have installed new inaccessible technology. One person surveyed, a transcriptionist, said she had lost a job because the employer installed an inaccessible transcription system, but noted she learned later, after losing the job, that the system could have been made accessible (see Appendix C). This kind of situation is disturbing, especially if the respondent didn't have the IT support or training needed to maintain employment. One case study on technology barriers was located and is described below (Mason, 2001). None of those interviewed were aware of job loss related to technology, but three said they understood how this could well be true (Foersterling, 2004; Kutsch, 2004; Rimkus, 2005). Ones of these said, "Conditions certainly exist in which people could lose jobs. A majority of the programming software now in use is high end, visually oriented software such as Visual C++ and JAVA. These are highly visual development tools that producers such as Microsoft aren't going to change" (Rimkus, 2005). No other information about job loss in other settings was located, although several did report the barriers and frustrations described in this paper.

The story of one information technology professional is instructive. Robert Rimkus is a system administrator working for a large NASA contractor with primary responsibility for space shuttle and space operations, communication, supply, repair and training (Rimkus, 2005). Rimkus, who has no vision, uses access technology (screen reader and Braille display). He has experienced good support from his employer and has had the foresight to position himself within an area, system security, in which he can work without having to use inaccessible development tools such as Visual C++ and JAVA. Rimkus notes this has been an intentional career strategy that has made it possible for him to advance. He has experienced access difficulty in job-related training. His employer adopted an outside training organization to conduct ongoing employee training; the platform used is inaccessible. Among other problems, Rimkus cannot use the automated testing facility of the platform because of its graphical orientation.

B. *Technology Optimism*

The Microsoft study identified the concept of "Technology optimism" (Microsoft Corporation, 2004c). This is a way of describing how those likely to benefit from using accessible technology view technology. The study found the following:

Only 51% of computer users who are likely and very likely to benefit from the use of accessible technology (due to having mild to severe difficulties and impairments) are technology optimists, compared to 58% of computer users who are not likely to benefit from the use of accessible technology. One possible explanation for the difference could be that individuals who are likely to benefit from the use of accessible technology have found that using computers is more challenging because the technology is not accessible. This illustrates the potential for accessible technology to improve an individual's satisfaction with computers and optimism about technology (Microsoft Corporation, 2004c).

Put another way, there is a high level of "technology pessimism" among persons with visual impairments. It is reasonable to infer that this pessimism is also present as people with visual impairments deal with a variety of technology-related barriers in the workplace and education. This point is reinforced in interviews and surveys conducted for the preparation of this paper. People with visual impairments describe reluctance to request alternate format materials when they believe the media may not be accessible (Foersterling, 2004). One person noted the continuing cycle of progress and setbacks in access. Because producers of access software and hardware are dependent on developers of operating systems and applications to cooperate in development, the users of access technology may go through periods when their level of access diminishes or vanishes altogether (Kutsch, 2004). This can leave technology users with high levels of frustration.

VI. The Case of Hal Richards

Southern Methodist University professor Richard Mason has authored what may be the only case study on access barriers from the perspective of the information technology field (Mason, 2001). In the case he describes the circumstances around the firing (and subsequent rehiring) of an SMU faculty advisor, Hal Richards. The advisor experiences color blindness, which meets the definition of disability under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973 (Mason, 2001). The University installed a new information technology system which included a student administration system with color display screens that Richards could not read. The case describes how Richards attempted to raise a red flag early in the system development, but his concerns were ignored by the University and PeopleSoft, the system developer. When he could not use the newly installed student administration system in his role as a faculty advisor, he was fired. Only after outcries from the student newspaper and the community was he rehired and placed in a community relations job where he did not have to use the PeopleSoft system. The case is important because it points out multiple failures on the part of the employer: the University administration failed to heed concerns raised by Richards before the system was installed; it failed to insist that the developer address the problem during development or after implementation; it failed to consider reasonable accommodation options which could have allowed Richards to continue in his job (and which probably would have not resulted in an undue hardship); and it terminated Richards, leaving the University vulnerable to potential litigation and, in this case, a good deal of negative press. Clearly, this case was mishandled by the University. Only through the goodwill of students and the community was Richards able to continue employment, although he did have legal recourse. Others with visual impairments may have experienced similar treatment (see above).

There are solutions to access barriers. Most are not costly and require little more of leaders than good planning and consideration. The next section describes many of the simple actions that can be taken to ensure effective learning and employment environments.

VII. Leadership Strategies and Considerations When Working with Students or Workers who are Blind or Visually Impaired

People with visual impairments secure information in different ways from their sighted peers. Team leaders, managers and instructors can take steps to facilitate an effective work or learning environment, just as they do for all other workers or students. The specific actions and considerations often are uncomplicated. There is little mystery about them. Here are some of the most important steps leaders can take to support work or learning of the person with a visual impairment and the overall effectiveness of the work or learning environment.

A. Access to Printed Material

Persons who are blind or visually impaired use alternate methods of accessing material. Electronic text can be read by screen readers, if in a readable format, or translated in to Braille, a raised dot language readable by touch. For those with partial vision, material on a computer display can be enlarged with software and viewed on larger monitors. Text from a book or document can be enlarged with a video camera and special hardware and viewed on a monitor.

As business and education adopt more and more electronic formats, this problem diminishes — as long as the new electronic formats are not inaccessible themselves. Often textbook publishers and others will provide publications in electronic formats, but rarely do they do so without considerable advance notice — weeks and sometimes months. Text file formats are perhaps the most usable, followed by files in Microsoft Word format and, as a last resort, Portable Document Format (PDF) files. Image (graphical) file formats (such as TIF, JPG and GIF) are unusable, unless they can be processed through Optical Character Recognition (OCR) software, which is rarely a satisfactory alternative. In some cases, documents can be scanned and converted through OCR software, but there's no guarantee that a book, document or image file will convert with any degree of accuracy.

Portable Document Format (PDF) file access is improving with successive releases of the Adobe Acrobat Reader software, but most visually impaired users continue to find the format cumbersome. Even with improved access, there are two problems which render PDF material unusable. First, PDF files created from images (often scanned documents) cannot be used. Second, PDF files which are encrypted or protected by the author often cannot be used. Some utilize password recovery utilities to make the files accessible, but this activity is, at best, on the borderline of ethical behavior, considering copyright laws. This is true even with amendments to copyright law (Copyright Law of the United States and Related Laws Contained in Title 17 of the United States Code" 2004; Copyright Law Amendment, 1996: PL 104-197 December 1996" 2004).

Having material read aloud is always an alternative, although less satisfactory if other solutions are available. Readers should be well qualified and able to read material accurately, pronouncing all terms correctly and describing diagrams, drawings and photographs correctly. Readers can record material on cassette tape or newer electronic formats or may be present with the user of the material where the reader can scan and pass over unneeded material. Audio

cassettes have the disadvantage of being a linear format; it is difficult to access specific pages or paragraphs without resorting to repeated and time-consuming forwarding and rewinding of the tape.

B. *Presentation Materials*

Presentation materials may often be most problematic for students and workers with visual impairments. Slides, overheads and Power Point materials used to augment presentations have little meaning, unless they are described thoroughly during the presentation or some other approach is used to make them readily usable. At a minimum, a presenter can describe a chart, table or photograph. He or she can read the text displayed. This works best when it is done clearly, but unobtrusively. A few presenters seem to have a talent for this; others either do a poor job, providing sketchy descriptions or disrupting the flow of the presentation for the rest of the audience. If not done well, this approach also has the potential of calling undue attention to the person requiring the accommodation; the student or worker may be embarrassed and others in the audience may become resentful of the disruption. Certainly, describing visual aids is an acceptable approach, but one which should be used only with careful, thoughtful planning.

If slides or overheads were prepared using a word processor or other text-oriented program, it is usually easy to share the file with the person needing the accommodation. The same is generally true of Power Point material. If the Power Point is created using text, it can be exported to a word processor or text file using the "Send To" option on the File menu of Power Point. Most other presentation software has a similar feature.

Presenters should share materials in advance; the worker or student may not have a means of accessing the material during the presentation and, even if the technology is available, most people, especially those using screen readers or similar hardware, find it difficult to review material during a presentation. Screen readers use synthesized speech to present material and listening to a presenter and the electronic speech at the same time is difficult.

Charts, tables, photographs and drawings will require extra attention. Charts and tables may be described in a narrative. Tabular material may be reformatted in a simplified style. An excellent idea is to provide a linear alternative for parallel, word-wrapped columns of text, because most assistive technology cannot yet read such columns. It is also beneficial to create brief narrative descriptions of drawings and photographs. While it is true that these suggestions aid the person with visual impairment, they have the added benefit of improving most presentations for other learners who are less visually oriented, including those with some forms of learning disabilities.

C. *Virtual Team Activities*

Electronic mail is generally accessible. The audio conferencing facilities of Net Meeting and most other "meeting" software are usable. Text conferencing can be problematic. Screen readers and other access technology cannot access text conferencing in all cases. This is dependent on the specific application, the access software and the skill of the user. For these reasons, text conferencing is best avoided, but may be usable. If important for the team, the team should

experiment with the blind or visually impaired user to determine whether the approach is at all workable.

Online group editing of documents is inaccessible in most instances, although some screen magnification software will work with this feature of Net Meeting—and possibly with other applications. A good alternative is to share documents through e-mail, placing edits inside French braces or brackets. Very recently, screen reader producers have managed to develop mechanisms which allow visually impaired users to work with the Track Changes and Comment features of Microsoft Word, but not all users will be fully familiar with these new features. White boarding is very problematic; there is presently no way for screen readers to access material in a white board session—and it is unlikely this will be possible in the foreseeable future. If a team must use white boarding, the person drawing the image (or another team member) must describe what is on screen.

Team leaders will do well to give attention to the team work process when one or more members cannot access some of the available technology. There may be the temptation for other team members to "move ahead" with the less accessible technology in the interest of expediting work, which can isolate the team members who cannot use the technology. This has the potential of serving as a barrier to building trust among team members. The team may benefit from honest and straightforward discussion at the outset of a project about how, when and by whom technology will be used. This kind of discussion can be incorporated in a team orientation process such as that described by Duarte & Snyder, 2001, p. 92) with discussion of team norms, technological planning, communication planning, and team building. Team leaders should recognize that, even when technology is accessible, it may take additional effort for visually impaired workers to become oriented to that technology. It may be useful to secure additional training or staff support to assist in learning the technology.

D. Distance Learning

Developers of web-based distance learning platforms such as Blackboard (www.blackboard.com) and WebCT (www.webct.com) have made significant advances in access, largely due to requirements of Section 508 of the Rehabilitation Act (see Legal Framework of Workplace and Education Access, on page 6). When developing courses, instructors should use caution to use only those features that are accessible. For example, most testing facilities of web learning platforms are not yet usable by those with visual impairments. The other technologies described in this section are often used in online learning; educators should follow the recommendations for making these technologies accessible when incorporating them into courses. Materials should be in formats readily accessible to persons with visual impairments. Virtual communications should be fully accessible. Web pages that become the content of courses should follow the same guidelines described below for web page design. Graphic images should have alternate descriptions. Text should be presented in a linear format. Frames should be avoided or, at a minimum, should be clearly labeled.

Many screen reader and Braille display users find the message sections difficult to navigate and read. These displays are not yet well labeled and their use is not at all intuitive. It may take considerable time for a user to learn the message board formats and commands. Many users will find additional orientation support helpful, as well as the time to become fully familiar with the

boards before instruction begins. It may also be useful to assign a teaching assistant or other staff member to serve in a support role. This support person could help with orientation and answer questions on an ongoing basis. This role is best assigned to someone who can work with several users at once and who will maintain the role over an extended time. Just as there is a learning curve for the user, there will also be a similar learning time for the person providing assistance. The person will need some familiarity with popular screen reading software—and possible Braille and screen magnification—so he or she can better understand how to assist.

E. *Access to Web Materials*

The World Wide Web Consortium (W3C), through its web Accessibility Initiative (<http://www.w3.org/WAI/>), has developed standards for web page design which afford access for people with visual impairments. Pages should be designed to conform to these standards. The following recommendations appear on the Amherst College web site (http://www.amherst.edu/~wwjarnag/index.html) and were developed by Willa Jarnagin in the College's public affairs office. They are some of the most useful recommendations available and are presented here.

- Reduce clutter--busy pages are annoying to everyone, but they can be especially confusing and cumbersome to someone using a screen-reader.

- State the purpose of the page at the beginning–A clear title and introductory paragraph are essential on any page, no matter who's reading it, but especially useful for users of screen readers.

- Use punctuation–Where you use commas and periods, voice synthesizers will produce cadences and pauses accordingly, making sentences more understandable as they are read aloud.

- Keep tables simple--Information will be read row by row. Will the page make sense when the content is read linearly?

- Include descriptive "ALT" attributes in image tags for all graphics that convey information.

Appendix D includes an illustration of how the American Foundation for the Blind conducts Web accessibility testing with visually impaired users. Appendix E is an excerpt from a Web page on how to make the online learning platform Blackboard more accessible.

F. *Information Technology Support*

Arranging for hardware and software support from the organization's information technology department can be very useful. Installing alternate access technology along with standard applications can involve much trial and error. Other applications may require special configuration to work with speech or a Braille display. The technical knowledge and experience of a staff person can cut through compatibility and configuration problems. Some visually impaired workers have become quite proficient at managing the complexities of software and hardware installation and compatibility, but leaving this responsibility solely in the hands of the

visually impaired worker can diminish the worker's performance and could leave access problems unresolved without required support.

G. *Advanced Planning for New Information Technology*

It is clear from the Hal Richards case (see The Case of Hal Richards, on page 9) that advanced planning can be useful for both the organization and the worker or student. Simple web searches may help identify compatibility issues and potential resolutions. It is not unusual for an organization to rush headlong into the installation of new hardware or software, only to find that it is incompatible with access technology. At the least, this could cause much additional work for the student or worker and for the organization. If one person (or a team) is assigned this work over time, they can develop a level of expertise with hardware and software.

H. *Material in Braille*

Some persons with visual impairments use Braille, letters and words embossed in raised dots on paper, which is read tactilely. Some prefer to have materials in this format. Braille is produced with a mechanical embosser, a device that can be attached to a computer, as is a printer. This requires translation software to convert documents into the Braille code. Businesses and schools may purchase and operate such devices or they may choose to have Braille production services handle the work. If so, files usually can be sent to the producer by electronic mail for rapid return by mail or even overnight delivery. Embossed documents are bulky and tactile displays for computers are now in more frequent use, so businesses and schools may be called on less and less to provide this accommodation.

I. *Adaptive Hardware and Software*

There is a variety of adaptive technology for persons with visual impairments. The technology may be necessary for work and education. For employers, providing such technology to an employee may be a reasonable job accommodation (see Legal Framework of Workplace and Education Access, on page 6). Examples of the technology include screen reading software, hardware or software speech synthesizers that work with screen readers, Braille displays, Braille embossers, screen magnification software and video devices that magnify print from a book or other document. Rehabilitation organizations are often a good source of information on these technologies.

VIII. Conclusions

Leaders can develop the competencies to incorporate students and workers with visual impairments into the workforce or classroom. None of what leaders must learn or do is terribly complicated. As much as anything, what must be done is to maintain a level of openness and awareness to what works well (and what doesn't) for effective work and learning. Effective access does often require additional planning — giving consideration when planning training, conferences, meetings and other activities. It means avoiding some technology or using it with consideration to those who receive information nonvisually. With good planning and the use of the strategies and techniques described in this paper, learning can be made more effective and

work can be productive and rewarding for workers with visual impairments and for the organizations in which they work.

American Foundation for the Blind. (2004a). *Blindness Statistics* (Web Page). Retrieved 16 September 2004, from American Foundation for the Blind: http://www.afb.org/section.asp?sectionid=15http://www.afb.org/Section.asp?SectionID=15.

American Foundation for the Blind. (2004b). *Employment Statistics for People Who Are Blind or Visually Impaired: U.S., 1994-95* (Web Page). Retrieved 16 September 2004, from American Foundation for the Blind: http://afb.org/info_document_view.asp?documentid=1529.

American Foundation for the Blind. (2004c). *Internet and Computer Usage* (Web Page). Retrieved 16 September 2004, from American Foundation for the Blind: http://www.afb.org/section.asp?sectionid=43&topicid=224&documentid=2317http://www.afb.org/Section.asp?SectionID=43&TopicID=224&DocumentID=2317.

American Foundation for the Blind. (2004d). *Key Definitions of Statistical Terms* (Web Page). Retrieved 16 September 2004, from American Foundation for the Blind: http://www.afb.org/Section.asp?SectionID=15&DocumentID=1280.

American Foundation for the Blind. (2004e). *Research* (Web Page). Retrieved 16 September 2004, from American Foundation for the Blind: http://www.afb.org/section.asp?sectionid=43http://www.afb.org/Section.asp?SectionID=43.

Americans with Disabilities Act, 101st Cong. (1990)

Avery, C., & Zabel, D. (2001). *The Flexible Workplace: A Sourcebook of Information and Research.* Westport, CT: Quorum Books.

Burns, R. (2002). The Adult Learner at Work: The Challenges of Lifelong Education in the New Millennium. Crows Nest, N.S.W.: Allen & Unwin.

Challenger, J. A. (2000, September). 24 Trends Reshaping the Workplace. *The Futurist, 34,* 35.

Duarte, D. L., & Snyder, N. T. (2001). *MASTERING VIRTUAL TEAMS: Strategies, Tools, and Techniques That Succeed* (2nd ed.). New York, New York: John Wiley & Sons.

Foersterling, M. (Mark.foersterling@cincyblind.org). (2004, 27 October). Telephone Interview (Interview Concerning Personal Use and Expert Perspective on Use of Technology by Persons Who are Blind). Cincinnati, Ohio (60 minutes).

Gerber, E., & Kirchner, C. (2001, March). *Who's Surfing? Internet Access and Computer Use by Visually Impaired Youths and Adults* (Web Page) (176-181). Retrieved 16

September 2004, from American Foundation for the Blind: http://www.afb.org/info_document_view.asp?documentid=1521.

Hipple, S., & Kosanovich, K. (2003). Computer and Internet Use at Work in 2001: In 2001, More Than Half of All Workers Used a Computer on the Job; the Most Commonly Reported Use Was Connecting to the Internet or Accessing E-Mail. *Monthly Labor Review., 126*(2), 26.

Kirchner, C. (2002, 30 April). *The Elusive Visually Impaired Audience: A Selective Profile* (Presentation to the Conference of Librarians Serving Blind and Physically Handicapped Individuals). Retrieved 16 September 2004, from American Foundation for the Blind: http://www.afb.org/Section.asp?SectionID=43&DocumentID=1720.

Kirchner, C. (2004, 29 December). *Definition of Severe and Non-Severe Limitation*. Retrieved 29 December 2004, from Electronic Mail Message.

Kutsch, J. (Ky2d@comcast.net). (2004, 26 October). Telephone Interview (Personal perspectives as a successful business user of access technology). Jacksonville, Florida (55 minutes).

Mason, R. O. (2001, August). Case Study: Hal Richards: Technological Change and Moral Response. *Association for Information Systems., 7*. Retrieved from Association for Information Systems.: http://cais.aisnet.org/cookies.asp.

Microsoft Corporation. (2004a, 30 August). *Accessible Technology Market Research* (Web Page). Retrieved 16 September 2004, from Microsoft Corporation: www.microsoft.com/enable/research.

Microsoft Corporation. (2004b, 30 August). *The Aging of the US Population and Its Impact on Computer Use* (Web Page). Retrieved 16 September 2004, from Microsoft Corporation: http://www.microsoft.com/enable/research/agingpop.aspx.

Microsoft Corporation. (2004c, 30 August). *Findings About Computer Users* (Web Page). Retrieved 16 September 2004, from Microsoft Corporation: http://www.microsoft.com/enable/research/computerusers.aspx.

Microsoft Corporation. (2004d, 30 August). *The Wide Range of Abilities and Its Impact on Computer Use* (Web Page). Retrieved 16 September 2004, from Microsoft Corporation: http://www.microsoft.com/enable/research/phase1.aspx.National Library Service. (2004, 20 October). *Copyright Law Amendment, 1996: PL 104-197 December 1996* (Web Page). Retrieved from Library of Congress: http://www.loc.gov/nls/reference/factsheets/copyright.html.

National Science Foundation, Division of Science Resources Statistics. (2000). *Science and Engineering Indicators–2000* (pp. 8-23). Chapter 8). Arlington, Virginia: National Science Foundation, Division of Science Resources Statistics.

National Science Foundation, Division of Science Resources Statistics. (2002). *Science and Engineering Indicators–2002* (Web Page). Retrieved 27 December 2004, from National Science Foundation: http://www.nsf.gov/sbe/srs/seind02/c8/c8s1.htm#c8s1l3.

Nondiscrimination on the Basis of Disability in State and Local Government Services 28 CFR PART 35 § Background (1992).

Patrick, D., Washington, D. C., to Senator Tom Harkin. (1996), September 6.

Presley, I. (Presley@afb.net). (2004, 25 October). Telephone Interview (Discussion of large print display, screen magnification and other access technology). Atlanta, Georgia (20 minutes).

Rimkus, R. W. (Robert.w.rimkus@usa-spaceops.com). (2005, 4 January). Telephone Interview (Interview with Expert User of Access Technology). Houston, Texas (45 minutes).

Standards for Implementation of Section 508 of the Rehabilitation Act Amendments of 1998 36 CFR Part 1194 § Summary (2001)

U.S. Copyright Office. (2004). *Copyright Law of the United States and Related Laws Contained in Title 17 of the United States Code* (Web Page). Retrieved from Library of Congress: http://www.copyright.gov/title17/.

U.S. Census Bureau. (2004a, 8 July). Table 2 – Disability status of persons less than 22 years old: 1994-1995 – Data from the survey of income and program participation. In *Americans with Disabilities:* (http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t2.html) (Web Page). Retrieved 16 September 2004, from U.S. Census Bureau: http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t2.html.

U.S. Census Bureau. (2004b, 8 July). Table 3 – Disability status of persons 22 to 44 years old: 1994-95 – Data from the survey of income and program Participation. In *Persons with Disabilities* (Web Page). Retrieved 16 September 2004, from U.S. Census Bureau: http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t3.html.

U.S. Census Bureau. (2004c, 8 July). Table 4 – Disability status of persons 45 to 54 years old: 1994-95 – Data from the survey of income and program participation (Web Page). Retrieved 16 September 2004, from U.S. Census Bureau: http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t4.html.

U.S. Census Bureau. (2004d, 8 July). Table 5 – Disability status of persons 55-64 years old: 1994-95 – Data from the survey of income and program participation.. In *Persons with Disabilities* (Web Page). Retrieved 16 September 2004, from U.S. Census Bureau: http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t5.html.

U.S. Census Bureau. (2004e, 8 July). Table 6 – Disability status of persons 65 to 79 years old: 1994-95 – Data from the survey of income and program participation. . In *Persons*

with Disabilities (Web Page). Retrieved 16 September 2004, from U.S. Census Bureau: http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t6.html.

U.S. Census Bureau. (2004f, 8 July). Table 7 – Disability status of persons 80 years old and over: 1994-95 – Data from the survey of income and program participation. In *Persons with Disabilities* (Web Page). Retrieved 16 September 2004, from U.S. Census Bureau: http://www.census.gov/hhes/www/disable/sipp/disab9495/ds94t7.html.

Appendix A. Information On Disability Rights Laws

This guide provides an overview of Federal civil rights laws that ensure equal opportunity for people with disabilities, including persons who are blind or visually impaired. This information is taken from materials developed by the U.S. Department of Justice, Civil Rights Division, Disability Rights Section. Contact information for the agencies that have responsibility for providing information about the different laws is shown.

Americans with Disabilities Act (ADA)

The ADA prohibits discrimination on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications. It also applies to the United States Congress.

To be protected by the ADA, one must have a disability or have a relationship or association with an individual with a disability. An individual with a disability is defined by the ADA as a person who has a physical or mental impairment that substantially limits one or more major life activities, a person who has a history or record of such an impairment, or a person who is perceived by others as having such an impairment. The ADA does not specifically name all of the impairments that are covered.

ADA Title I: Employment

Title I requires employers with 15 or more employees to provide qualified individuals with disabilities an equal opportunity to benefit from the full range of employment-related opportunities available to others. For example, it prohibits discrimination in recruitment, hiring, promotions, training, pay, social activities, and other privileges of employment. It restricts questions that can be asked about an applicant's disability before a job offer is made, and it requires that employers make reasonable accommodation to the known physical or mental limitations of otherwise qualified individuals with disabilities, unless it results in undue hardship.

Religious entities with 15 or more employees are covered under title I. Title I complaints must be filed with the U.S. Equal Employment Opportunity Commission (EEOC) within 180 days of the date of discrimination, or 300 days if the charge is filed with a designated State or local fair employment practice agency. Individuals may file a lawsuit in Federal court only after they receive a "right-to-sue" letter from the EEOC.

Charges of employment discrimination on the basis of disability may be filed at any U.S. Equal Employment Opportunity Commission field office. Field offices are located in 50 cities throughout the U.S. and are listed in most telephone directories under "U.S. Government." For the appropriate EEOC field office in your geographic area, contact:

(800) 669-4000 (voice)   (800) 669-6820 (TTY)
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.eeoc.gov

Publications and information on EEOC-enforced laws may be obtained by calling:
(800) 669-3362 (voice)   (800) 800-3302 (TTY)

For information on how to accommodate a specific individual with a disability, contact the Job Accommodation Network at: (800) 526-7234 (voice/TTY)
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.jan.wvu.edu

ADA Title II: State and Local Government Activities

Title II covers all activities of State and local governments regardless of the government entity's size or receipt of Federal funding. Title II requires that State and local governments give people with disabilities an equal opportunity to benefit from all of their programs, services, and activities (e.g. public education, employment, transportation, recreation, health care, social services, courts, voting, and town meetings).

State and local governments are required to follow specific architectural standards in the new construction and alteration of their buildings. They also must relocate programs or otherwise provide access in inaccessible older buildings, and communicate effectively with people who have hearing, vision, or speech disabilities. Public entities are not required to take actions that would result in undue financial and administrative burdens. They are required to make reasonable modifications to policies, practices, and procedures where necessary to avoid discrimination, unless they can demonstrate that doing so would fundamentally alter the nature of the service, program, or activity being provided.

Complaints of title II violations may be filed with the Department of Justice within 180 days of the date of discrimination. In certain situations, cases may be referred to a mediation program sponsored by the Department. The Department may bring a lawsuit where it has investigated a matter and has been unable to resolve violations. For more information, contact:

U.S. Department of Justice
Civil Rights Division
950 Pennsylvania Avenue, NW
Disability Rights Section – NYAV
Washington, D.C. 20530
www.usdoj.gov/crt/ada/adahom1.htm or ada.gov
(800) 514-0301 (voice)   (800) 514-0383 (TTY)

Title II may also be enforced through private lawsuits in Federal court. It is not necessary to file a complaint with the Department of Justice (DOJ) or any other Federal agency, or to receive a "right-to-sue" letter, before going to court.

ADA Title II: Public Transportation

The transportation provisions of title II cover public transportation services, such as city buses and public rail transit (e.g. subways, commuter rails, Amtrak). Public transportation authorities may not discriminate against people with disabilities in the provision of their services. They must comply with requirements for accessibility in newly purchased vehicles, make good faith efforts to purchase or lease accessible used buses, remanufacture buses in an accessible manner, and, unless it would result in an undue burden, provide paratransit where they operate fixed-route bus or rail systems. Paratransit is a service where individuals who are unable to use

the regular transit system independently (because of a physical or mental impairment) are picked up and dropped off at their destinations. Questions and complaints about public transportation should be directed to:

Office of Civil Rights
Federal Transit Administration
U.S. Department of Transportation
400 Seventh Street, S.W. Room 9102
Washington, D.C. 20590
http://www.fta.dot.gov/contact_us.html
(888) 446-4511 (voice/relay)

ADA Title III: Public Accommodations

Title III covers businesses and nonprofit service providers that are public accommodations, privately operated entities offering certain types of courses and examinations, privately operated transportation, and commercial facilities. Public accommodations are private entities who own, lease, lease to, or operate facilities such as restaurants, retail stores, hotels, movie theaters, private schools, convention centers, doctors' offices, homeless shelters, transportation depots, zoos, funeral homes, day care centers, and recreation facilities including sports stadiums and fitness clubs. Transportation services provided by private entities are also covered by title III.

Public accommodations must comply with basic nondiscrimination requirements that prohibit exclusion, segregation, and unequal treatment. They also must comply with specific requirements related to architectural standards for new and altered buildings; reasonable modifications to policies, practices, and procedures; effective communication with people with hearing, vision, or speech disabilities; and other access requirements. Additionally, public accommodations must remove barriers in existing buildings where it is easy to do so without much difficulty or expense, given the public accommodation's resources.

Courses and examinations related to professional, educational, or trade-related applications, licensing, certifications, or credentialing must be provided in a place and manner accessible to people with disabilities, or alternative accessible arrangements must be offered. Commercial facilities, such as factories and warehouses, must comply with the ADA's architectural standards for new construction and alterations.

Complaints of title III violations may be filed with the Department of Justice. In certain situations, cases may be referred to a mediation program sponsored by the Department. The Department is authorized to bring a lawsuit where there is a pattern or practice of discrimination in violation of title III, or where an act of discrimination raises an issue of general public importance. Title III may also be enforced through private lawsuits. It is not necessary to file a complaint with the Department of Justice (or any Federal agency), or to receive a "right-to-sue" letter, before going to court. For more information, contact:

U.S. Department of Justice
Civil Rights Division
950 Pennsylvania Avenue, NW

Disability Rights Section – NYAV
Washington, D.C. 20530
www.usdoj.gov/crt/ada/adahom1.htm or ada.gov
(800) 514-0301 (voice)   (800) 514-0383 (TTY)

ADA Title IV: Telecommunications Relay Services

Title IV addresses telephone and television access for people with hearing and speech disabilities. It requires common carriers (telephone companies) to establish interstate and intrastate telecommunications relay services (TRS) 24 hours a day, 7 days a week. TRS enables callers with hearing and speech disabilities who use telecommunications devices for the deaf (TDDs), which are also known as teletypewriters (TTYs), and callers who use voice telephones to communicate with each other through a third party communications assistant. The Federal Communications Commission (FCC) has set minimum standards for TRS services. Title IV also requires closed captioning of Federally funded public service announcements. For more information about TRS, contact the FCC at:

Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.fcc.gov/cgb/dro
(888) 225-5322 (Voice)
(888) 835-5322 (TTY)

Telecommunications Act

Section 255 and Section 251(a)(2) of the Communications Act of 1934, as amended by the Telecommunications Act of 1996, require manufacturers of telecommunications equipment and providers of telecommunications services to ensure that such equipment and services are accessible to and usable by persons with disabilities, if readily achievable. These amendments ensure that people with disabilities will have access to a broad range of products and services such as telephones, cell phones, pagers, call-waiting, and operator services, that were often inaccessible to many users with disabilities. For more information, contact:

Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.fcc.gov/cgb/dro
(888) 225-5322 (Voice)
(888) 835-5322 (TTY)

Fair Housing Act

The Fair Housing Act, as amended in 1988, prohibits housing discrimination on the basis of race, color, religion, sex, disability, familial status, and national origin. Its coverage includes private housing, housing that receives Federal financial assistance, and State and local

government housing. It is unlawful to discriminate in any aspect of selling or renting housing or to deny a dwelling to a buyer or renter because of the disability of that individual, an individual associated with the buyer or renter, or an individual who intends to live in the residence. Other covered activities include, for example, financing, zoning practices, new construction design, and advertising.

The Fair Housing Act requires owners of housing facilities to make reasonable exceptions in their policies and operations to afford people with disabilities equal housing opportunities. For example, a landlord with a "no pets" policy may be required to grant an exception to this rule and allow an individual who is blind to keep a guide dog in the residence. The Fair Housing Act also requires landlords to allow tenants with disabilities to make reasonable access-related modifications to their private living space, as well as to common use spaces. (The landlord is not required to pay for the changes.) The Act further requires that new multifamily housing with four or more units be designed and built to allow access for persons with disabilities. This includes accessible common use areas, doors that are wide enough for wheelchairs, kitchens and bathrooms that allow a person using a wheelchair to maneuver, and other adaptable features within the units.

Complaints of Fair Housing Act violations may be filed with the U.S. Department of Housing and Urban Development. For more information or to file a complaint, contact:

Office of Program Compliance and Disability Rights
Office of Fair Housing and Equal Opportunity
U.S. Department of Housing and Urban Development
451 7th Street, S.W., Room 5242
Washington, D.C. 20410
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.hud.gov/offices/fheo/index.cfm
(800) 669-9777 (voice)
(800) 927-9275 (TTY)

For questions about the Fair Housing Act, you may call the Office of Fair Housing and Equal Opportunity at: (202) 708-2333 (voice); (202) 401-1247 (TTY)

For publications, you may call the Housing and Urban Development Customer Service Center at: (800) 767-7468 (voice); (800) 877-8339 (TTY)

Additionally, the Department of Justice can file cases involving a pattern or practice of discrimination. The Fair Housing Act may also be enforced through private lawsuits.

Air Carrier Access Act

The Air Carrier Access Act prohibits discrimination in air transportation by domestic and foreign air carriers against qualified individuals with physical or mental impairments. It applies only to air carriers that provide regularly scheduled services for hire to the public. Requirements address a wide range of issues including boarding assistance and certain accessibility features in newly built aircraft and new or altered airport facilities. People may enforce rights under the Air

Carrier Access Act by filing a complaint with the U.S. Department of Transportation, or by bringing a lawsuit in Federal court. For more information or to file a complaint, contact:

Aviation Consumer Protection Division
U.S. Department of Transportation
400 Seventh Street, S.W. Room 4107, C-75
Washington, D.C. 20590
http://www.transportation.gov/airconsumer
(202) 366-2220 (voice)
(202) 366-0511 (TTY)

Voting Accessibility for the Elderly and Handicapped Act

The Voting Accessibility for the Elderly and Handicapped Act of 1984 generally requires polling places across the United States to be physically accessible to people with disabilities for federal elections. Where no accessible location is available to serve as a polling place, a political subdivision must provide an alternate means of casting a ballot on the day of the election. This law also requires states to make available registration and voting aids for disabled and elderly voters, including information by telecommunications devices for the deaf (TDDs) which are also known as teletypewriters (TTYs). For more information, contact:

U.S. Department of Justice
Civil Rights Division
950 Pennsylvania Avenue, NW
Voting Section - 1800 G
Washington, D.C. 20530
(800) 253-3931 (voice/TTY)

National Voter Registration Act

The National Voter Registration Act of 1993, also known as the "Motor Voter Act," makes it easier for all Americans to exercise their fundamental right to vote. One of the basic purposes of the Act is to increase the historically low registration rates of minorities and persons with disabilities that have resulted from discrimination. The Motor Voter Act requires all offices of State-funded programs that are primarily engaged in providing services to persons with disabilities to provide all program applicants with voter registration forms, to assist them in completing the forms, and to transmit completed forms to the appropriate State official. For more information, contact:

U.S. Department of Justice
Civil Rights Division
950 Pennsylvania Avenue, NW
Voting Section - 1800 G
Washington, D.C. 20530
http://www.usdoj.gov/crt/voting/index.htm
(800) 253-3931 (voice/TTY)

Civil Rights of Institutionalized Persons Act

The Civil Rights of Institutionalized Persons Act (CRIPA) authorizes the U.S. Attorney General to investigate conditions of confinement at State and local government institutions such as prisons, jails, pretrial detention centers, juvenile correctional facilities, publicly operated nursing homes, and institutions for people with psychiatric or developmental disabilities. Its purpose is to allow the Attorney General to uncover and correct widespread deficiencies that seriously jeopardize the health and safety of residents of institutions. The Attorney General does not have authority under CRIPA to investigate isolated incidents or to represent individual institutionalized persons.

The Attorney General may initiate civil law suits where there is reasonable cause to believe that conditions are "egregious or flagrant," that they are subjecting residents to "grievous harm," and that they are part of a "pattern or practice" of resistance to residents' full enjoyment of constitutional or Federal rights, including title II of the ADA and section 504 of the Rehabilitation Act. For more information or to bring a matter to the Department of Justice's attention, contact:

U.S. Department of Justice
Civil Rights Division
950 Pennsylvania Avenue, NW
Special Litigation Section – PHB
Washington, D.C. 20530
http://www.usdoj.gov/crt/split/index.html
(202) 514-6255 (voice/TTY)

Individuals with Disabilities Education Act

The Individuals with Disabilities Education Act (IDEA) (formerly called P.L. 94-142 or the Education for all Handicapped Children Act of 1975) requires public schools to make available to all eligible children with disabilities a free appropriate public education in the least restrictive environment appropriate to their individual needs.

IDEA requires public school systems to develop appropriate Individualized Education Programs (IEP's) for each child. The specific special education and related services outlined in each IEP reflect the individualized needs of each student.

IDEA also mandates that particular procedures be followed in the development of the IEP. Each student's IEP must be developed by a team of knowledgeable persons and must be at least reviewed annually. The team includes the child's teacher; the parents, subject to certain limited exceptions; the child, if determined appropriate; an agency representative who is qualified to provide or supervise the provision of special education; and other individuals at the parents' or agency's discretion.

If parents disagree with the proposed IEP, they can request a due process hearing and a review from the State educational agency if applicable in that state. They also can appeal the State agency's decision to State or Federal court. For more information, contact:

Office of Special Education Programs
Office of Special Education and Rehabilitative Services
U.S. Department of Education
330 C Street, S.W. (Room 3086)
Washington, D.C. 20202
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.ed.gov/offices/OSERS/OSEP
(202) 205-5507 (voice/TTY)

Rehabilitation Act

The Rehabilitation Act prohibits discrimination on the basis of disability in programs conducted by Federal agencies, in programs receiving Federal financial assistance, in Federal employment, and in the employment practices of Federal contractors. The standards for determining employment discrimination under the Rehabilitation Act are the same as those used in title I of the Americans with Disabilities Act

Section 501

Section 501 requires affirmative action and nondiscrimination in employment by Federal agencies of the executive branch. To obtain more information or to file a complaint, employees should contact their agency's Equal Employment Opportunity Office.

Section 503

Section 503 requires affirmative action and prohibits employment discrimination by Federal government contractors and subcontractors with contracts of more than $10,000. For more information on section 503, contact:

Office of Federal Contract Compliance Programs
U.S. Department of Labor
200 Constitution Avenue, NW Room C-3325
Washington, D.C. 20210
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.dol.gov/dol/esa/public/ofcp_org.htm
(202) 693-0106 (voice/relay)

Section 504

Section 504 states that "no qualified individual with a disability in the United States shall be excluded from, denied the benefits of, or be subjected to discrimination under" any program or activity that either receives Federal financial assistance or is conducted by any Executive agency or the United States Postal Service.

Each Federal agency has its own set of section 504 regulations that apply to its own programs. Agencies that provide Federal financial assistance also have section 504 regulations covering entities that receive Federal aid. Requirements common to these regulations include reasonable accommodation for employees with disabilities; program accessibility; effective

communication with people who have hearing or vision disabilities; and accessible new construction and alterations. Each agency is responsible for enforcing its own regulations. Section 504 may also be enforced through private lawsuits. It is not necessary to file a complaint with a Federal agency or to receive a "right-to-sue" letter before going to court.

For information on how to file 504 complaints with the appropriate agency, contact:

U.S. Department of Justice
Civil Rights Division
950 Pennsylvania Avenue, NW
Disability Rights Section – NYAV
Washington, D.C. 20530
www.usdoj.gov/crt/ada/adahom1.htm
(800) 514-0301 (voice)   (800) 514-0383 (TTY)

Section 508

Section 508 establishes requirements for electronic and information technology developed, maintained, procured, or used by the Federal government. Section 508 requires Federal electronic and information technology to be accessible to people with disabilities, including employees and members of the public.

An accessible information technology system is one that can be operated in a variety of ways and does not rely on a single sense or ability of the user. For example, a system that provides output only in visual format may not be accessible to people with visual impairments and a system that provides output only in audio format may not be accessible to people who are deaf or hard of hearing. Some individuals with disabilities may need accessibility-related software or peripheral devices in order to use systems that comply with Section 508. For more information on section 508, contact:

U.S. General Services Administration
Center for IT Accommodation (CITA)
1800 F Street, N.W., Room 1234, MC:MKC
Washington, DC 20405-0001
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.itpolicy.gsa.gov/cita
(202) 501-4906 (voice)   (202) 501-2010 (TTY)

Architectural Barriers Act

The Architectural Barriers Act (ABA) requires that buildings and facilities that are designed, constructed, or altered with Federal funds, or leased by a Federal agency, comply with Federal standards for physical accessibility. ABA requirements are limited to architectural standards in new and altered buildings and in newly leased facilities. They do not address the activities conducted in those buildings and facilities. Facilities of the U.S. Postal Service are covered by the ABA. For more information or to file a complaint, contact:

U.S. Architectural and Transportation Barriers Compliance Board

1331 F Street, N.W. , Suite 1000
Washington, D.C. 20004-1111
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.access-board.gov
(800) 872-2253 (voice)   (800) 993-2822 (TTY)

General Sources of Disability Rights Information

ADA Information Line
(800) 514-0301 (voice)
(800) 514-0383 (TTY)
www.usdoj.gov/crt/ada/adahom1.htm or ada.gov

Regional Disability and Business Technical Assistance Centers
(800) 949-4232 (voice/TTY)
http://www.usdoj.gov/cgi-bin/outside.cgi?http://www.adata.org

Statute Citations
Air Carrier Access Act of 1986
49 U.S.C. § 41705
Implementing Regulation: 14 CFR Part 382

Americans with Disabilities Act of 1990
42 U.S.C. §§ 12101 et seq.
Implementing Regulations:
29 CFR Parts 1630, 1602 (Title I, EEOC)
28 CFR Part 35 (Title II, Department of Justice)
49 CFR Parts 27, 37, 38 (Title II, III, Department of Transportation)
28 CFR Part 36 (Title III, Department of Justice)
47 CFR §§ 64.601 et seq. (Title IV, FCC)

Architectural Barriers Act of 1968
42 U.S.C. §§ 4151 et seq.
Implementing Regulations: 41 CFR Subpart 101-19.6

Civil Rights of Institutionalized Persons Act
42 U.S.C. §§ 1997 et seq.

Fair Housing Amendments Act of 1988
42 U.S.C. §§ 3601 et seq.
Implementing Regulation: 24 CFR Parts 100 et seq.

Individuals with Disabilities Education Act
20 U.S.C. §§ 1400 et seq.
Implementing Regulation: 34 CFR Part 300

National Voter Registration Act of 1993
42 U.S.C. §§ 1973gg et seq.

Section 501 of the Rehabilitation Act of 1973, as amended 29 U.S.C. § 791
Implementing Regulation: 29 CFR § 1614.203

Section 503 of the Rehabilitation Act of 1973, as amended 29 U.S.C. § 793
Implementing Regulation: 41 CFR Part 60-741

Section 504 of the Rehabilitation Act of 1973, as amended 29 U.S.C. § 794
Over 20 Implementing Regulations for federally assisted programs, including:
34 CFR Part 104 (Department of Education)
45 CFR Part 84 (Department of Health and Human Services)
28 CFR §§ 42.501 et seq.

Over 95 Implementing Regulations for federally conducted programs, including:
28 CFR Part 39 (Department of Justice)

Section 508 of the Rehabilitation Act of 1973, as amended
29 U.S.C. § 794d

Telecommunications Act of 1996
47 U.S.C. §§ 255, 251(a)(2)

Voting Accessibility for the Elderly and Handicapped Act of 1984, 42 U.S.C. §§ 1973ee et seq.

Appendix B. Survey Form Used in the Development of This Paper

Technology in the workplace is becoming more sophisticated. Organizations are often using virtual work teams in which workers at different locations use technology to work together. Some workers telecommute. Workers may use e-mail, discussion boards, video conferencing, white boarding, text messaging and other techniques to enhance effectiveness while working with people down the hall or around the world.

As a blind person, I have encountered many people who have described problems with workplace and team access. I face many of these problems myself. Because of my interest in this problem, I am writing a graduate school paper and article about workplace and virtual team access issues. I would appreciate it if you would take a few minutes to respond to the brief survey below. If you like, you can let me know if it's ok to contact you to ask for additional information or clarifications. The survey results will remain anonymous. If I quote you—and you don't mind that I include your name—then I'll make sure you're given full credit. Thank you in advance.

Richard Petty
Independent Living Research Utilization – ILRU
Houston, Texas
Richard.petty@bcm.edu

Questions

1. What is your job title and briefly describe your job.

2. Has office technology presented on-the-job barriers? (For example, does the organization where you work use computer hardware or software which is inaccessible or which affects your job performance?) Please describe.

3. Have you ever lost a job, lost a promotion or been moved to another job because the technology used in the workplace could not be made accessible? If so, please describe.

4. Have you ever had difficulty using the same word processing, spreadsheet, database or electronic mail software used by your coworkers in your workplace?

5. Please describe.

6. Are you a member of a virtual work team in your workplace? Have you encountered any barriers in being part of that work team? Have you ever been left out of a project—or forced to insist your workplace use a different way of working because other members could use technology which was inaccessible to you?

7. Has virtual team software (such as Net Meeting) prevented or hindered you in working in a team environment? For example, have you been unable to use the group editing features, white boarding, text chat or audio meeting features of NET Meeting or other software?

8. Does your work involve Webcasts or video casts and, if so, how accessible are these for you? Is the accompanying presentation material, such as online Power Points, accessible to you?

9. Does your organization use intranet or internet pages for work or training? If so, is the material readily accessible to you? Can you navigate and read pages and complete Web forms with a screen reader or Braille display?

10. Do you telecommute or work with coworkers at remote locations? If so, do you feel fully a part of your work team and organization? As a blind person, do you believe working virtually has an effect on your performance or how you relate to and work with coworkers?

11. What are the most important changes which would improve access in your workplace? This could include improvements in software or hardware, changes in policies, additional or special training, or other changes in the organization.

12. May I contact you if I have additional questions? If so, please place your e-mail address in the space below. I'll respect your time and keep contacts to a minimum.

13. The survey is anonymous, but if you don't mind being quoted—and if you give me permission—I will cite you as a source in this study if you are quoted. If I may quote you, please state this here and write your name as I should show it in the article.

Appendix C.   Completed Surveys For Survey
On Workplace And Virtual Work Team Access

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Monday, August 16, 2004 3:45 PM

Answer to question 1: I am a Receptionist II for the Division for Blind Services. I am responsible for the incoming calls and responsible for the receptionist duties for our office numbering 34 people. My other job duties include but are not limited to: Screening of first-time applicants, directing calls to the proper people, handling telephone and email requests for information about adaptive and assistive products for the blind, assisting other staff with mail-out projects, providing support and training as a member of the Second Level Support team as it relates to Assistive Technology for employees which includes installation of screen reading software on other computers, training on office-specific applications and Internet-based forms; compile and edit office-related signin-signout sheets, calendars designating responsibility for a particular day on both receptionist duties and counselor duties; intake packages and notify responsible staff, and greet and direct persons who come in to the office and inform staff of their presence and business.

Answer to question 2: Texas state government.

Answer to question 3: I am fortunate, I am able to access everything, whether hardware or software based, that my job requires. I have, because of this accessibility, been able to exceed my job goals and have been able to achieve above and beyond my assigned goals, as well.

Answer to question 4: Yes, before coming to work here, I was turned down for jobs by companies unwilling to make the accommodations necessary for me to perform the job duties which were required even though those accommodations would have been provided by other financial assistance organizations.

Answer to question 5: Yes, there have been times when a new form, untested and untried, was introduced and which was totally unworkable. There are, however, channels that one can go through to resolve this problem. For the most part, the forms I have found to be unacceptable have been "fixed" and resubmitted to me or other blind persons within Division for Blind Services for testing. However, I am able to use all of the tools, such as email clients, word processing applications, Internet Web site, that others in my position and even tools that are used by staff in positions above mine and have even trained those very staff to use these applications.

Answer to question 6: No.

Answer to question 7: No.

Answer to question 8: No, Not Applicable.

Answer to question 9: Yes, we have something called TCBWorks which is an online medium to search for cases, input case notes, purchase vendor services (whether in-house or external), enter referral/intake information, and, fill out and print a full consumer application for services including the input of an electronic "pin" number chosen by the client/consumer. I have trained other blind persons on this Internet software with varying degrees of success based on their computer capabilities and, excluding the times that the system is giving everyone else problems, rarely because of lack of accessibility.

Answer to question 10: No, I do not telecommute or do any kind of virtual communication.

Answer to question 11: The Division for Blind Services, formerly Texas Commission for the Blind, is a part of the Department of assistive and Rehabilitative Services. These are recent changes and with those changes have come the growing pains of transition. In this process, certain forms used by the Department of Human Services have come down that are presently not accessible. Efforts are being made to change this and, in the meantime, blind staff are requesting, and being given assistance to work with these forms. Some of the problems are not due to the forms, but due to screen reading software that is being upgraded throughout the State to keep up with the changes. All in all, however, the attitude is that accessibility of the materials is important and is part of the transition process.

Answer to question 12: Yes, the email address is sharon.ewing@sbcglobal.net

Answer to question 13: Yes, you may quote me and my name is Sharon Ewing

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Tuesday, August 24, 2004 12:52 PM

Answer to question 1: Environmental Health Manager II. Inspect Child Care Centers, Foster Care Homes, Evaluate complaints that are called into the office, Inspect Schools, Quality assurance of Files and Documentation of Rabies Control Program, Develop and teach Training Classes for Child Care Infection Control, Blood Bourne Pathogens, Playground Safety and Playground Equipment, Various administrative duties as required including management of nursing student community health visits, employee duty lists, Emergency Management books, Maps and Materials for Shelters and incoming personnel assistance during disasters.

Answer to question 2: I am a full time State Government employee and volunteer my time to a non-profit organization.

Answer to question 3: Not really.

Answer to question 4: No, but without accessible technology (furnished through another source) I may well have lost this position.

Answer to question 5: No.

Answer to question 6: If we used virtual teams, I would be capable of most needs based on having Zoomtex installed at work.

Answer to question 7: True, not all programs work well with Zoomtex, especially ones designed and utilized for in-house programs.

Answer to question 8: No. If it were a requirement, I think? With my vision, I would manage it.

Answer to question 9: Yes.

Answer to question 10: Yes, I don't have any big issues with anything that I do. After rehabilitation training, it just took some time to make sure that supervisors and the Director knew what I can do (I became legally blind while working at this position. There have been a few compromises and the job description has changed somewhat over the years).

Answer to question 11: Publications and Regulations often can be a chore to read. If it were a perfect world, I would like to have a software reading scanner and software similar to "Open Book" for example (which I use at home). I do have a CCTV at work that solves most problems.

Answer to question 12: Yes. vevtsline@bellsouth.net (home) or hearnwm@dhec.sc.gov (work)

Answer to question 13: Yes. Max Hearn

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Wednesday, August 25, 2004 9:39 AM

Answer to question 1: Senior Access Technology Specialist:, provide A-T support and training to co-workers, associate agencies and others. Also liaison with government, industry and academia on standards for accessibility.

Answer to question 2: nonprofit

Answer to question 3: Mostly no accessibility barriers. In a few instances there are problems with older equipment or new technologies that have no accessibility options available.

Answer to question 4: No.

Answer to question 5: Mostly no. Some Excel, PowerPoint and PDF files present obstacles but I can usually work with the sources to provide alternative formats or make changes so the document is more accessible in the native format.

Answer to question 6: Mostly no. I am the secretary for a technical standards committee and often work via teleconference and email reflectors. When colleagues use whiteboards, slides or graphical media they will verbally describe the pertinent information for me and other vision impaired members. Occasionally it is necessary to be assertive and remind them, but usually they remember to do this.

Answer to question 7: In general I have avoided chat rooms and net meetings because a phone teleconference is an available alternative. I have tried chat rooms but found they require more effort than I would like (although perhaps more experience and practice will alleviate this). Whiteboards are not accessible and I can have the information read by the presenter (which I think is a reasonable accommodation).

Answer to question 8: Web cast and power point are used in the plenary meetings of the standards committee but, as noted before, visual information is described for vision impaired members. This usually flows smoothly with the presentation.

Answer to question 9: WE use Web-based information extensively. We have our home Web site, an employee and associated agency bulletin board, Web based newsletters, company databases, survey forms and product catalogs. Part of my responsibility is making sure these are accessible to vision impaired users with screenreaders.

Answer to question 10: I work in our office headquarters but often telework for plenary meetings of the standards committee. I work more efficiently in the office with my desktop and local network resources than on site with a laptop. I also have a moderate hearing loss and find a phone telecon preferable to a real presence because the speakerphone is always close to the principal speaker. I do not think working virtually adversely affects my performance or relationship to colleagues.

Answer to question 11: Improvements in portable wireless technologies such as smarpphones and PDAs with less expensive A-T capabilities are needed. Presently the PDA alternatives like PACmate and BrailleNote are much more expensive and not as portable. Cell phones still lack full accessibility to all the functionality of the device. I expect this will not really improve much until voice recognition and voice output become high quality standard features of mainstream devices. Training is important but both mainstream and access technologies need to become smarter and more intuitive.

Answer to question 12: Yes. jroeder@nib.org

Answer to question 13: You may quote me.
Joe Roeder
(703) 578-6524
Secretary
INCITS-V2 Technical Committee
www.incits.org/tc_home/v2.htm

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Wednesday, August 25, 2004 9:18 PM

Answer to question 1: My job title is financial analyst. The duties include analysis of accounts receivable, accounts payable, bank reconciliation and tax reporting as well as financial reporting

Answer to question 2: I work in the business sector.

Answer to question 3: Yes I have come across software application that have been inaccessible and has made it difficult to do my job such as Sap accounting packages, and Orical database software as well as Lotus notes for e-mail and other tasks like that.

Answer to question 4: Yes but over time they were able to locate to do other tasks until they could come up with the technologies to promote to other areas that my talents would enhance the organization Answer to question 4

Answer to question 5: No since they use the basic Microsoft office, Sql database, the only exception have been Orical database in one of the departments, Sap Accounting in another and lotus Notes in another department.

Answer to question 6: No since we used e mail for some of the interaction and instant messaging clients like msn messenger or AIM.

Answer to question 7: No.

Answer to question 8: No for Web type applications but at times it is a bit inaccessible to be able to use PowerPoint to do presentations and require an assistant to assist in these instances.

Answer to question 9: Yes the company Internet is accessible to use with a screen reader as well as filling out forms with a screen reader as well.

Answer to question 10: Yes part of the job requires telecommunicating and the other part requires working in a team situation. I feel in either situation I am part of a team. Maybe my personality allows me to be a team player and understand what is required of my team members to get the job done in a productive fashion.

Answer to question 11: Major changes could be that some people in the workplace treat me as if my legal blindness requires special attention and some times they are a bit ignorant and a bit of education on the issue and they understand and are willing to help me out in any way they can. Also I would like to see changes in most of the software that is used in the organization could be easy to use with screenreaders like window ees and jaws Also be an equal and not feeling that just that you are blind you can do anything or you do know as much as others but when you communicate openly to others it breaks the ice and they understand and are more friendly to you and understand that you can do almost anything that a sighted colligue with a little bit of modification and understanding on the part of the organization.

Answer to question 12: garymelc@msn.com

Answer to question 13: No problem every bit helps in the awareness of the blind in the workplace. My name is Gary Melconian.

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Thursday, August 26, 2004 2:21 PM

Answer to question 1: Investigations Officer Australian Broadcasting Authority - field all phone calls related to the content regulation answer correspondence on same, maintain stocks of all printed information

Answer to question 2: Australian government

Answer to question 3: Photo copying equipment with touch pads is unuseable, a custom designed information management application written in JAVA is proving to be inaccessible, an off the shelf records management application is inaccessible

Answer to question 4: No not to date

Answer to question 5: I have difficulty using some of the custom designed features of database reporting, word documents written in tables

Answer to question 6: I have had to lobby for more screen reader friendly document design particular in the human resources area, articulation of progress through meeting agendas etc.

Answer to question 7: This has not been used to date

Answer to question 8: No

Answer to question 9: For the most part

Answer to question 10: I've never worked in this way

Answer to question 11: Consciousness of accessibility in purchasing of hardware such as fax machines and photo copiers; commitment to insuring that software contractors live up to the accessibility requirements of a contract; procedures which consider accessibility when designing information products, software, and presentations

Answer to question 12: suethomp@ozemail.com.au

Answer to question 13: You may quote me, but ask that you don't quote the exact name of my employer; my name is Susan Thompson

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Thursday, August 26, 2004 3:25 PM

Answer to question 1: Tax Fraud Investigative Assistant for the Dept. of the Treasury.

Answer to question 2: Government

Answer to question 3: N/A

Answer to question 4: Was moved to current position back in 1982 partly due to employer not being able to get the proper technology.

Answer to question 5: The screens used by the other employees are not large like the one I currently have. It is difficult to read on those computers.

Answer to question 6: N/A

Answer to question 7: N/A

Answer to question 8: N/A

Answer to question 9: We do use intranet and internet. The pages are accessible.

Answer to question 10: N/A

Answer to question 11: Accessible technology and more training.

Answer to question 12: Kevin.Berkery@ci.irs.gov

Answer to question 13: Yes, Kevin Berkery

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Thursday, August 26, 2004 4:57 PM

Answer to question 1: I am a medical transcriptionist. My job is to type from doctors' dictation that information necessary for a patient's chart.

Answer to question 2: I work for a national medical transcription firm where I telecommute.

Answer to question 3: Both the local company and the national one for whom I work as an independent contractor do not have inaccessible workplace constraints. I use MSN for messaging, a wav pedal for taking the dictation and Microsoft Word and JFW 5.0 for both accessing templates and taking down dictation. I also use the Stedman reference books and wordbooks for any looking up I must do.

Answer to question 4: Yes. I did lose a job because of this. I was working for a company out of Texas and when they went to Transnet, a Dictaphone product, I lost that job until I found out that there was a blind person using it but by that time it was too late.

Answer to question 5: I haven't had any difficulties using the same email clients, databases and/or spreadsheets utilized by my coworkers. With one company with whom I worked briefly, the patient census database was a little hard to access but by a little bit of struggling with it, I was able to get it to go. Where I really had the problems was in the master files that were in PDF and PDF at the time of this particular job was virtually inaccessible. I had the supervisory team convert it into doc format and then I could utilize it effectively.

Answer to question 6: I am a member of a virtual work team as the whole company is a virtual workplace. I have worked with this team for almost 2 years and have not encountered the barriers of which you speak.

Answer to question 7: I have never used white boarding but have utilized net meeting and have helped to get others to utilize the IE Vocalize conferencing system.

Answer to question 8: This has not been the case in my particular workplace.

Answer to question 9: This is not the case in my particular workplace.

Answer to question 10: I do work virtually as described above. I have had no problems feeling part of the whole team as I am only an instant message away. The only thing I have had to do is to tell workers when they make a graphic such as a smile; frown or other facial expression is to write that expression out in parentheses such as (smile) or (lol), etc.

Answer to question 11: I very much like the software and hardware we have at present.

Answer to question 12: You may contact me at cutterdog@earthlink.net or (415) 586-0742 should you need clarification.

Answer to question 13: You may quote anything I have stated. You can quote me as Marsha Macchi.

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Monday, August 30, 2004 11:12 AM

Answer to question 1: Visual Impairment Service Team Coordinator

Answer to question 2: Government

Answer to question 3: Yes, photocopying machine and telephone displays are not at all accessible to people unable to read standard print. The VA uses a variety of software such as, CPRS that presents significant barriers to speech access.

Answer to question 4: No.

Answer to question 5: Yes.

Answer to question 6: No.

Answer to question 7: N/A

Answer to question 8: No

Answer to question 9: Yes we use them, no they are not accessible for the most part, and occasionally I will find some that are.

Answer to question 10: No

Answer to question 11: Compliance with 504 and 508, and the implementation of a watchdog within the federal government to assure full and equal access to all employees by implementation of existing laws.

Answer to question 12: Yes, margie.donovan@med.va.gov

Answer to question 13: Yes, Margie Donovan

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Monday, August 30, 2004 6:02 PM

Answer to question 1: Recently retired from Mississippi State University

Answer to question 2: Education

Answer to question 3: Yes, copier handouts in meetings and printers

Answer to question 4: No

Answer to question 5: Yes some of the spread sheets etc. are created using spss

Answer to question 6: No

Answer to question 7: Yes blackboard for example

Answer to question 8: Yes using audio-tips

Answer to question 9: Yes

Answer to question 10: No

Answer to question 11: I should have been consulted before purchasing many pieces of hardware and software prior to purchasing the equipment to see if it was compatible with my equipment

Answer to question 12: franklin1234@cableone.net

Answer to question 13: Franklin Johnson

From: "anonymous" <yamform-admin@bcm.tmc.edu>
To: <Richard.petty@bcm.tmc.edu>
Subject: WWW form from
Date: Tuesday, August 31, 2004 5:11 AM

Answer to question 1: VIST Coordinator, provide service to blinded veterans, ie., assessment of needs, screen for benefits, make referrals to various government agencies, case manage.

Answer to question 2: Federal government

Answer to question 3: For the most part no. The VA keeps my special needs software up-to-date.

Answer to question 4: No.

Answer to question 5: No.

Answer to question 6: No.

Answer to question 7: Never used NET Meeting. I don't think that it is used here at all.

Answer to question 8: No.

Answer to question 9: Yes.

Answer to question 10: No, no problem.

Answer to question 11: I am happy with the software and hardware that I am using at this time.

Answer to question 12:

Answer to question 13: No

Appendix D. Making Your Module Accessible in the Blackboard

The following Web page is included as an appendix to illustrate the issues and barriers to Web pages faced by users who are blind or visually impaired. This report describes a review of the Medicare Web site operated by the U. S. Department of Health and Human Services. This report is from the Web site of the American Foundation for the Blind, the organization that conducted the study (http://www.afb.org/info_document_view.asp?documentid=1718>).

American Foundation for the Blind

Conducting Usability Testing With Computer Users Who Are Blind or Visually Impaired

Table of Contents

Abstract

There are three main points to this paper:

1. To illustrate the frustrations of accessible Web sites. That is, even technically compliant sites can be inaccessible to the user, because they are so difficult to use. Compliance with accessibility laws and guidelines, in other words, is necessary but not sufficient for users to access what they need. I hope that illustrating this highlights the importance of usability studies as integral to Web design.

2. To give some background and information about how to conduct usability and user experience studies. I am particularly interested in how they can be adapted for and what may

be unique about computer users who are blind or visually impaired. I will include a discussion of the added value that the Web offers to this community.

3. To present generalizable findings, the results of research conducted by the American Foundation for the Blind (AFB), which we hope can be applied more broadly.

   Section 508 of the Rehabilitation Act now requires, among other things, that all Web sites used by federal employees and members of the public seeking information and services from the federal government be accessible. The World Wide Web Consortium (W3C) has published guidelines (known as the Web Accessibility Initiative or WAI) in addition to the legal requirements. Furthermore, there are now a number of automated tools (such as Bobby and WAVE), which detect compliance with these standards. And the field of accessible Web design is growing. However, as any computer user knows, in order to be truly accessible, a site also has to be usable. There has been very little focus thus far on measuring whether what is technically "accessible" for individuals with visual impairments is reasonably usable. In fact, our research suggests that it often is not: Technical compliance with accessibility standards is necessary but not sufficient for building truly usable sites for people who are blind or visually impaired.

   This paper presents findings from extensive usability and user's experience research conducted with computer users who are blind or visually impaired. I review previous research conducted in this arena, illustrate how it can be adapted for this population, and present generalizable lessons drawn from three different Web site tests conducted by the Policy Research and Program Evaluation Department of AFB, involving over 100 research participants. This paper, I hope, will allow Web designers, software and assistive technology developers, researchers, and anyone else interested in learning how to conduct these tests to make more usable, and therefore accessible, Web sites.

Part I: Background - Usability and User Experience Testing

   The field of mainstream Web design has incorporated usability testing as its mainstay; research methodologies have been tested and metrics developed in large part due to the effort of Jakob Nielsen. According to his research, Nielsen has found that generally five users is a sufficient sample size to determine 80% of the site level usability. (See <www.useit.com/alertbox/20000319.html>). There are however some exceptions to this "rule," and I would add to his preexisting list some additional considerations based on my research among individuals with visual impairments: in particular, testing with people with low vision, older persons, and beginning users, since so little is known about computer use among these overlapping populations.

   Previous usability and user's experience research has, almost without exception, been conducted with an able-bodied population, or at least with people for whom the use of assistive technologies was not noticeable. Some of the work of the Nielsen Norman group has begun to look at people with disabilities, and these findings are discussed below. The only other research to date conducted with people who are blind or visually impaired was a pilot study. In this work (see http://www.csun.edu/cod/conf2000/proceedings/0073Barnicle.html), Barnicle identified a number of pertinent questions, such as: How must the testing techniques be adapted to accommodate the needs of participants; Would the study yield useful, (i.e. generalizable) data;

and how will I know if the obstacles encountered were due to the mainstream software application, the assistive technology or the unique characteristics of an individual user? I hope to identify and answer some of those questions in this paper as well.

The research on which this paper is based consists of three rounds of Web usability and user experience testing. Two of these were conducted for the purpose of revising the American Foundation for the Blind's Web site (<http://www.afb.org/>) and one round of testing on the Center for Medicare and Medicaid Services' (CMS, formerly HCFA) Web site (<http://www.medicare.gov/>). People in the usability field tend to refer to objective, quantitative tests as "usability studies": they gather objective metrics, such as the time a task requires, the error rate, which keystrokes were used for navigation, etc. Expanding the concept of usability a bit more broadly is often referred to as "user's experience" data: these studies include measuring users' subjective satisfaction, why they would visit one site as opposed to others, and for our purposes, how people with visual impairments conceptualize the Web. Generally speaking, gathering "user's experience" data is more ethnographic in its approach; my emphasis was to understand how users approach and use a site, what they like and do not like qualitatively about it, and mainly, whether they perceive it as "accessible."

The findings presented below come from tests, all of which included individuals who accessed the screen using screen reading and screen magnification technologies. Testing AFB's Web site involved 27 and 29 individual interviews in different rounds; CMS testing included seven at home, individual interviews, and eight focus groups involving 43 participants. A total of 106 people have participated in the testing. Greater detail about our selection process, justification for sampling, and obstacles to recruitment are available upon request (see Gerber and Kirchner 2001).

Part II: Adapting Methods and Unique Considerations

The second main point has to do with methods. (See the additional methodological considerations below). The Policy Research and Program Evaluation Department at AFB is convinced that a combination of methods, in particular focus groups and individual interviews, works best with this population.

In-depth, in-person, individual interviews (ideally conducted at the subject's natural workstation) take advantage of what is known in the field as the "thinking aloud method." Because the data are gathered through observation, subjects are literally asked to "think aloud," telling the researcher what they are doing and why, as they perform a variety of predetermined tasks. Tasks should be based on one's research needs as well as geared towards the research participant's interests; better data are collected when the individual involved is more highly motivated. The benefits of in-depth interviews (or IDIs) are not necessarily different for a visually impaired than for a sighted sample. That is, the researcher can observe what errors are being made, if the subject is "lost" (they think they are somewhere they aren't), and numerous other scenarios where a difference in perspective between user and observer may arise. Additionally, clarification can be sought for vague descriptions used by participants, such as "over here" or "I like that part there." Similarly, being present while someone is working gives the opportunity to probe on any new, unsuspected issues that arise while they are actively

engaged on a site. There is a great need, as identified by Barnicle, for further research to take place in "real life" settings.

The second strategy, and one that deviates from the standard literature of usability, is to test using telephone focus groups. Although there are limitations to telephone focus groups, efforts should be made to work to minimize the effects, as they make obtaining data from individuals with low prevalence conditions much more easy and affordable. In part, Nielsen warns against using focus groups (and he refers to in-person groups, rather than ones conducted by phone) because the results are misleading: he says that individuals tend to focus on the hypothetical (See, for example, <http://www.useit.com/alertbox/20010805.html>). We circumvented this difficulty by assigning practical "tasks" in advance of focus groups. Individuals were asked to complete two tasks and to spend about 10 minutes just "surfing." Concerns that people bend the truth to be closer to what they think you want to hear or what's socially acceptable were also avoided in this design, as only two people per group were assigned the same task. Positioning the participants as experts by soliciting, and valuing, their opinions further indicated that "there were no right answers", and helped elicit honest responses.

The last two reasons that Nielsen warns against the use of focus groups actually may not apply to the majority of computer users who are visually impaired. Specifically, he suggests that in focus groups users tell you what they believe they did, not what they actually did. Although I agree that memory is highly fallible, I would argue that, on average, people who are blind have trained themselves to be more dependent on their memory than most sighted individuals (both in terms of computer use and, most likely, in terms of other skills as well). For example, it may be that the use of memory results from heavy reliance on technical support (as computer use with adaptive equipment is frequently mediated by experts); simply, people with visual impairments are accustomed to recounting details when they call the "help desk" for support. Regardless of the cause, our data clearly indicate that blind and visually impaired users can remember with a high degree of accuracy exactly which steps they took to accomplish a particular task, which keystrokes or commands they used, and the wording of error messages they received as a result. Examples such as these abound from our research.

The second and major reason that, again on average, this population differs from that on whom all the other usability research has been conducted, is that these individuals seem especially highly motivated to clear any hurdles to accessing computer information. Being blind, these individuals have had limited access to graphical user interfaces (GUIs) and are accustomed to software that is incompatible with adaptive equipment. In other words, they are used to struggling to get the information they need. And, most importantly, because this medium allows users to access information independently (some for the first time), they are extremely motivated. While we encouraged users not to spend more than a half hour accomplishing their task assignment, users usually could not complete the tasks in the given time; however, very few stopped at a half hour, and some continued until they could complete it, taking as much as 10-14 hours.

One participant in the Medicare study told me that she had just spent two days purchasing airline tickets online. When I asked her why she did that, why didn't she just call a travel agent or the airlines directly, she said, "Well, I wanted to be able to do it. I wanted to see if I could."

The fact that participants in our studies were so motivated, so driven to succeed that they would spend days on the computer at the task at hand, reiterates the main theme of this presentation: visually impaired computer users tolerate many frustrations in using computers, even on Web sites meeting technical standards of "accessibility," and they do so, I believe, mainly because of the "added value" that the Web offers compared to other sources of information, especially for persons who are blind or visually impaired. By "added-value", we mean mainly unmediated access to information. That is:

a. the information is more consistent than that provided by various phone operators;
b. the information is considered to be more valid than what is offered by phone -- it is "in print", and thus has legal validity, it is accountable;
c. information is available "on call", so that individuals can access it whenever they want, on their own time schedule, including the middle of the night or whenever they have time to pursue the issues in more depth;
d. information can be copied verbatim and shared with others who need it;
e. there is opportunity to come across new, relevant information that they didn't know existed or might not have thought to ask about;
f. accessing it does not require one to divulge private information. Judy who likes to keep her Medicare status confidential, went on to say, "...I think the Internet for my use is good, as I may not be happy talking over the phone, so I want as much information on the Internet as possible." and, perhaps most importantly for people who are blind or visually impaired,
g. users have direct access to information. This has both practical and psychological implications (i.e., the self-satisfaction, or empowerment, that results from being independent).

Part III: Generalizable Findings

The third main objective is to present our results, and in particular, those findings which can be applied more generally to Web sites than just the few on which we generated these data. In addition to the items discussed previously, there are another nine presented below. Some of these findings compare results to sighted counterparts (as in the case of the Nielsen Norman study discussed below). However, when asking the question, "How well did our Web site fare?" it may be equally or more appropriate to compare the results to other, similar Web sites or benchmarks, as also accessed by people who are blind or visually impaired. In the Medicare study, for example, this would mean sites such as WebMD or drkoop.com. Similarly, for users who are blind or visually impaired it would also be useful to compare findings to other sources of information, such as the phone, for getting at the same data. Participants' responses are shaped not only by how they feel an individual site functions, but also by these other experiences.

1. Time spent on tasks.

A discussion of the time it took individuals to accomplish assigned tasks in our studies is presented above. Generally speaking, it took participants far longer than anticipated; individuals would continue working until they had succeeded, and they were not "timed-out." The Nielsen Norman Group estimates that the Web is about three times easier for sighted users than for users who are blind or visually impaired. Sighted users in their study were six times more successful

than users of screenreaders at accomplishing given tasks, and three times more successful than users of screen magnification. (See <http://www.useit.com/alertbox/20011111.html>). These numbers clearly demonstrate just how poorly the Web is designed for people who are blind or visually impaired, and how far we have to go.

2. Need for clarity and consistency

People also had problems working with the interactivity of sites, particularly when sites deviated too much from standard Internet conventions. Because this population relies heavily on memorization to aid in their navigation, if there is a convention, use it. Deviating from these norms, means users have to learn a new routine for each site. Many people have told us that they re-visit sites because "they know it," because they "know it's accessible." They re-visit sites because they are familiar with their layout and therefore can navigate more easily. Thus, once a site has set up a system that works well, keep it: change content but don't change the overall gestalt. This point supports the importance of "early and often" user testing.

3. Patterns of information-seeking

Elsewhere I have described in greater detail (see Gerber 2002) the two main approaches users take when they navigate the Web: scrolling and searching. Designs should take into account the fact that many users will mine for just the kernel of information they are seeking, while others are more apt to listen to the whole page, or the whole list of links, before proceeding.

4. Issue of separate screen reader (SR) or "text-only" versions vs. accessibility of default site

Most users told us they do not appreciate having a separate SR or "text only" version of a site. They were concerned that they might not be getting the same thing as the default site, and that it might not be updated as regularly. Those who did appreciate the "SR version," because of its name, also expected it would be specially designed for them (but in this case saw that as a positive, assuring ease of use and appropriate content). If a separate version must exist, they definitely recommended calling it a "text only" version, because this makes it a "universal design" feature. Importantly, users of screen magnification had difficulty finding the separate screen reader version in the Medicare study, didn't know it applied to them, and often preferred pages with graphics because too much text is harder for them to read.

As Marlene described it, "I like graphics. If I go to a site with a text version, that is not my first choice. I like the option of looking at the page, with a text version I have to scroll down more...I want to find information quickly and move on with less reading which is not possible with text version."

5. Repetitiveness of main navigation links

Having repetitive links is time-consuming, frustrating, and presents serious obstacles to navigation and orientation.

William described this problem: "The biggest thing I found was when I down arrowed and found what I was looking for, when I clicked on it I have to hear that full list of things again. It would be nice if these sites could be indexed like how tapes are. We heard it once, why do we have to hear it again? For example, from the home page, I clicked on FAQ; it would be good if it went to there but instead it starts at the top again."

Karen elaborated, "I found the repetition to be very difficult in terms of navigation. I would be on a page and I would know that this or that information was presented, and then I might come back to it and find it again and think, 'Have I been here or is this a new page?' Because it seemed to be so repetitive. So that was a little bit confusing for me."

Build into design the ability to skip links, particularly main navigation links. Furthermore, immediately confirm home page and subsequent pages, once loaded.

6. Search functions are too complicated and don't always work well

Search functions were very often felt to be too complicated; they didn't function properly to get users the information they wanted. Searching was generally problematic. Users suggested that, to make it more effective, create search engines that are key word and text sensitive searches, that the search recommend the next closest matches in case of misspellings or accidental key strokes, that it indicate when it was actively searching, and that users be taken immediately to their results. There were also numerous suggestions about how to present the results more clearly. These particularly had to do with less jargony, more user-driven language. Results generally were not where or what users expected. For example, on AFB's Web site people had difficulty locating "jobs" (it was housed under the broader category of "community"). And with Medicare, in a section that compared nursing homes, the language reflected an agency or researcher, not a user's, perspective -- such as "total number of health deficiencies," not something users knew readily how to interpret.

7. Difficulty accessing publications

Documents in PDF are considered to be inaccessible. Period. Although some very high-end, expert users know how to work with Adobe Acrobat, the majority of participants in our studies (who also had more experience than the average user) had difficulty with the files, were intimidated or didn't want to download from the Web, had the download crash their system, and considered PDF to be inaccessible to them. This again proves the point that accessibility does not necessarily guarantee usability: when we design for the Web, we need to design for an average, not high end, user. For a more technical explanation of the problems surrounding PDF, please see (Sajka and Roeder 2002): <www.afb.org/AboutPDF.asp>

8. Difficulty with the interactivity of the site

The interactivity on Web sites, particularly although not exclusively, with forms -- order forms, "shopping carts", and the like -- posed serious difficulty. In designing forms: A) make the tab order follow logically; include only one item per line; and label it appropriately. B) Consider longer times before being "timed out" and the ability to "page back" without losing all entered data. C) Place the submit button close to the last entry. This last consideration is particularly important for users of screen magnification. The Medicare Web site is riddled with places where

the submit button is located after confusing and lengthy layout (including misleading "top of page" and "bottom of page" arrows). I invite you to try their nursing home comparison, and remember you will only have a fraction of the screen visible when it is magnified, at: http://medicare.gov/NHCompare/home.asp#NewSearch

9. Items not included that users would like to see added

In thinking about how users who are blind or visually impaired benefit from electronic media, building sites that consider the added value will be more useful, and therefore more likely to be accessed by this population. Consider the case of Medicare once again. Users wanted additional links because they rely on online sources for prescription drug information. Users wanted the ability to email Medicare about coverage questions. They wanted replies sent to them in an accessible format. They suggested setting up a "my account" section. Those of you in the audience interested in electronic banking, as well as other fields, might do well to think of the added benefits that Web access can bring to your clientele.

In conclusion, the single most important thing I want to convey is the importance of testing sites, including accessible ones, for usability. Users have told us time and again, that if they had a choice between two sites to get what they needed, they would go to the one where they knew how it worked, where it was easy to get what they needed, and they would keep coming back-using it almost as a portal, if you will. So, if you are trying to drive traffic to your site, build a site that is designed from the point of view of the end-user, as they have told us repeatedly that they would prefer to go to sites that they know are usable. Test early and test often. Thank you.

METHOLOGICAL CONSIDERATIONS

Research design will vary according to the objectives and nature of the particular research project at hand. The following methodological considerations are lists of details to be considered, and modified according to the nature of specific projects.

General considerations:

1. Participants should be given compensation, which may be monetary or non-monetary.

2. Obtain consent for all participants about taping and uses of the data.

3. Provide participants with a copy of the findings, or summary of the findings, that has been learned with the client.

4. Recruitment variables will vary depending on the nature of the project. See below.

Recruitment details

Screening variables on which respondents should meet a minimum requirement:

a. *Vision loss* - minimum is self-reported, e.g., "ongoing difficulty seeing words and letters in ordinary newsprint, (even with glasses on, if usually worn);"

b. *Use of the internet* - Has ever used the internet, and has current access at home, work, a library or other place that the person does visit.

c. *Language/literacy* - English speaking, unless some provisions are made for moderators who speak another language; literacy presumed if has used Internet.

Respondent characteristics, which can be confirmed by a telephone screening, interview and used to achieve diversity, are:

a. *Degree of vision loss:* No usable vision vs. otherwise visually impaired.
When considering the degree of vision loss, we generally advise organizing groups according to whether they use visual (i.e., screen magnification) or non-visual means (i.e., screenreaders) to access the Web. In the research presented above, users of screenreaders and screen magnification were grouped separately from each other whenever possible, as their concerns tended to differ; all other variables were mixed within groups.

b. *Computer experience:* Less experienced vs. more experienced. Diversity can also be sought on the following characteristics, but may be secondary in the selection process:

c. *Geographic location:* Broad census-defined regions, i.e. east, midwest, west, south

d. *Age or "life stage"* (e.g., school/transition age; young and middle aged adults; older adults)

e. *Employment status* (employed now or ever vs. never employed)

f. *Educational attainment* (and implied literacy level)

g. *Age at loss of vision / length of time visually impaired* (related but separate variables)

h. *Ethnic identity* (1st or 2nd generation U.S. citizen, any nationality; African-American/Blacks of 3rd+ generation; other)

i. * *Health status* (self-reported as "excellent, very good or good" vs. "fair or poor")

j. * *Medicare eligibility and experience* (very recent vs. long time or frequent user)
   * for our purposes, these last two variables only applied to the Medicare study

Additional Rationale for Testing in "Real-Life" Settings

Usability testing conducted in the user's home environment, by an anthropologist or other trained researcher, adds an ethnographic approach to the typical "laboratory" usability technique; this is an especially strong methodology because of its authenticity. That advantage has several aspects:

a. it shows how the Web site works on computer hardware and access software that are what people really use, i.e., presumably older and with more limited capacity than what they would experience in a "lab" setting; this takes into account other software they have installed at home;

b. it takes place in environmental conditions (e.g., lighting, background noise, clutter in the vicinity, family distractions, etc.) that closely approximate actual usage, allowing for slight alteration due to the researcher's presence;

c. users are more at ease than in the "lab" setting, thus enhancing performance, and also tending to make their comments more meaningful in terms of their actual behavior in seeking information, particularly if the topic involves personal matters, such as health.

d.   Finally, and importantly, this technique clearly reduces "respondent burden" both in terms of their not having to travel, and comfort during the testing. This makes it possible for people to participate who would not agree to testing in a "lab" because of the travel.

Methodological Limitations

It is always advisable to know what the limitations inherent in one's research design are, in order to minimize their impact, if possible, and to know how they may shape the extent and quality of the data gathered. Consequently, we compiled a list of issues, which represent possible limitations. In addition to considerations presented in the body of the paper, researchers should consider the following:

a) Number of groups - Given the nature of one's project, there may be many relevant demographic, health, computer usage variables, etc under consideration. Consider the number of groups and/or individuals involved in the study. Do they represent the minimum acceptable composition? How would you expand your project if you had unlimited time and resources (e.g., including Spanish-speaking users, etc)?

b) Composition and size of groups - It is desirable to make focus groups more homogeneous in respects besides whether they use visual or non-visual access; this may only be possible with a larger number of groups. For example, in the Medicare study mentioned above, we aimed to have separate groups of beneficiaries by age and by disability status. However, limited time and resources required us to occasionally mix those types of respondents within a group.

We experienced, as expected, that it would be particularly difficult to find older individuals who are beginner or intermediate-level Internet users, i.e., older visually impaired persons typically are either not computer users at all or have been using computers for a long time and are quite expert.

c) Recruitment sources - A main limitation is the heavy reliance on a single strategy or source for recruitment (e.g., via electronic advertisements to list serves). While online sources or known computer user groups are valuable resources to achieve relatively well-targeted recruitment in a short period of time, this design will not result in representativeness, and is biased toward people skilled in using computers with assistive technology.

Use of prior research subjects has the advantage that one already knows about many of an individual's relevant characteristics, but has the disadvantage that those persons may become "professional respondents" and therefore less representative of other users.

d) Content - See above for a critique of obtaining precise or reliable information about issues of content and navigability via focus groups. It has been suggested in previous literature (i.e., <http://www.useit.com/alertbox/20010805.html>) that focus groups cannot provide the same level of detail as observation, and it is possible that this will be a limitation. In our research, however, we attempted to compensate for this by complementing our focus group findings with in-person interviews. Moreover, there are certain characteristics of the study population, which we believe, actually increase the utility and accuracy of such information (again, see above).

References

American Foundation for the Blind Web site: http://www.afb.org/

Barnicle, Kitch. 2000. Paper presented at the California State University Northridge (CSUN) "Technology and Persons with Disabilities" Conference. See: http://www.csun.edu/cod/conf2000/proceedings/0073Barnicle.html)

Bobby Worldwide, Center for Applied Special Technology (CAST). 1984. See: http://www.cast.org/bobby/

Centers for Medicare and Medicaid Services (CMS) Web site. Department of Health and Human Services, U.S. government. See: http://www.medicare.gov/

Federal standards for accessibility can be found at: < http://www.section508.gov/>

Gerber, Elaine. 2002. "Surfing By Ear: Usability Concerns of Computer Users Who Are Blind or Visually Impaired." AccessWorld, Vol 3(1).

Gerber, Elaine and Kirchner, Corinne. "Social Research on Use of, and Preferences for <http://www.medicare.gov/> By People who are Blind or Visually Impaired." Unpublished report, Policy Research and Program Evaluation, AFB, December 2001.

Nielsen, Jakob. 2000. "Why You Only Need to Test With 5 Users." The Alertbox: Current Issues in Web Usability. See: <www.useit.com/alertbox/20000319.html>.

Nielsen, Jakob. 2001. "First Rule of Usability? Don't Listen to Users." The Alertbox: Current Issues in Web Usability. See: <http://www.useit.com/alertbox/20010805.html>.

Nielsen, Jakob. 2001. "Beyond Accessibility: Treating Users with Disabilities as People." The Alertbox: Current Issues in Web Usability. (Work prepared by the Nielsen Norman Group). See: <http://www.useit.com/alertbox/20011111.html>

Sajka, Janina and Joe Roeder. 2002. "PDF and Public Documents: A White Paper." See: <www.afb.org/AboutPDF.asp>

WAVE. Len Kasday, Pennsylvania's Initiative on Assistive Technology (PIAT). Institute on Disabilities, Temple University. See: www.temple.edu/inst_disabilities/piat/wave/

Web Accessibility Initiative. World Wide Web Consortia, 1997 - 2001 (W3C, MIT, INRIA, Keio). See: <http://www.w3.org/WAI/>

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Appendix E.   Making Your Module Accessible In Blackboard

The exerpts from this Web page provides examples of the steps that can be taken to make an online learning platform more user friendly for persons with visual impairments.

The Web site is operated by the University of Wales Institute (http://www.uwic.ac.uk/ltsu/5min_guide_module_accessible.htm).

Carol Doyle, Accessible Curriculum Development Advisor, University of Wales Institute, Cardiff UK, Web: http://www.uwic.ac.uk/ltsu/accessible.html

What is accessibility?: What is accessibility?: Curriculum accessibility refers to designing course work that is barrier-free. For a *fully inclusive curriculum* staff needs to consider the presentation of their online learning materials since, although computer technology has enabled access to higher education for students, inaccessible computer based learning materials may actually restrict access. Well-designed course work should be accessible to everyone no matter how individuals access it.

Blackboard and accessibility: Blackboard and accessibility: Learners have different learning styles and will access course work in different ways and under a variety of constraints. Inappropriate use of HTML and other formats can render course work inaccessible to a variety of users (users with low vision, dyslexia, blindness, cognitive-perceptual difficulties etc as well as individuals using hand-held devices, slow modem connections and black and white screens.

How does Blackboard work with assistive technology? : Blackboard is a Web-based application that requires a browser to access it. Assistive technology such as text-to-voice (screenreaders) sit 'on top of' the browser (e.g. Internet Explorer, Netscape). In order for low-vision learners to read the contents of Blackboard, he/she must use assistive software that will be fully supported by the browser (Internet Explorer4 or Netscape4 and higher have the capability). Further, the online material must conform to standard Web techniques and technologies (see below). Learners accessing the learning environment remotely may use older browsers, text-only browsers or specialist browsers (e.g. Opera). These browsers may not have the capability of reading frames, java scripts etc. Blackboard is a Web-based application that requires a browser to access it.

'Blackboard is a delivery system for content – it passes along content but doesn't change the format of the content it delivers. If Institutions choose to deliver in a format that is inaccessible, then all of the efforts of Blackboard and the assistive technology companies are lost'
Greg Ritter, Technical Support, Blackboard

Quick Tip Guide

Colour: Use solid background colour. Low visual users and students with dyslexia have difficulty reading loud textures, patterns or images; text and links may be difficult to read. Ensure sufficient level of contrast between background and text. Some individuals

can only read black on white or black on yellow for example. Take into account users with visual colour difficulties. Some individuals have difficulty distinguishing the colours red, green, brown, grey & purple. Be sure not to use these colours on top of or next to each other. Do not rely on colours alone to convey meaning. Individuals using screenreaders will not be able to 'read' colours. Users with visual colour difficulties will not be able to competently carry out task, which says, 'click green button' for example.

Text: Avoid large blocks of *italic* text. This can appear 'wobbly' to some individuals and therefore difficult to read. Use relative font sizes in your HTML. Users will be able to alter font size on their browser set-up. Avoid moving, blinking and auto-refreshing text. Low-vision users find these hard to deal with. Flickering screens can promote epileptic attacks. Students with dyslexia, low vision and screen reader users may find these difficult to read. Avoid using large blocks of CAPITALISATION. Some users find this difficult to read.

Images: If image is essential, insert meaningful textual description. Screen magnification can display text accurately when enlarged whereas images look 'pixilated" and difficult to read if containing text [It's important to use both images (which are especially useful for learners with specific learning difficulties such as dyslexia) and text, but it's better not to use images *of* text. Use text with a style applied to it than an image with the text on it for a button. Screenreaders will pick up the ALT text of the image, but screen enlargers work better with « real » text. Take care with moving elements. Users of screen magnification software may find difficulty in reading images (and texts) if the information is moving around. Screen reader software cannot read moving text.

Underlining: Don't underline large blocks of text. Underlining represents hyper-linked text. Large blocks of underlining can be confusing for users of screen reader software.

Headings: Use headings appropriately. Appropriately written headings will make navigation easier for individuals with cognitive difficulties. It's good to use HTML header tags, for example H1, H2, H3, and to construct the document like an outline—the more structured it is, the easier it is for all users, including disabled users.

Links: Avoid use of more than 10 links to page. For the blind user, the process of scanning links is linear and therefore slow. The use of too many links on a page can be very frustrating for the user. Separate links by punctuation for screen reader software to read it correctly. Don't use 'click here' for link. This can be confusing for screenreaders. Instead use: 'click here to go to UWIC's homepage.'

Check your work: You will need to use an online (or downloadable) Web page validation tool. There are a number of them around. Try:

http://www.cast.org/ (Well respected and well used 'Bobby' check)

http://www.aprompt/snow.utoronto.ca (called 'Aprompt' - useful and easy to use)

http://www.vischeck.com/ (excellent site to ensure your colour has sufficient colour contrast)

http://www.anybrowser.com/ (will test to ensure your pages are compatible in several browsers)

http://www.delorie.com/Web/lynxview.html (will strip all the images from your site and will allow you to look at how your site will look with a text only browser or if an individual is using a screen reader or has turned their images off on the browser)

Get students with disabilities to test your pages to ensure they are fully accessible with assistive software

Use the human eye to further check your pages. You could use a template such as:

File Name Welsh.jpg

How many occurrences throughout pages? 15

Is it informational or decorative? * Informational

Can image be retained? Yes

*[This will therefore require an ALT tag]

How to Upload Accessible Materials

Images: (i) Screenreaders cannot read images (ii) Magnification software (if extensively magnified) may render an image meaningless. Remotely accessing learners might use old browsers, text-only browsers. Provide a textual representation of the image for people accessing the page in a non-graphic way (e.g. text only, speech or Braille). This can be done by adding an alternative text attribute found in Web authoring software, e.g. FrontPage and is called ALT text. This text should convey what is important or relevant to the image.

Graphic/Charts: Some screenreaders cannot read. Provide a textual representation of the graph or chart so that it is meaningful and logical to student. If a long description is required one can either: (i) place the letter 'd' next to the graph or table (or image) and link it to a page that contains the detailed description. If using a Web authoring tool, use the LONGDESC attribute.

Tables: Some screenreaders are not able to read tables. Do not use tables for layout unless the table makes sense when linearised. Magnification of tables can render them incomprehensible. Make line-by-line reading meaningful in the table. Older screenreaders may read straight across a page, so you can test by holding a ruler up to the page and reading straight across—does it still make sense? Newer screenreaders will read from the top left cell of the table to the bottom right cell. Check to make sure that tables created with publishing tools don't « merge » cells so they can't be read from left to right

and top to bottom. Summarize table. For further information go to:
http://www.Webaim.org/tutorials/tables

Image Maps: For assistive software users 'click here' on an image map may not be accessible. Don't use colour to convey meaning. Avoid using "click here." Use text that is meaningful when read out of context. If you do use an image map insert an alternative access route (i.e. textual description for users who are not able to access this feature)

PDF Documents & Abode Acrobat: Some screenreaders are not able to read pdf files or user might not have plug-in. Users can download a plug-in 'Access Adobe' for free. However, the user might not be able to do this. Also ensure that plain text or HTML texts are also available. If you offer pdf files on your site give the URL of your site and provide a link to http://access.adobe.com/ you can convert pdf files to html or plain text on this site.

PowerPoint Slides: Original PowerPoint files will be inaccessible to users of screenreaders. From a usability perspective, PowerPoint slides may take a considerable time to download on slow home Internet connections. Offer a HTML version of the slides. Copy content of outline view of PP into a HTML editor and give textual descriptions for images/video's etc. You may need to re-organize headings to ensure outline reads logically/meaningfully. You may need to retype anything put in text-box as outline view does not show up text-box information.

Browser Detection Scripts: Not all users will use up-to-date browsers or 'common' browsers. Some assistive software works in conjunction with standard browsers which may not be able to translate and present everything that the browser is able to handle. Also, some browsers can « fool » browser detection scripts. This can cause a problem if you're relying on them for functionality. If using Flash animation for example, always allow the user to choose 'Flash' or 'Non-Flash' version of a page.

Animation: Screenreaders will not be able to read animation. Use ALT tags to describe the function of each visual or link to a page that contains a detailed description. Animation can be distracting to cognitively disabled users, and screen movement of a certain frequency can be a problem for other users, such as those with epilepsy. Don't cause the screen to flicker between 2 and 55 Hz, and if you use animations, make sure that the user can turn them off.

Scripts, applets and plug-ins: Not everyone has the capability or desire of downloading scripts and plug-ins. Always provide plain HTML text if you present information in formats other than plain HTML. If it is not possible to make the page usable without scripts, provide a text equivalent with the NOSCRIPT element. For further information go to: http://www.Webaim.org/tutorials/scripts.

Multimedia: For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation.

Advanced Information on Blackboard 5.5 and Accessibility Issues

Frames: Blackboard has a frame structure. Some learners may use text-based or older screenreaders to access online materials. Frames are very difficult/impossible to navigate through. Screenreaders that do not support frames: By creating a 'NOFRAMES alternative in each frameset it will enable the learner to have access to the same information via a link to a non-frames version: By creating a 'NOFRAMES alternative in each frameset it will enable the learner to have access to the same information via a link to a non-frames version. Until screenreaders that support frames are commonplace, alternative navigation needs to be included. Screenreaders that support frames: All frames should be identified with the 'title' attribute. Learners will then be able to determine their location as they navigate between two or more related pages.

Java Script and Java: The Blackboard platform uses javascript to perform validation for forms, provide validation messages via « alert boxes », and to write some content to the Web page Virtual Classroom (Chat) Tool: Screenreaders currently do not work within the Virtual Classrooms (chat) as Java is used in this application. Currently individuals with low vision/blindness/dyslexia will not be able to participate. Newer screenreaders, such as Jaws 4.0, can read javascript alert boxes. Any screen reader that works with IE 4.0 or Netscape 4.0 and up will work with Blackboard's form validation and content writing. If students are using assistive technology that doesn't support javascript, provide the material in another format. If you wish to put up Virtual Classrooms there is a workaround for individuals to follow current text chat transcript

Go to www.uwic.ac.uk/ltsu/accessible/virtualchat.htm for help. Version 6.0 will have an accessible chat tool.

Browse button on 'Submit work' page: On the Web mail interface within the communications tab and in the tutors digital drop-box (anywhere where you search the files on the hard drive to attach a message) JAWS 4.0 does not recognize the existence of the button. (UWIC is currently collaborating with other HEIs to ascertain whether other assistive software works within this environment. Get students to submit work via conventional email. (There is a workaround for lecturers to offer students - go to www.uwic.ac.uk/ltsu/accessible/submitbutton.htm)

Online assessments: There are currently coloured buttons for use in online assessments. This could cause problems for students with colour visual difficulties

The answers to online assessments are returned to the student in tabular form. This could cause difficulties for a number of students, particularly those using assistive technology. Until Blackboard come up with an alternative method of submission of assessments, you need to consider whether you can use an alternative method to this tool since between 5-10% of the UK male population have colour visual difficulties.

Timed assessments: For students who are allowed extra time for assessments/exams, Blackboard does not currently have the capability of putting up the same assessment with several timings. Post the assessment up twice - a standard one ('Assessment A') and another with extra time ('Assessment B'). Offer explicitly clear instructions regarding which test the students need to carry out.

Improvements with Version 5.5 Further improvements in Version 6.0 (Spring 2002)

Description of images: Blackboard has ALT tags for semantically rich images (those with text on them and other images. In version 5.5 it has added ALT tag on images used for graphic purposes e.g. 'spacer' images) or for images that form part of the page architecture.

Name framesets: Version 5.5 is able to identify titles on each frame. Each frame has a link to a no frames option. This will link to the default content of the frameset and explains the layout

Column headings and table content: Version 5.5 has data tables are optimized for use with screenreaders by the addition of attributes associating column headings with table content.

Text only interface: Blackboard 5.5 does not currently have a text only version but it is possible to link pages to non-framed pages. Blackboard is currently evaluating whether to include a text only or WAI Double A compliance interface in Version 6.0.

Search/logout buttons: In version 5.5 search/logout buttons, which form part of an image map, are not readable by some screenreaders or browsers.

Alternative interfaces: Blackboard has stated that they are investigating the inclusion of alternate interfaces in Version 6.0 (out in Spring 2002) for users to choose from to maximize accessibility.

Virtual classroom chat: Blackboard have stated that they are currently addressing the accessibility problems in Version 6.0

For further information on Blackboard and accessibility please go to: http://company.blackboard.com/products/orientation/ Updated: December 2004