

Assistive Technologies

IN THE LIBRARY



Barbara T. Mates

WITH CONTRIBUTIONS BY WILLIAM R. REED IV

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Retiring after twenty-five years as the head of the Ohio Library for the Blind and Physically Disabled, **Barbara T. Mates** now works as an independent consultant specializing in topics related to senior services and accessibility options for persons with disabilities. She is a past president of ALA's Association for Specialized and Cooperative Library Agencies (ASCLA) and chaired ALA's 2010 Schneider Family Book Award Committee. Mates has presented numerous papers and workshops across the country and is the author of *5-Star Programming and Services for Your 55+ Library Customers* (ALA, 2003); "Computer Technologies to Aid Special Audiences" (*Library Technology Reports*, 2004); and "Assistive Technologies for Today's Libraries" (*American Libraries*, 2010). Her awards include the 2001 Francis Joseph Campbell Award and the 2010 ASCLA Exceptional Service Award.

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Preface

As *Assistive Technologies in the Library* was being created, many libraries around the world were feeling the crunch of one of the deepest recessions of the last two generations. Administrators and library boards were being forced to rethink their vision and mission statements as well as rework their long- and short-term plans to accommodate funding cutbacks. The number crunchers are still carefully going through libraries' budgets to see where money can be found. Very often they look to see what would do the least harm to the public or what can be eliminated that no one will notice. They look to see which branches can have their hours reduced or staff trimmed. They look to see what services are being underutilized or not utilized. It is when quantitative analysis without qualitative input transpires that services to patrons who need libraries the most are affected. There is a tendency to trim outreach services as well as those services that require a large amount of staff time.

Very often the services that are scaled back are those services to persons with disabilities, as their library use numbers are often low in comparison to those patrons without disabilities. The availability of assistive technologies or an accessible website is not something that is acknowledged by the library profession. Hennen's widely respected index, which ranks U.S.

public libraries, examines “traditional data for print services, book check-outs, reference service, funding and staffing” but does not factor in equity in access to these services.¹

More than likely, if the library has an extra thousand dollars to spend, and staff can either buy fifty DVDs to circulate or one piece of adaptive software to be used in-house, the DVDs are going to be the selection, as they have the potential to generate ten thousand circulations. This tendency is unfortunate, as people with disabilities are a population that is generally at an economic disadvantage as well as an educational disadvantage and that can benefit the most from free access to technology.

The number of persons with disabilities is also growing as the baby boomers age and as disabilities that cannot be remedied by today’s medical advances develop. This, unlike previous generations, is a population that will be demanding access; it is best to be prepared.

Higher numbers of persons with disabilities are also caused by a rise in people with cognitive or learning disorders. Testing mechanisms are allowing professionals to diagnose learning differences as well as autism spectrum disorders in certain of their clients more readily than they had been able to do in the past. As a result, more individuals are realizing that they can be helped by adaptive technologies to reach their own achievement goals.

Although there is a venerable network in place—the National Library Service for the Blind and Physically Handicapped (a division of the Library of Congress), which provides materials for leisure reading for some people with disabilities—there is now a growing need for access to information and technology within the individuals’ communities.² As with the general population, people with disabilities need to be able to access the Internet to research benefits, identify local community resources, download books and music, learn, and grow.

Assistive Technologies in the Library seeks to guide information providers in selecting technologies, designing accessible websites, learning how to purchase accessible electronic resources, establishing access policies, training staff to work with patrons with disabilities, funding accessible technologies, and marketing the services using both traditional methods and new social networking tools.

This book incorporates work (chapters 2 and 12) by William R. Reed IV, the regional librarian for the Ohio Library for the Blind and Physically Disabled. He has worked with the American Library Association to ensure that

members of the association with disabilities can access the ALA site. Additionally, he led a task force to develop a checklist to which persons making purchasing decisions can refer to determine if a resource is accessible. He represents the generation of librarians who will develop methods to help people with disabilities exploit electronic resources.

Within *Assistive Technologies in the Library*, information providers will be given the tools to develop and retain access in their libraries, and they will learn how to convince their financial personnel that it would be more expensive not to create accessibility portals in the library than to create them. A population that is gainfully employed and educated has a greater tendency to vote for library levies. It is my hope that this work will enable all libraries to give all patrons equal access to information and services.

Notes

1. For further information on Hennen's American Public Library Rating Index, visit www.haplr-index.com/faq.html.
2. The National Library Service for the Blind and Physically Handicapped, part of the Library of Congress, provides books and magazines on cassette tape, in Braille, and in digital cartridge format to qualified patrons in the United States and its territories; visit www.loc.gov/nls/.



1

The Library's Mission To Serve All Patrons

There are some staff members and administrators who think that their library does not have any people in their service area with disabilities because they do not see any in the library. The truth of the matter is that people with disabilities live, love, and learn everywhere. There are no ghettos of people with disabilities, and unless these libraries are in an alternate reality, they need to examine the reasons why they are not seeing people with disabilities using their library.

Statistics

Determining accurate statistics of persons with disabilities is a difficult task, as the term *disability* is totally subjective on the part of the person being queried. For example, a person whose vision is so limited that she must be three inches from a monitor may feel that her vision is not a disability, as she can still read the text on the screen. She would probably reply in the negative to the question of whether she had a disability. Likewise, someone who has severe arthritis in her hands might not think of herself as having a disability, while another person with recurrent calluses on her hands would say she has a disability. This reaction replays itself throughout the disability spectrum. Yet here's just one piece of data worth noting as the library does

long-range planning: experts predict that by 2030, rates of vision loss will double along with the country's aging population.¹

Researchers and census takers all agree that the total number of people with disabilities is very large, and probably larger than is being reported. Some interesting statistics include those from the World Health Organization, which estimates that of the world's population of 6.5 billion people, nearly 100 million are moderately or severely disabled.² According to the U.S. Census Bureau, as of 2004 there were some 32 million disabled adults (aged eighteen or over) in the United States, plus another 5 million disabled children and youth (under age eighteen).³ If one were to add impairments or limitations that fall short of being disabilities, the census estimates put the figure at 51 million.⁴ These numbers make Americans with disabilities the third-largest minority (after persons of Hispanic origin and African Americans); all three of those minority groups number over 30 million Americans.⁵ Yet the amount of dollars spent by libraries or other institutions to remove barriers and offer services to Americans with disabilities is well below its proportion in the population.

Although there are not overall, definite disability statistics, those related to vision loss are more reliable. This can be attributed to organizations such as the American Foundation for the Blind (AFB), which has excellent data collection and research facilities. The AFB maintains a user-friendly facts-and-figures database that can be accessed by state.⁶ This data should be helpful when determining what types of software and hardware to purchase.

Laws Relating to Access for Persons with Disabilities

It is important to be aware of laws that govern access to information for persons with disabilities, as failure to comply may result in cause for litigation. Applicable laws are Sections 504 and 508 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990, which was amended in 2008 and reaffirmed in 2009.⁷ Section 8 of the "Americans with Disabilities Act Accessibility Guidelines" (ADAAG) specifically addresses libraries.

Briefly, these laws mandate that persons with disabilities have access to public programs and services. Thus, if the library offers free access to computers and training, it must offer access for persons who need adapted access avenues. Reasonable accommodations must also be made to meet the needs of staff with disabilities.

ALA Takes a Positive Stand on Accessibility for All

The American Library Association (ALA) has long held that libraries were places where people could access and exchange information in a manner that was undeterred by predisposed policies and barriers. The ALA “Mission Statement” states that the work of the association and libraries is “to ensure access to information and enhance learning and ensure access to information for all,” and the preamble to the Library Bill of Rights clarifies that “all libraries are forums for information and ideas.”⁸

In 2008, the ALA offered an interpretation of this Bill of Rights as it applies to persons with disabilities. In part it reads: “ALA recognizes that persons with disabilities are a large and often neglected part of society. In addition to many personal challenges, some persons with disabilities face economic inequity, illiteracy, cultural isolation, and discrimination in education, employment, and the broad range of societal activities. The library plays a catalytic role in their lives by facilitating their full participation in society.”⁹

Universal Access through Universal Design

If the library is in the fortuitous position of undergoing a major renovation or undertaking a new building project, then the best approach for creating an environment that all people can use is to apply “universal design” principles. Universal design was defined by the late architect Ron Mace as “the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life.”¹⁰ The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities.¹¹

Universal design in learning environments can be accomplished by providing multiple means of representation, action, expression, and engagement. Through thoughtful planning and without spending additional money, the library can create an environment in which a person with or without a disability feels comfortable. Universal design can save money by not having to make adaptations or accommodations. Additionally, there is the bonus to patrons, as there isn't a stigma attached to having to have accommodations made for their disability. Examples of this concept would be a ramp entrance to a building, where steps would traditionally be placed, that

would accommodate wheelchairs as well as strollers; adjustable workstations throughout the facility; and clear signage that could be read and comprehended.

The concept of universal design also extends to the virtual library site as well. If web pages are designed correctly, persons using screen readers will be able to access the pages unassisted; people with cognitive disabilities will be able to understand the text without needing translations. This flexibility also benefits people *without* disabilities in certain situations, such as people using a slow Internet connection, people with “temporary disabilities” such as a broken arm, and people with changing abilities caused by aging.¹² Thoughtful design once again saves staff from constantly being queried needlessly; plus, it empowers the user through independence.

Assistive Technologies Help Everyone

Younger people may not remember a time when street crossings did not have curb cuts in them, but such a time did exist. If one was using a wheelchair, crossing the street unassisted was virtually impossible without risking injury to self or to chair. As city planners actually started renovations, they found that the Americans with Disabilities Act mandated curb cuts; they complied with the mandates, and curb cuts became a way of life. In addition to people using wheelchairs or scooters using curb cuts, businesspeople with wheeled bags use them, as do parents with strollers, people on skateboards, and people riding bicycles. Curb cuts are used instinctively by the mass population, as they make moving about easier.

Likewise, some of the assistive technologies that are added to the library environment are used by people without disabilities. In a survey conducted by Microsoft, it was determined that 57 percent of computer users would benefit from the use of accessible technology.¹³ Oversize monitors are sought out by many, as it's just easier to see what is displayed; trackballs help some patrons scroll through large amounts of text more quickly; tables that have the ability to be raised or lowered help patrons who may just be having a physically hard day and need to sit differently.

Adaptations you make for patrons with special needs do have the potential for serving more patrons than those they are intended to aid. If you only have funding for one computer station, make it one that will serve all patrons.

Brave New World via the Computer and Internet

Computers and the Internet have become a necessity for many. For those with disabilities, these technologies have an even more significant value because they provide access to information in formats that are not available elsewhere.

Ready access to information is very often taken for granted by those without disabilities. For example, if we need a book for a book club discussion, we have the choice of driving to a bookstore or a library to get it. If we need to do some research on the new television we want to buy, we can log on to a myriad of consumer sites or locate a consumer magazine and read about its pros and cons. For people who are blind, going to the local bookstore or library for needed titles often isn't an option because the titles are not available in a usable format. Likewise, if a person with a visual disability wants to do research on that television set, he would need to access the text with magnifying hardware or find a person willing to read the information aloud. However, if the person had access to the Internet and assistive equipment, he probably would be able to download the book title as well as reading as many reviews about the television as time permitted. Through computer access, people with disabilities can have the same opportunities as those without; however, there is a noted lag in this group to embrace the technology.

How Can Libraries Encourage People with Disabilities to Embrace Computer Technology?

A recent study conducted by the Consumer Expert Group at the request of Digital Britain determined that four issues are causing people with disabilities to not embrace the Internet.¹⁴

1. Lack of motivation. Persons with disabilities are often not part of the workforce and are less likely to have had to use computers. Additionally, the cost of computer technology for those in a low-income bracket is prohibitive.
2. Difficulty starting out and getting online. Often persons with disabilities lack awareness that computers can assist them. This factor is not helped by the fact that mainstream vendors

of computer equipment know little about accessibility technology and often give the wrong advice. Once the person realizes that accessible technology is available, the cost of it, coupled with training in the use of the products, makes the learning curve very steep.

3. The Internet's inaccessibility. A disconcerting fact is that many websites and applications are becoming less accessible rather than more accessible. It is disappointing for a user with a disability to learn how to use a computer, then reach sites that are inaccessible because of poor design.
4. Not fully realizing the benefits of the Internet and being afraid of Internet predators. For some people who have never used the Internet, it is hard to comprehend the vast amount of information that can be found and used, including some vital to their well-being. Also, certain groups of persons with disabilities are fearful that they may be conned online and thus avoid the Internet.

These issues can all be addressed and in part conquered with the help of the library.

Libraries can provide the technology, inform the public, make accessible sites available, and train and educate the patron. As with most educational and intellectual pursuits, libraries can make a difference in the lives of ordinary people and help them realize a potential they never knew existed.

Technology Solutions for Persons with Disabilities

It is important to remember that although the accessibility options discussed can and will be used by most persons with the disability, people and their disabilities are unique. Each person will work to find his own access solution and should never have it forced on him by an instructor. It is also important to remember that it is the library staff's job to demonstrate and educate, but not to dictate. Generally speaking, users seek solutions to make their computers easier to use, not for solutions based on their disability.¹⁵

Visual Impairment

The disability term *visual impairment* is a broad-based term used to describe a myriad of vision problems. Most people do have some type of impairment, whether it is being nearsighted or farsighted or having dry-eye syndrome, but

they can use computers without special accommodations. However, there are also impairments that cannot be remedied, such as macular degeneration, color blindness, or simply poor vision. These people still have usable vision. For example, they may be able to drive, but they cannot read standard print (print that is smaller than 14 points; most commercial print is standard print).

People with a visual impairment will prefer using text and manipulating the text display to suit their needs. Patrons with low vision may seek to enlarge the display font just a little, or they may supersize the cursor. People who have color blindness may need to change the background on page displays. Most people with usable vision will not use a screen reader.

Blindness

The accepted definition of *legal blindness* is complicated and basically summed up as lack of the ability to see anything regardless of objects being close or far.¹⁶ People who are blind may be able to differentiate from daylight or nighttime; however, the vision is so limited they cannot safely move about in unfamiliar areas without the aid of a cane, a guide, or a guide dog.

People who are blind need to access information aurally or by touch. People who are blind listen to books and can listen to the Internet. If they read Braille books, they can use Braille displays to access the Internet. They are best accommodated by software that reads text aloud using synthetic text-to-speech software or by using refreshable Braille displays.

Hearing Loss

The term *hearing impairment* is a general term that applies to persons who have trouble differentiating certain frequencies, localizing sounds, and hearing certain pitches. People with hearing loss are often helped with hearing aids or by seeking visual cues during conversations.¹⁷

Until the last few years, people with a hearing loss did not face many barriers when using the Internet and the World Wide Web. However, with the advent of product instructions being given on such sites as YouTube and the incorporation of sound clips within websites, people with a hearing loss are starting to lose the ability to fully use the Internet. People with hearing loss need visual cues and text descriptors functionality.

Deafness

Persons who are deaf lack the ability to hear any sound and are reliant on visual cues to communicate and learn. Many people who are deaf know some version of sign language (each language has its own sign language) or

are proficient in lipreading. Until recently they were not hampered by too many obstacles when accessing the Internet, as it was a very visual product. Their basic need was for the computer to provide visual cues to auditory signals.

However, the Internet and the World Wide Web are becoming increasingly multisensory devices. Although visual displays are useful, unless there is text for each word spoken, some sites are not usable by people who are deaf. Using captioning and instant messaging on websites with auditory applications is necessary.

Mobility or Dexterity Issues

When speaking in relation to persons with mobility or dexterity issues, we are addressing those individuals who may need to use a wheelchair and want to slide it under a public worktable, persons who may have severe rheumatoid arthritis and cannot flex their fingers, or persons who may not be able to sit or stand for long periods of time. They may not have the ability to move their fingers across a standard keyboard or move *any* part of their limbs.

Patrons with mobility disabilities may be helped by adding different types of input devices to the library's computer tool chest. Large keyboards, small keyboards, trackballs, scanning software—the possibilities are enormous, and there is something for every need. As long as a person has control of one part of his or her body, whether the use of a finger, an eye, or a smile, they can use a computer.

Learning Disabilities

Learning disabilities are often not obvious by cursory observation, and there is no widely accepted definition of the term. People who have this disability are often bright but cannot always correctly interpret visual symbols such as letters and words as having meaning. Although some people can't read and understand text, others may not be able to see numbers correctly or perform mathematical calculations. Often, persons with learning disabilities may become easily distracted when reading and lose their thought processes. This work only seeks to address reading disabilities.

Some persons with learning disabilities succeed by hearing words as they read. For these people, there are software solutions that will help them read and learn—and enjoy the reading and learning process. HumanWare

and Kurzweil Education Systems offer software that will read information aloud as words are highlighted (see appendix A for a list of vendors). If there are words that are not understood by the user, he or she may jump to a dictionary to have the word defined.

Cognitive Disabilities

Persons with cognitive disabilities generally need more time to process information, and they might be overwhelmed with the presentation of a multitude of new information. Cognitive disabilities may be congenital, may develop as a result of a physical trauma, or may be part of the aging process.

Persons with this disability might benefit from technologies such as screen readers, modifying the appearance of the screen display by eliminating ribbons or buttons, or using different types of inputting hardware. People with cognitive disabilities can learn to use computers, but it may take more time and more patience on the part of the patron with the disability and the staff trainer.

Autism and Autism Spectrum Disorders or Condition

In 1970, autism, a developmental and behavioral disorder that affects a person's verbal and nonverbal communication, understanding of language, and socialization skills, only affected 1 out of every 10,000 children.¹⁸ Today, the Centers for Disease Control estimates that 1 out of 150 children, mostly males, have some form of autism.¹⁹ With numbers this large, it is inevitable that people with autism or autism spectrum disorders (ASDs) or condition will be visiting the library.

Researchers, teachers, and parents of children with ASDs or condition have found that computer programs do aid their children or young adults, as computer programs are predictable and therefore controllable. They enable errors to be made safely, they offer a highly perfectible medium, and they give possibilities of nonverbal or verbal expression.²⁰ Computer software programs in the realm of learning basic social skills, and storyboard-writing software such as Mayer-Johnson's Boardmaker, which enables teachers to print symbols and pictures to communicate daily life needs, have been found to help individuals learn and grown intellectually and socially.

Generally speaking, people with autism are able to use a standard computer. Some, however, will need to use input devices, such as joysticks, over-size keyboards, or touch screens. Numerous software programs can teach social skills to help individuals learn how to act in social situations.

As noted earlier, some assistive technologies added to the library environment are used by people without disabilities. Similarly, some assistive technologies can be used by most people; others are used by people with specific disabilities. Table 1.1 offers a snapshot of these accessibility options with the cautionary advisement that because human beings are unique, their abilities to work with assistive technology will vary. An option may be suggested for a person who has a physical impairment only to discover the option may also help someone with a visual impairment.

What to Do First? Create an Advisory Board

It is highly unlikely that the library will have sufficient funds and staff to simultaneously install all needed technologies; thus, the accessibility initiatives will have to be done in phases. So, which do you do first, the ones that will help patrons who are blind or those who are hearing impaired? It's a tough call, but someone will have to make it.

It is suggested that the library create an advisory board made up of technology staff, a financial person, public service staff, liaisons from rehabilitation centers, and, most important, patrons with disabilities. Together, work out long- and short-term goals for the library. Before doing this, however, ask, What do we have that can improve services starting today? It may be something as simple as moving a workstation with a large monitor to a better-lit area or enabling some of Microsoft's or Apple's Macintosh accessibility attributes to be reached by creating shortcuts on the computer's desktop.

Together, staff, patrons, and professionals can access the community demographics and determine what appears to be most needed. If the library is in a community with a large amount of seniors, then tools that enlarge on-screen text would be a good place to start. If the library is in a younger community, then tools that will help students with disabilities—such as software that highlights and reads text aloud—would be a good step.

Summation: One Size Does Not Fit All

It should be noted here that although there is a vast array of both hardware and software that will help people achieve success, a device that might help one person's particular disability might create a barrier for another. Do not avoid adding technologies; just plan their placement.

Table 1.1
Accessibility Options

For Persons with:	Visual Impairments	Blindness	Learning Disabilities	Deafness	Hearing Impairments	No Disabilities	Physical / Mobility Disabilities	Autism	Cognitive Disabilities	Deaf-Blindness
Large Monitor	•		•			•	•		•	
AbleLink Web Access Suite			•					•	•	
Text Enlarging Software	•		•							
Large-Print Keytops	•		•			•			•	
Large-Print Output	•		•			•			•	•
Braille Key Tops		•								•
Raised Dot Home Keys	•		•			•				
Screen Reader / Synthesizer	•	•	•					•	•	
Braille Software Translator		•								•
Refreshable Braille Display		•								•
Braille Embosser		•								•
Speech Recognition	•	•	•				•		•	
Show Sounds			•	•	•					
Captioning Text			•	•	•					
Alternate Keyboards							•	•	•	
Trackballs							•	•	•	
Screen Display Keyboards							•			
Text Browser Software	•	•						•	•	
Headphones	•	•	•		•	•		•	•	
OCR Scanning	•	•	•					•	•	
Correctly Designed Websites	•	•	•	•	•	•	•	•	•	•
Touch Screen			•			•		•	•	
Storyboards								•		
Jelly Bean Switch								•	•	
Nontraditional mice	•						•	•	•	
Zac Browser								•		
Videophone				•	•					
Skype Video Call				•	•					
Sorenson Video Relay				•	•					
IntelliKeys							•	•	•	
Adjustable Work-table	•	•	•	•	•	•	•	•	•	•

It is important to remember the obvious, that people with disabilities are individuals. Their personalities, values, intellectual abilities, and social mores will all affect their willingness and ability to learn computer skills with assistive devices. More than likely, the library will not be able to have all solutions for all people with disabilities, but having solutions for most people with disabilities is acceptable.

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4

When Computers Talk

Listening to the Web and Printed Materials

Most people who have low vision or who are blind access computers by listening to text being read by screen-reading technology. Likewise, people with certain types of learning disabilities, such as dyslexia, are better able to comprehend when they hear printed text read aloud.¹ Additionally, some people with cognitive disabilities are empowered by access to this technology.

Screen Readers

How the Technology Works

Screen reader technology involves using software that recognizes online text and uses its intelligence to translate that text to a verbal output through synthetic speech or a refreshable Braille display. Most users opt for the verbal output although users who are avid Braille users or people who are deaf and blind will use the screen-to-Braille output option.

A screen reader is the interface between the computer's operating system, its applications, and the user.² Today's screen readers are robust and usually incorporate a speech synthesizer. A screen reader will recognize the words and relay the text to the synthesizer; the synthesizer will speak the words

through the computer's sound card, enabling the user who cannot read the text to hear the text.

Most synthesizers are able to speak at a variety of speech rates and vocal pitches. Many offer the user a wide selection of voice options, and some even speak in languages besides English. The technology allows users to dictate how they want the text read in regard to rate of speech, pitch of the synthetic voice, and how much should be read at a time (i.e., word, sentence, paragraph, page, or the entire document). Shortcut key commands are prevalent in most screen reader programs, which enables skilled users to zip through a document with speed.

Basically, the user sends commands by pressing different combinations of keys on the computer keyboard to instruct the screen reader as to what to read and to speak automatically when changes occur on the computer screen. Key commands allow users the flexibility to perform more advanced functions, such as locating text displayed in a certain color, reading pre-designated parts of the screen on demand, reading highlighted text, and identifying the active choice in a menu. Users may also access the spell-checker in a word processor or read the cells of a spreadsheet with a screen reader.

The screen reader will read all that is on the screen, including names, descriptions of buttons, menus, text, and punctuation, but the keyword here is *read*. When we see things with our eyes, we use recall to know what the object is. If the objects on-screen are not identified with an appropriate text description, their presence will not be comprehended by the screen reader. For example, if the library has a logo that defines the organization and the web designer simply identifies it as a logo, all the reader will know is that there is a graphic of the logo on the page. However, if the web designer described the logo as "library logo, book with a beacon emitting light," the screen reader will relay that information to the patron. Mozilla Firefox supports a free extension that enables site managers to view a textual representation of a web page similar to how the page would be read by a modern screen reader.³

Selecting a Screen Reader

It is challenging for public entities such as libraries to select products that will meet each user's individual needs or desires. Libraries are faced with the challenge of providing technology that will offer the most access for the most people without infringing on the rights of other patrons. The key thing

to remember when selecting a screen reader is to ask patrons, consumer organizations, and assistive-technology vendors what is the preferred reader in the library's service area.

Although screen readers are similar in their functionality and capabilities, there are differences. For example, the keyboard shortcuts in one screen reader will rarely perform the same function in other screen readers.⁴ Likewise, they also have different ways of notifying users of important information, such as which pieces of text are links, which pieces of content are images, and so forth. Regardless of reviews of the products or the cost, it is wise to select the one that has a "fan base" in the library's service area. Screen readers are a very personal choice, and there is a brand loyalty for most users as there is much time spent learning the intricacies of the software as well as the money invested in the product.⁵ Selecting a preferred product will also give the library's information technology (IT) staff a knowledge base to turn to should problems arise, reduce the need to offer intensive training, and help promote the product being available in the library.

System Requirements

The most important system requirement is a staff willing to understand the process of the interface. Often this task falls to one person, which would be acceptable if that person agreed to work around the clock. Although this technology is not difficult to comprehend, it does need to be understood by more than one person.

When purchasing the computer framework for such assistive technologies as screen readers, the rule of thumb is to purchase the latest model, with the most memory, with at least two open USB ports, a large display monitor, and a high-quality graphics card. Although this may seem strange, as screen readers do not read graphics, they do "look" at all the graphics on a web page. If the graphic is identified properly, using a word description, it will be read aloud, and the user will be aware of the graphic. A more efficient graphics card will perform this task more quickly, and because screen readers cause a little drag on the processing speed, a high-end graphics card will help move the process along a little faster.

Software Programs

Software programs are relatively easy to install and offer the user a wide range of options while reading web pages or documents. Only rarely does

any software problem interfere with the operating system. All of the products come with excellent documentation and support.

Job Access with Speech (JAWS)

Job Access with Speech (JAWS), a product of Freedom Scientific, is probably the most popular screen reader used today.⁶ It was initially developed for computer users whose vision loss prevents them from seeing screen content. JAWS reads aloud information that is sent to the screen, and it has numerous hot-key commands, or shortcuts, which are fairly straightforward. For example, Ctrl+O opens a file. Alt+F4 will close a window. JAWS is compatible with the most frequently used office and school environment software.

In addition to performing the basic tasks of reading pages or paragraphs and announcing what it is seeing, JAWS has additional utilities that were developed in response to user requests. For example, a tool called Research It allows the user to jump to and from the Internet to a document in process by simply using a few keystrokes. Another feature is the Wiktionary, which is a web-based dictionary. The user places the cursor on a word in a document or web page, then presses the default keystroke (INSERT+WINDOWS Key+R) to quickly look up the Wiktionary definition for that word.⁷

JAWS also provides Braille output in addition to, or instead of, speech. The user must have a refreshable Braille display to use this utility (see chapter 5 for more information on Braille).⁸ The Braille function works with key commands as well, with the only difference being that output is in the form of raised Braille cells and not audible output.

JAWS works well with both Internet Explorer and Firefox, and both browsers have help pages for people who are using JAWS with their product. Because of the popularity of JAWS, there are numerous tutorials available, hot-key tip sheets, and a multitude of users.⁹ This latter attribute translates to it being easier for the library to find volunteer trainers to instruct new users on the product's use. It should be noted that JAWS, although being the most popular screen reader, is expensive. Many people with low incomes cannot afford to purchase it for their own home use yet are expected to know how to use the software to acquire good-paying jobs. In a very unofficial survey of libraries that have assistive technology, this is the most requested and most used product.

Window-Eyes

Window-Eyes, a product of GW Micro, is the second most popular screen reader in North America. It supports all the functions readers need to access the World Wide Web as well as all Microsoft programs, including PowerPoint and Excel. It offers support for Skype, which is unique, and has support for mobility through USB drives. A very strong feature supported through Window-Eyes is that it excels in reading PDF files, as it pioneered the utility. Window-Eyes also has a key describer mode, useful hot keys, four alternate keyboard layouts, a utility that can describe online colors, and enhanced Braille features. Key commands are logical—for example, a user wishing to locate the next link simply presses the *L* key, or to find the next header, the *H* key.

Window-Eyes works well with both Internet Explorer and Firefox, and both browsers have help pages for those people using Window-Eyes with their products.

With library funds being in short supply, it should be noted that this package is less expensive than similar products. It has all the functionality most users will require in a public setting. The product is well documented online, and tutorials and cheat sheets are available.¹⁰

HAL

HAL, from Dolphin Computer Access, a United Kingdom company, is a powerful screen reader that works to give both speech and Braille output. It works in harmony with a vast array of products from the Microsoft line. It is proficient in reading PDF files and has a forms utility allowing users to locate boxes that need data input. It is popular in some areas of the world, as the product has strong scripting support, which allows users to tailor products to fit their needs.

HAL offers multiple one-key command options that enable users to breeze through documents. A strong selling point for Dolphin's HAL is that it is also available as a product called Dolphin Pen, which allows users to take their software with them and have it travel from computer to computer without having to install it. In a public setting, this would enable the library to make any PC one that has screen-reading capabilities.

Dolphin Computer Access has a number of online support utilities, including tutorials and links to discussion forums, where users can find answers to

their questions. For all its strength and comparable pricing, the product has spotty use in North America, although it is said to be growing with the availability of the Dolphin Pen. If there is a demand for this particular package it would be prudent to ask the vendors about the number of users in the library's service area.¹¹

Serotek Corporation System Access Standalone

Another product line to consider comes from Serotek Corporation. The company was formed by users who are blind and wanted to offer others a quality product at a lower price than those in the marketplace. In their company's System Access Standalone with NeoSpeech VoiceText, they have done that.¹² System Access Standalone provides screen-reading options to use with spreadsheets, word processing, and surfing the Web. System Access Standalone provides intuitive access to all Windows-based applications. Purchase of a license allows the product to be used on up to two computers.

What You Need Now (WYNN)

What You Need Now (WYNN) is a product of Freedom Scientific and works in support of literacy enhancement for those who have a learning disability that prevents them from comprehending the text they are reading. The software (unlike most humans) is a patient companion and will repeat words and pages as many times as necessary. The learning curve is a short one, and tutorials are available.

The product has four toolbars with a point-and-click interface. There are large, intuitive universal buttons that are easy to use as they are color coded and labeled with both pictures and words. The screen reader will read the text and highlight the words as they are spoken. The user can ask for an immediate definition of any words not understood and consult a thesaurus to ensure he or she understands the word. The software also allows users to mask the amount of information they are hearing and seeing, so as to not create a sensory overload. One of the toolbars that is most useful to the user with a learning disability is the writing toolbar, which has many of the features of a word processor but also has features such as word prediction, homophone explanations, and the ability to create an outline. This last allows the user to visually organize ideas, concepts, and topics helping in the writing process. The program allows for a smooth toggling from Web to word document. Freedom Scientific offers total support for the program.¹³

Read and Write Gold

Read and Write Gold is a robust software program from Texthelp Systems, which has a strong international user base. This technology enables those with learning disabilities to comprehend what they are reading and learn through the reading experience. The program has many utilities that support easier reading for many. The software masks text, allows words to be defined as needed, utilizes word prediction, reads PDF files, and enables the user to toggle to and from the Internet as required. It also enables speech input and has a speech pronunciation tutor. The program is also being marketed as a resource for learners of English as a second language.¹⁴

Budget Screen Readers

If the library does not have a budget to purchase a commercial screen reader, there are some low- to no-cost options. The adage that “you get what you pay for” applies to software as well. Nevertheless, they are worth considering as they offer some access rather than ignoring the issue totally.

NVDA (NonVisual Desktop Access)

There’s a relatively new software package for those with visual impairments to gain greater access to digital media, NVDA. NVDA is short for NonVisual Desktop Access, a “free and open source screen reader for the Microsoft Windows operating system.”¹⁵ The software can be installed on a host computer or run from a USB flash drive, which empowers the user with its portability. It comes with eSpeak, a free open-source multilingual speech synthesizer, and will also work with Audiologic, Display, and Silence. NVDA supports Mozilla Firefox Thunderbird and offers “basic support” for such Microsoft products such as MS Word 2003, Outlook Express, MS Excel 2003, and many other programs.

Although it could be useful to those with visual impairments, the product would not aid those with a learning disability as it does not provide a visual cue to indicate to the user what is being read.¹⁶ It is free, however, offers portability, and is an open-source product, which means it could get better.

NaturalReader

NaturalReader is a mainstream product line developed by NaturalSoft and is one of the most reasonably priced text-to-speech systems available. There are six versions available: the Free Version, the Personal Edition, a developer

edition, and three professional versions. The Free Version does not offer many utilities, but it may be enough to help patrons read documents or work their way through short articles. It will not enable users to use Internet Explorer and some word-processing programs. On the other hand, the Gold Edition has utilities such as typing echo, works with most word-processing programs, can handle large files, and offers the user the choice of several realistic synthetic voices. NaturalReader supports German, Spanish, French, Arabic, and UK English voices. Depending on the library's budget and needs, the Personal Edition and professional versions, which are more complete and priced at under \$100, could be a reasonable way to place access at more locations.¹⁷

Microsoft Narrator

Narrator is a text-to-speech program (or basic screen reader) that is built into Windows XP, Windows 2000, Windows Vista, and Windows 7. The utilities of the product vary from version to version.

With the release of Windows 7, users are saying that Narrator is finally a usable product as it lets the user define how the reader will read the display and announces some of the events happening on the screen. Although Narrator is not an answer for those who are totally dependent on having a screen read to them for school or work, this will be of some use to the user needing to seek out some short pieces of information. Narrator is easy to launch, and Microsoft provides thorough tutorials for each version.¹⁸ If the library cannot afford to purchase a commercial screen reader, staff should be aware of the Accessibility products offered by Microsoft and should be allowed to launch them for patrons needing them.

Mac VoiceOver

Apple's Mac supports a text-to-speech utility called VoiceOver, voiced by Alex, a natural-sounding speech synthesizer that actually pauses at appropriate places as it reads paragraphs. Users are able to control their computers using only keyboard commands. One of the strongest features of VoiceOver, however, is that personal settings can be saved on a USB drive and used on any Mac computer, eliminating the need for special workstations for persons with special access needs. VoiceOver is available through Mac's Universal Access Panel.¹⁹

Reading and Scanner Technology

Although more documents are becoming available electronically, there are valuable pieces of information that are still only available in traditional print format, including correspondence that is still delivered to mailboxes. Technology that can scan printed documents or graphic-based text and convert it to speech output (also large print) is a valuable tool for people with print disabilities who wish to do research or read the daily mail. The software works with a flatbed scanner using advanced optical character recognition (OCR) to scan the text and send the text to a text-to-speech software synthesizer. There are several units available.

Text-to-Speech Software

OpenBook

OpenBook scanning and reading software, a product of Freedom Scientific, is a proven and reliable device. When coupled with a scanner, it will scan documents and convert them to speech, which will be read aloud at the command of the user. OpenBook also allows the user to search for and download books and audio files from the Internet. The product works in harmony with Microsoft Word, allowing users who are blind, are visually impaired, or have a learning disability to prepare homework assignments, work documents, or correspondence. Braille users will also find support within the product.

OpenBook is a good tool for people with low vision in that font style, type size, character spacing, and colors can be easily manipulated to suit the users' needs. Among many features, the Masking and Word Spotlighting tools synchronize the text with the verbal output, making it easy to follow along.²⁰

Kurzweil 1000

Kurzweil Education Systems has a long history in the field of scanning and reading technology. When connected to a scanner, the Kurzweil 1000 will scan printed or electronic text and read homework assignments or the daily mail with ease. There are utilities for browsing documents by having the first or last (or both the first and last) sentence of each paragraph read, which allows the user to quickly scan a document. The user can then choose to read the paragraph sentence by sentence or skip it. A bookmarking feature

lets users mark areas they want to refer to later, and there is a note-taking feature, which the user may wish to refer to after the document is read thoroughly. Additionally, this feature will present a summary of all that is marked up along with the notes on command.

The strength of the Kurzweil 1000 is its immediate connectivity to online materials; just a simple keystroke will take the user to the Internet. The Kurzweil 1000 comes with a classic literature CD that contains hundreds of public-domain titles that can be accessed and read aloud.

Kurzweil products are well supported and documented. The parent company is well aware of legislation that affects education for students with disabilities and offers help in composing grant requests.²¹

Smart Talking Scanners

If the library's budget is nonexistent, the library may opt to go with a stand-alone scanner with speech output. Such scanners can read aloud what they scan, which opens the library's print collection to patrons with print disabilities. Books, magazines, and the patron's own correspondence go from being inaccessible to accessible.

What the scanners do not do is connect to the Internet, which could be problematic for some patrons. Staff could perform the searches and print the material, then patrons could scan the printout. This option could become time-consuming, and some patrons might take exception to the fact that someone is performing the searches for them, but it still is a viable option.

ScannaR

The ScannaR from HumanWare is easy to learn how to use; one lesson should be sufficient for most users. It is simply a flatbed scanner that can translate the printed word to a spoken word by pressing one button. After the scan, the user can opt to save the scanned materials, to reread, or delete them. It is easy for patrons to add file names to the scanned documents, as there is a built-in microphone. If saving scanned documents is a problem, the microphone would have to be disabled.²²

Scanning and Reading Appliance (SARA)

Freedom Scientific produces Scanning and Reading Appliance (SARA), which is a reliable, sophisticated, and fairly easy-to-use device with a one-button Start command and an installed dictionary. There is a lot of flexibility in the

product as users can have materials read line by line or word by word, or they can have a complete document read.

SARA also can be connected to a monitor to enable people with low vision to read scanned documents in a mode that they can see. There are thirty-five interchangeable text and monitor color combinations, plus numerous font and color options. An attribute called spotlighting helps users keep their places within documents and works with the SARA voice output. This feature could help both low-vision patrons and patrons with learning disabilities.

In addition to being a reader-scanner, SARA plays most audio formats, including Digital Accessible Information System (DAISY), which is the internationally acceptable method of formatting talking books for readers who are blind. SARA comes loaded with one hundred classic titles.²³

Eye-Pal SOLO

There is a fairly new device in the marketplace, from a small company called ABiSee, called Eye-Pal SOLO. The product was named Eye-Pal SOLO because it reads to the user on its own—absolutely no buttons to push, nothing to adjust. All staff members need to do is plug it in, and it's ready to operate. A patron simply places a book or newspaper on the reading bed, and it starts reading. To stop Eye-Pal SOLO from reading, the user simply removes the reading material from the bed. To pause the machine from reading, all the user has to do is wave a hand near the device; to resume, another hand motion will restart it. Eye-Pal SOLO can be connected to a monitor and used as a text enlarger, as the text scanned and read will be displayed on the screen. This is a basic, easy-to-use device that will enable patrons who are not willing learners to read magazines, newspapers, and their correspondence. In addition to the basic model, there is a more advanced option.²⁴

Web-Based Screen Readers

Relatively new developments in the field of voice output to Internet content are web-based applications such as Spoken-Web. These web portals are capable of managing content like news updates, weather, science information, and so forth, and adding text-to-speech functionality to the web content.²⁵ The primary audiences for such applications are those who have difficulty reading because of learning disabilities or language barriers.

Another portal is Browsealoud, which was created by Texthelp Systems. Texthelp Systems promotes a tool to website owners that makes their web

pages audible. A links library of sites that are audible without the user having to download software is maintained on the Texthelp website.²⁶

Web Anywhere (WA) is another product that provides audio output of screen contents and is restricted to the web browser.²⁷ WA was developed by the Computer Science Department of the University of Washington and is free. The product offers basic web browsing that includes navigation by heading, link, and input control, but it lacks many of the sophistications found in traditional screen-reading programs such as reading tables or incorporation of links. What it will do, however, is allow users who need voice output to connect to the World Wide Web or check for e-mail messages anywhere without specialized software having to be purchased. WA does caution that it is in early release and promises to improve access as soon as possible. This product would be useful to have on computer stations allocated for quick access.²⁸

A Word about Browsers

When interfacing with the Internet, screen readers essentially read what they see, so it is imperative for websites to be accessible. Likewise, browsers must also be useful tools for those with some type of disability. If you cannot use the browser, you cannot surf the web. The World Wide Web Consortium (W3C), the organization that sets guidelines and standards for web accessibility, has created a standard for Accessible Rich Internet Applications (ARIA). Two popular web browsers have proven themselves to work with the most technologies as well as a text-based browser.

Internet Explorer

Microsoft, with Internet Explorer, has actively sought to offer accessibility support for Internet surfers using assistive technology. Each release of Explorer has been more usable than the last. The browser allows the user to select text and move around the web page using keyboard commands (as opposed to mouse clicks); enables the user to change the text, colors, and font size on web pages and documents; and helps locate text on web pages.

Additionally, there are options given to simplify common tasks through accessing the accelerators using keystrokes. These applications are fairly straightforward, easy to learn, and come with tutorials.²⁹

Mozilla Firefox

Firefox has become a preferred browser for many web surfers, but many users of screen readers consider it an essential tool. Firefox has many “extensions” that can be installed to make browsing function better as patrons need to find ways around barriers. Extensions can do things such as make web pages more accessible or block advertisements that get in the way of accessibility. Firefox also enables the user to make the font size and button size larger or change their color. The user can turn off the Java applets or restrict what information is presented, such as pictures.

Firefox is committed to enabling screen readers to locate information with greater ease. It works with the three leading commercial screen readers and maintains dedicated accessibility information pages.³⁰ Additionally, several active blogs maintained by developers or expert users of assistive technologies offer tips to users and often act as conduits to Firefox developers.³¹

Lynx

Lynx is a text-only browser, and it is disability-friendly in a way that no graphical-user-interface-based browser can be.³² By its very nature, Lynx is designed for keyboard-only interaction, with no pull-down menus, no pop-up windows, no mouse controls, and nothing to click on. In short, it cuts through a lot of the “window dressing.”

The product is upgraded with fixes and modifications from the World Wide Web community. The browser is free and may be already on the library’s computers. It should be bookmarked for easy access. Staff may find that patrons without disabilities may enjoy and prefer using Lynx, as it is extremely fast.³³

Environmental Add-Ons

It is useful to have a keyboard that has some tactile surface to enable patrons to find their way around the keyboard unassisted. For persons who are totally blind, the home keys are all that need to be marked, but for those with low vision, it is helpful to have large print on the keyboard.

Although specialized keyboards can be purchased for use in conjunction with large-print screen readers, there are low-cost alternatives, such as pres-ply key tops, which can be added to the library’s existing keyboards.

The large-print key displays are useful for those with some vision and those not comfortable with keyboards as well as for people with learning or cognitive disabilities. The items are low cost, easy to apply, and available from a variety of retailers offering assistive-living products. Additionally, there are versions that have large print as well as tactile surfaces.

It is also prudent to equip the workstation with headphones (with disposable covers) or earbuds. This allows the patron a sense of privacy while listening to text and keeps the noise level down in the computer area. Inasmuch as sanitation is justifiably a concern, patrons can be asked to purchase the earbuds or bring a pair from home.

A Final Word of Advice

Giving voice to the text may very well be a challenging venture, but it is encouraged, as it can be a solution for many people with print disabilities. A final word of advice is to select the solution(s) that the library can best support with staffing or volunteers. It does no good to have the software and hardware if library personnel do not know how to use them.

Notes

1. A simulation of reading with dyslexia is offered by the organization WebAIM, at www.webaim.org/simulations/dyslexia.php. The simulation demonstrates how people with dyslexia incorrectly see words and how a screen reader sees them correctly.
2. American Foundation for the Blind, "Screen Readers," www.afb.org/prodbrowsecatresults.asp?catid=49.
3. Peter Krantz, "Fangs—the Screen Reader Emulator," *Standards-Schmandards: A Problematic Approach to Web Accessibility* (blog), www.standards-schmandards.com/projects/fangs/.
4. Utah State University, "Designing for Screen Reader Compatibility" and "How Screen Readers Read Content," WebAIM, www.webaim.org/techniques/screenreader/.
5. WebAIM, "Screen Reader User Survey Results," *WebAIM Blog*, October 29, 2009, <http://webaim.org/blog/screen-reader-user-survey-results/>. Interesting and useful information from consumers in relation to screen readers can be accessed within this survey.
6. WebAIM's survey reported that 75 percent of users responding to the survey replied that they used JAWS software, <http://webaim.org/blog/screen-reader-user-survey-results/>.

7. JAWS is available from numerous dealers. To download a trial copy of the software, go to “What’s New in JAWS 11,” www.freedomscientific.com/downloads/jaws/JAWS-whats-new.asp.
8. A refreshable Braille display is a piece of hardware that sits alongside of the keyboard. It works in conjunction with screen-reading software to enable users to read what is on the screen. It has actuators that raise and lower to form Braille cells, which Braille readers can feel with their fingers to read what is being displayed on the screen.
9. Kathleen Beaver’s *JAWS Tutorial* is designed for a sighted tutor to teach a blind user to use JAWS with Windows programs: <http://atto.buffalo.edu/registered/Tutorials/jaws/index.php>.
10. Cheat sheets are extremely helpful and often enough to enable staff and patrons to quickly learn a product. The Wisconsin Center for the Blind and Visually Impaired offers a host of instruction sheets that can help form the foundation of training manuals. The center supports a “Cheat Sheet for Window-Eyes” as well as a host of other products used by people using adaptive technologies at www.wcbvi.k12.wi.us/technology.new/assets/handouts/Window-Eyes%20Cheat%20Sheet.pdf.
11. Dolphin is getting a foothold in North America. To determine if there is a dealer in your area, see www.dolphinuk.co.uk/dealer_zone.asp?id=&country=198&state=999&Submit=Submit.
12. To learn more about the product, including system requirements, visit <http://serotek.com/system-access-standalone>.
13. WYNN is a product of Freedom Scientific’s Learning System Group. The company offers online support, and the products are fully documented with tip sheets, FAQs, and system requirements. Visitors can also request free demonstration software at www.freedomscientific.com/LSG/products/wynn.asp.
14. To learn more about this product and view a video of it in use, visit the website, at http://texthelp.com/default.asp?pg_id=10250. The website also has grant-seeking tips.
15. NonVisual Desktop Access (NVDA) offers this product free of charge at <http://nvda-project.org>.
16. J. Howe, “Free Screen Reader for the Visually Impaired,” *Associated Content Technology*, October 1, 2008, www.associatedcontent.com/article/1025898/free_screen_reader_for_the_visually_pg2.html?cat=15; and Access Technology Team, “Low-Cost Screen Readers,” www.nfb.org/images/nfb/Publications/bm/bm09/bm0905/bm090506.htm.
17. NaturalReader offers an overview of its products at www.naturalreaders.com/products_compare.htm.

18. To determine which Accessibility programs the library might be able to utilize as well as to learn how the products work, see Accessibility in Windows, www.microsoft.com/enable/products/default.aspx; and see www.microsoft.com/enable/training/windowsvista/narvoice.aspx. Tutorials are available at the Microsoft site.
19. For more information on Apple's VoiceOver and other accessibility features that may assist those with visual impairments, visit www.apple.com/accessibility/macosex/vision.html.
20. Visit the website, at www.freedomscientific.com, to locate a dealer, determine system requirements, or to download a demonstration copy of the software.
21. In addition to providing information about the product and offering downloadable demo copies of the programs, the site supports free webinars and gives tips on applying for grants, at www.kurzweiledu.com.
22. For further information about ScannaR, visit the HumanWare website, at www.humanware.com.
23. To learn more about SARA, visit www.freedomscientific.com/products/lv/sara-product-page.asp.
24. To learn more about the ABiSee product, visit www.abisee.com.
25. Spoken-Web is available at www.spoken-web.com/index.cgi?p=about and does require the user to download a configuration file to use.
26. To view speech-enabled websites, visit Texthelp Browsealoud, at www.browsealoud.com/page.asp?pg_id=80098.
27. National Federation of the Blind, "Low-Cost Screen Readers," *Braille Monitor* (May 2009), www.nfb.org/images/nfb/Publications/bm/bm09/bm0905/bm090506.htm.
28. To use the program or to learn more about Web Anywhere, visit <http://wa.cs.washington.edu>.
29. Microsoft, "Internet Explorer 8 Accessibility Tutorials," www.microsoft.com/enable/training/ie8/default.aspx.
30. To learn more about Firefox's accessibility features, visit www.accessfirefox.org/Firefox_Accessibility_Features.php.
31. Marco's Blogspot, found at www.marcozehe.de/, and Mindforks, at <http://mindforks.blogspot.com>, are two.
32. Dave Taylor, "What Capabilities Does the Lynx Text-Only Web Browser Offer?" *Ask Dave Taylor*, www.askdavetaylor.com/what_capabilities_does_the_lynx_textonly_web_browser_offer.html.
33. To locate Lynx on the library's computer, try typing "which lynx" or "locate lynx." If Lynx is not found, it may be downloaded from <http://lynx.isc.org>. Full documentation and tips for use are also located on the website.

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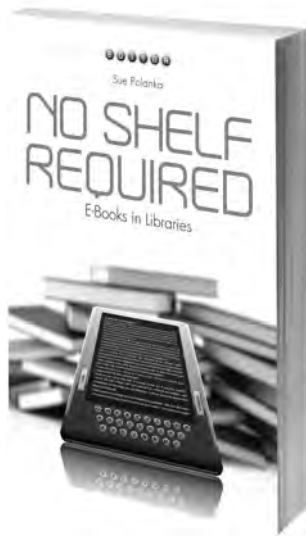
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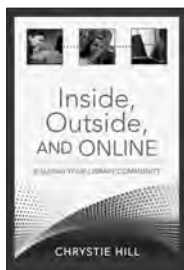
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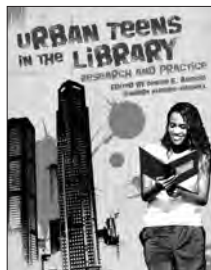
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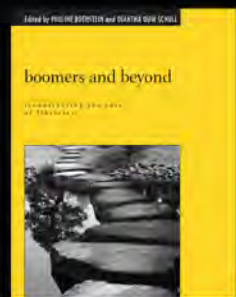
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