ADAPTIVE AND ASSISTIVE TECHNOLOGY

For Libraries

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INTRODUCTION

The concept of adaptive and assistive technology is not a new one. Historically, print-enlarging devices like eyeglasses were probably a first step in the direction of assistive technology in connection with books and libraries. It is not a coincidence that eyeglasses remained extremely rare from their invention around the year 1000 as privileges of the wealthy until the invention of the printing press when they filtered down to a larger number of people.

Fast-forward 1000 years from the first eyeglasses to contact lenses, a fraction of the size, a fraction of the weight. Still, they had only one use: to assist vision. Many of the new assistive and adaptive technologies are combinations of technologies addressing not only one disability like vision or hearing, but several. Instead of mechanical aids, they are now combinations of mechanical and electronic aids. One single machine like a computer running Windows XP can aid the vision impaired by magnification or Braille, the hearing impaired by amplified headsets and visual cues instead of aural cues, the mobility impaired by alternative input devices like trackballs or joysticks, and the learning disabled by having text read aloud through Optical Character Recognition.

One of the best, simplest and cheapest pieces of assistive and adaptive equipment in libraries today is the screen-enlarging software. ZoomText is one of these, but there are many different companies that make similar products. They are all easy to use, have good tech support, and are upgraded regularly (Mates 2004). Text may be magnified up to 32x, colors can be adapted, font size can be adjusted, and a different cursor may be chosen. Price range for this technology is $500 to $700.

ADAPTIVE AND ASSISTIVE TECHNOLOGY: A BRIEF HISTORY

In the 1800s an increasingly consistent attempt was made to aid those with disabilities (Pedroddy and Briant). In 1817, the Gallaudet school for the hearing impaired was opened by Thomas Hopkins Gallaudet. A few years later, Louis Braille, a Frenchman, adapted Charles Barbier's "Ecriture Nocturne" or nightwriting, originally developed for the military, specifically Napoleon's army so that he could send messages to be read in the dark. This became Braille embossing that enables blind people to read by feeling the raised   letters. (Could the abacus have been used for math like a calculator for the blind)?

In 1872, Alexander Graham Bell began to conduct classes for teachers of the deaf. (Infinitec), and in 1876 he invented the telephone, a byproduct of his work with the deaf. In 1916, through Harvey Fletcher and Irving Crandal's work at Bell Labs on assistive hearing and speech, a hearing aid was developed. (Infinitec 2006). In 1921, invention of the loudspeaker, amplifier, and microphone furthered the cause of assistive technology in the form of the first public address system. Its components became valuable aids for the hearing impaired.

 In 1934, the Readphon was born, which stored literature and music on LP's, a great advance for helping the vision impaired. In 1936, an artificial speech synthesizer was developed by H.W. Dudley for Bell Labs, another great stride for assistance of the disabled. In 1948, the first talking book in the form of a tape recording arrived. From 1948 on, much time and energy was spent into miniaturizing all the components to aid the deaf and blind. The transistor was a product of these efforts.

 In 1952, a speech recognition system was developed by Bell Labs. In 1964, a major breakthrough occurred for deaf people in the form of the TDD (telecommunications device for the deaf) and TTY (teletype). The TDD is essentially a typewriter that connects to a visual screen, allowing the deaf to communicate with the hearing. In 1972, the first large-scale packet network was developed by Vinton Cerf which popularized text messaging (Infinitec 2006).

Kurzweil technology arrived in 1975 with flatbed scanners and the first character recognition technology. OCR is computer science that allows translation of written text into digital language. From there it can be translated into audio output or print, including Braille. The Kurzweil 1000TM is software that enables the visually impaired or blind to read information originally in print or electronic form. The equipment speaks text aloud and the voices can be adjusted for personal preference. It can access on-line materials which may be sent on to Braille embossers or to MP3 and DAISY. The Kurzweil 3000 for Windows was first introduced in 1996. It is used for people with cognitive impairments like dyslexia, and can be accessed by alternative means via computer.   It reads aloud and the user can type directly onto the scanned text. (Kurzweil Ed. Systems).

POPULAR ASSISTIVE DEVICES AVAILABLE FOR LIBRARIES

There is an infinite number of type and quality of assistive devices to choose from. Many of the technology companies produce products that overlap in function. Price ranges are from a few dollars to thousands of dollars. A few of the available products are:

The Kurzweil 3000 reader has been a tremendous and popular aid for the visually impaired as well as the learning disabled: it simply scans the material including full color and graphics into the computer and reads it aloud to the user. The innovation with this device is that it allows interaction rather than passive reading. Users may make notes on the screen and write answers to test questions while the apparatus is scanning the material. Test worksheets like T/F, short answer, and multiple choice are included. It contains aids like dictionary in different languages, and thesaurus.
Interaction allows on-screen highlighting of text, annotation, and outlining, as well as separating the outline from the text. It also contains word prediction, spellchecker and bookmarking. The requirements for installation are Pentium or AMD 400MHz at least, 128 MB of memory, 2MB video RAM, sound card with speakers and scanner.

Kurzweil 1000 is a text-to-speech screen reader with many attractive features. It has a choice of 14 voices male, female, or child, spell-check, e-mail options, multi-language speech, braille embossing actions, text editing. It will automatically install from a CD.

Since the early Kurzweil inventions, most of the adaptive technology has undergone continuous changes. An example of the change is the ZoomText. The version discussed briefly in Burke is the ZoomText 2. Now the ZoomText 9 is available with many new additions and changes, like NeoSpeech synthesizers that read in pleasant, human-sounding voices and font changes that make reading easier.

Since the mid 1990's, there has been an accelerated outpouring of technology for the handicapped; voice activated technology for light switches, and telephones. Talking caller ID's for the blind, large keypads for telephones, pagers, calculators, and volume control for telephones. The newest version of JAWS just released has place markers which allow the user to electronically mark a place to return to later.

Several specific pieces of technology that are being used successfully in libraries and for private use are:

SmartCat from Cirque software, a touchpad controller with an area only 3x2". It provides scroll and zoom with distinctive sounds for each operation, combining mouse and touchpad functions in one unit. It is compatible with IBM PC or Mac., Windows 95-2000, and XP. Trackball technology (a mouse with a ball controller) is relatively cheap, with a SAM trackball for $82, and a Joystick for only $29. A trackball from Office Depot costs only $20 and works quite well.

Other new items are CrossScannerX for Mac OS 10 which controls the computer with one or two switches, 2+2, a question/answer for equations, Talk'nScan Calculator, a

talking calculator for only $25, all from RJ Cooper. There is also an On-Screen Keyboard from RJ Cooper and Associates and pwWebSpeak, a web browser that reads the screen. A few of the current technologies are:

VERA. This device is a Very Easy Reading Appliance. It is a personal reading machine in a self-contained unit in an attractive wooden box that reads any printed material with a user-friendly keypad with large keys and tactile markings. There are only three keys to make it work: scan, read, and stop. The voice is pleasant and clear, the same voice that is used as one of the MAGic readers. The text may be read word for word or line by line. Text size and colors can be changed and the document can be saved. The problem with this gadget, easy though it may be, has built-in flaws. It occasionally reads both sides of the printed matter, and will garble fonts that are not quite standard. This is a good example of what not to purchase.

SARA. The SARA scanning and reading appliance with OCR that is another simple self-contained reader that can be connected to a monitor for looking at enlarged print. SARA is compatible with Daisy formatted talking books. The principle is the same as the VERA, easy to use, reads many languages in various voices and accents. It is one of the newer readers from Freedom Scientific that also reads many different file types. At this time the cost is about $2,600.

MAGic for Windows provides screen magnification for the internet. The letters can be magnified to such a degree that there are large empty spaces on the screen and the user must have an idea where he is on screen at the moment. The most recent upgrade of this unit from Freedom Scientific is the 8.02 version, a screen magnifier that either stands alone or has speech support. (Salmon 2006). Installation is easy, with large-print prompts and allows selection of languages. There are various magnification views: full, overlay, and split screen. The size of the window as well as the border colors and contrast can be adjusted. MAGic tracks either with mouse, cursor, tool or window. This magnifier may be combined with the JAWS unit reader for Windows. For example, when JAWS speech is used, MAGic turns its own speech off.

JAWS: Job Access With Speech for Windows. This is screen reading software from Freedom Scientific. Instructions for installation are read aloud, enabling blind persons to install it and connect it to refreshable Braille displays. A unique scripting language allows customization with non-standard software. It allows access to Internet Explorer with links lists, frames lists, HTML tables and graphics that let the user change the sound to symbolize quotes or boldface text. Instructional CDs make Windows navigation relatively simple. It comes in 17 languages. Price I around $1,000. It is compatible with Windows 2000, XP, ME, 98 and 95. 60 MB of hard drive disk space are required as well as a sound card.

ZoomText, version 8.0, a device offered by Ai Squared and available in either a simple screen magnifier or a dual system of magnifier and screen reader (Salmon and Anzlovar). Since this version was reviewed in 2003, the newer version, the ZoomText 9 became available which has better sounding speech synthesizers and the magnification has been

upgraded from 16x to 36x. The stand-alone magnifier or the magnifier-reader may be used with Windows XP, 2000, ME and 98.

There are no tutorials for this system, but it comes with a manual and reference guide in large print. On line help is also available. It can be installed with pre-set settings or customized for individual preference. Tool bar buttons on the control panel have picture icons and large print labels. The user is allowed to switch between the magnifier and screen reader tools. The unit's new control panel is easy to use and well organized.

Magnification (32x in the new version) can be turned off or on and increased or decreased. A hotkey may be used to change magnification, and a voice will confirm the change.

There are four different screen view settings, a full view, an overlay, a lens view that allows different sections of the screen to be magnified as desired when the mouse is moved and images can be resized.

A color enhancement button allows for many different combination of color settings to enhance contrast for those who have problem with color vision. ZoomText offers tracking with mouse, cursor, tool tip, and window.

Speech output is provided by the magnifier/reader combination only. It can read documents and web pages, graphics, menu bars and can be customized to different languages. Reading a document can be accomplished by either the AppReader or the DocReader. The AppReader reads continuously. The DocReader allows reading of material from a separate enlarged window. Individual words may be spoken by clicking on them.   Words are spoken as they are typed if desired. The user is able to simply read the chosen material or print it in a chosen font. The program loads by typing ZoomText into the computer. This is a very user-friendly gadget and is quite sophisticated for the low cost. Price for the ZoomText 8.0 magnifier is$395.00 and the Magnifier/Screen Reader is $595.00.
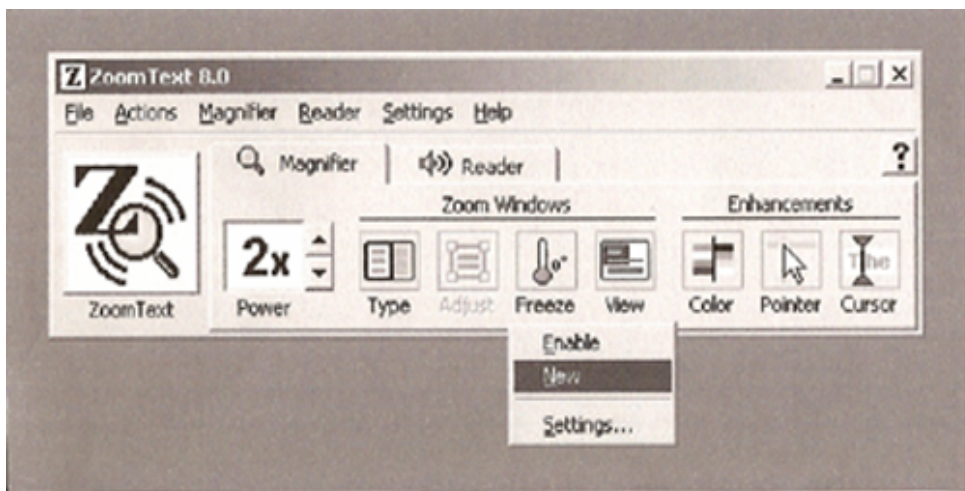
ZoomText Software, one example of many available

Another impressive piece of software is the **Dragon Naturally Speaking**, a speech recognition system. It orks with Microsoft Word and other systems to write documents from dictation. There is a five minute training period where it learns the user's voice, and then it is ready to perform. It is compatible with e-mail programs Microsoft Outlook and Microsoft Express, and can be used for web browsing, and replying to email messages. Specialized medical and legal systems come ready to use, with vocabulary easily added to the program. It writes at an incredible rate of 160 words per minute. A drop-down box gives a choice of words where a question exists. A personal version of this software costs only $200 and is a small price to pay for the convenience.

Since the advent of digital technology, it has become easy to translate among vision, sound, and tactile languages. It is also capable of multiple languages.
There are adaptive keyboards with Braille letters raised letters, operating systems with easier access, digital sound, robotics and cybernetics., word recognition, talking electronics, alternative mice, adapted telephones, and alternative communication There are headmice for the severely disabled who can move a cursor with a reflective dot on a headband or their glasses.

New technology enables the deafblind to communicate in the form of Dexter/RALPH, a mechanical hand that can translate language from a computer into hand-spellings. This makes Web communication a reality for the deafblind.

The hand began development in 1978 for the deaf-blind, and has undergone many changes, over the years; The latest form is RALPH, for Robotic Alphabet, which allows deaf-blind people to use the internet by touch communication with RALPH. As an interesting note, most cases of deaf-blindness are caused by Usher's syndrome, which is a result of pre-natal Rubella infection (Jaffe2006).

ACCESSIBILITY ISSUES

There are several issues to consider when discussing the accessibility for libraries as well as access issues in general. There are moral, social, and legal obligations that must be examined.

In the Tech Act, (Technology-Related Assistance for Individuals with Disabilities Act of 1988) an "assistive technology device" is defined as "any device, piece of equipment, or product system…used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Wehmeyer citing Wallace, Flippo, Barcus, and Behrman 1995). According to a census in 2000, there are approximately 20% of the population above the age of five who have some sort of disability. (Mates 2004). Many of these people have more than one type of disability. There are 57 million computer users in the US who use some type of assistive device, and, according to a Microsoft study, 57% of

computer users in the US would benefit from some type of assistive device. By the year 2010, 70 million people will need some type of assistive technology.

Web Page accessibility must also be considered when discussing access to online materials by persons with disabilities. W3C, the WorldWideWeb Consortium offered the WAI or Web Accessibility Initiative in 1997. It takes into consideration all types of disabilities—visual, hearing, cognitive, and physically challenged in any way. There are organizations that specialize in making web pages accessible to all. DO-IT (Disabilites, Opportunities, Internetworking, and Technology) (Mates 2006).

In designing web pages, separate structure from information. Should also be independent of hardware required: be able to use alternative screens, alternative mice, alternative input/output to screen. Make it navigable: I experienced this when looking at a screen magnifier-reader: the magnification was so large that often large blanks were seen on the screen, and complete disorientation resulted.

BOBBY is a web program designed to check the accessibility of websites by the visually impaired. The URL in question is entered into the computer and in just seconds, it is graded with tags where questionable data is noted.

There are other issues to consider when discussing access to library materials for the disabled. First, there are the obvious physical access for wheelchairs, elevators, and workstations that must be adjustable. Often rooms for the disabled in libraries are away from the mainstream and difficult to access. (Mates 2004). Disability may be a person's being unable to enter information into a computer due to paralysis or lack of coordination on mouse or keyboard. For these people, alternate input devices must be used, like voice-command or rocker switches (Mates 2004). For   people who need assistance in getting information from the computer: screen magnifiers, Braille readers, large print screen, text to Braille, and Braille to audio translators, refreshable Braille (screens that allow a person to feel Braille letters on a mouse or computer screen) may be needed. There are micro keyboards for patrons with limited mobility, large key keyboards for people with coordination problems, and trackball or touchpad controllers allow people with limited manual dexterity to provide input into a computer. (Burke 2001). There are also touchpads and on-screen keyboardsIn 1999, the WC3 mandated web accessibility guidelines. Some specifications include access by lower-powered PCs and narrower bandwidths, enabling web pages to communicate without graphics (Infinitec).

New technology like DAISY formatting allows talking books to be navigated, making them much more useful for the disabled. DAISY "Digital Accessible Information SYstem" is a system of marked-up text linked with audio that allows a disabled person to search (an encyclopedia, for instance) more effectively than a straight talking book requiring linear access (Wikipedia). The Key foundation is a multimedia internet library active in helping institutions prepare books into DAISY format.

There are general classes of people with disabilities that must be considered when designing rooms with assistive technologies in libraries: those who are print-disabled:

low vision, blind or deaf and blind; those with cognitive impairments: dyslexia and poor verbal skills; the hearing impaired; the physically impaired with neuromuscular or skeletal disorders or limited mobility, and those with age related disabilities.

More and more materials that used to be available in print format- from the government, service organizations and corporations are now available only on websites that older non-computer literate people have no access to (Mates 2004). That includes medical information from drug companies, insurance information, and health information from governmental and local agencies. Once seniors are able to use computers, however, they become just as or more enthusiastic about going on line than younger people. It is to this, the largest population of assistive technology users that libraries must market their technology.

The general aging of the population is one of the largest contributors of people who need assistive technology; failing eyesight, cognitive disabilities, crippling arthritis, and hearing loss. Funding for much of this technology remains a problem. Much of the insurance of Medicare, Medicaid, and Social Security will cover only some of the costs. Many companies are now investigating a universal design concept, which would make all products more easily accessible by all people. Some of this is already being used in the form of the handicapped sign in the computer control panel where some hearing, vision, and motility problems are addressed and alternative keyboard, sound, display, and mouse options are offered. The universal design concept is a product of the Archimedes Project started in 1990, a group of people dedicated to making information accessible to all. The developmental trends are toward wireless systems in libraries that will allow people to bring their own adaptive technology tools. The Windows XP is a phenomenal piece of software with already available assisting devices for visual contrast, audio, speech, and mobility and cognitive disabilities.

Librarians can help senior/disabled learn what information is available on-line and demonstrate that those with low vision or hearing loss can access computers with assistive and adaptive technology. Some of the simplest adaptations for libraries that benefit seniors are large monitor, good lighting, adjustable desks and chairs, large computer keys, trackball mice for stiff joints, closed circuit TV, and magnification software. Microsoft has an Aging and Accessibility website that covers some of its built-in features like StickyKeys, which allows one keystroke for double keystrokes, filterkeys which ignore repeated keystrokes due to tremors, and contrast control. (Mates).

Staff should receive training in how to approach the handicapped and simply ask them what assistive devices they need and would like to have. An advisory committee from a cross-section of people with impairments should make sure that all groups are fairly represented. This should become part of the goals of the library. There should be ongoing awareness training for the library staff and information should be sent to the community in large print for easier reading.

More than ever, people with disabilities are seeking higher education and employment. This increase in the last ten years has been partly due to advances in technology that

allow the disabled access to the same information that the able bodies have access to (Gelbwasser). Many of the disabled who used to be isolated at home are now mainstreamed into regular schools. There are support programs, more general public awareness, library access, funding and continuing research. Adaptive technology is being advanced through faculty and library inservices, training sessions in new technology, publications, and general marketing. Equipment costs are coming down.

Access to information fosters self-reliance in the disabled and they are able to develop to their full potential. Life becomes more manageable through technology. Another positive result of information access is to reduce the isolation barriers that previously kept the disabled at home or in institutions. Another reason for libraries to provide equipment for the disabled is because it is required by law under the ADA. Assistive technology provides opportunities for people to become self-reliant, and develop self esteem; it provides people with the necessary tools to acquire skills that will help them become independent in a career; it provides basic skills for those with disabilities to build additional skills for self-satisfaction and fun as well as work. This endeavor is truly the dream come true of librarians in providing skills for lifelong learning.
It is interesting to note that since I started working at the BCPL as an Intern, I have changed my mind several times concerning just what it is that should be available in a *library as* Just because all this new technology for the disabled is available does not mean it is practical or cost-effective for public libraries to stock it. Equipment like Dexter and RALPH, at the cost of about $30,000, is best left to specialty libraries.

At first, I considered the two magnifier-readers, which are really CCTVs, and the two computers with Magic and JAWS phenomenal technology. As I began to learn more about adaptive and assistive technology, I changed my mind many times as to what constitutes a good, basic library assistive room. After a year of research, the following innovations to an assistive program make the most sense.

There are several simple, relatively cheap assistive aids that can quickly pay for themselves in patron satisfaction. I would first of all make the room larger, at least 14 x 14 feet. The doorway needs to be widened to make room to maneuver a wheelchair. Large signs need to be procured identifying the room as assistive. Desks need to be adjustable and monitors need to be on movable arms. For a public library the size of Blount County, there should be at least two large24" flat-screen monitors at a cost of $2000 each with Windows XP. For alternative input devices, at least a trackball mouse and a joystick should be included. One very large keyboard with Braille signage should be available; one refreshable Braille unit for one computer to allow blind persons to surf the web, one very small keyboard, as well as a large-format laser printer. Headphones should be available. One TTY device should be available for hearing challenged persons to communicate with library personnel. For software, the Kurzweil 1000 for blind users and the Kurzweil 3000 for developmentally challenged persons makes sense—an interactive screen reader that reads aloud and underlines. It can also be used as a web-tool that allows reading aloud from the web. A Closed-circuit TV is probably the simplest mechanical magnifier available. Software like MAGic and JAWS, also magnifiers with speech capability and web browsing, work well but are not user-friendly and require

tutoring. DragonNaturallySpeaking is a must for those who cannot type due to mobility problems or because they never learned.

The thing to keep in mind when developing assistive technology for a library is that most of the people who require assistance are not totally blind, deaf, or paralyzed. Most of the users will be older people who have lost some of their vision, hearing, and mobility. While esoteric devices like Dexter for the deafblind are available, they are not practical or cost-effective for a small library.

Some of the most sensible technology that could be installed in a library is:
ZoomText Magnifier ($500-$700).
TEXT-TO-SPEECH SYSTEMS WITH OPRICAL CHARACTER RECOGNITION.
These also allow interface with the Web.
ScreenReaders: ($400-$1200).
MAGic Screen ($745).
JAWS (JobAccessWithSpeech)
Kurzweil 3000 ($2695 for the color version or $1995 for black and white).
TTYs and telephone aids. ($379).
CCTV, $500 to several thousand dollars. These magnifiers are very easy to use, turn on the machine and begin to read. Background colors can be changed for better contrast. These magnifiers are available from pocket-sized to large table-top models.
One Speech-to-Text for dictation like Dragon Naturally Speaking is a must.

In addition, a Dell Pentium IV computer workstation, a large format laser printer, Braille printer and a closed circuit TV would be a good investment.
Headsets, alternative mice, especially trackball and joystick, Braille keyboard, large keyboard, and small keyboard would complete the basic equipment.

This equipment, together with the superb computer, large flat-screen monitor and printer and alternative mice, cover most of the basics for vision and hearing problems that include older individuals and those with cognitive disabilities. Braille printers have become affordable and as easy to use as ordinary printers, many as simple as plugging a unit into a USB port. I would also like to see public libraries carry a selection of Braille books. As we can see, the total cost for a well-equipped basic room for the visually and hearing disabled library patrons can be acquired for around $10,000. This would be an extremely wise investment in the community and would bring many older patrons into the library in addition to those with more obvious disabilities. Librarians should carefully research what products would make the most sense for their library. Ask patrons with disabilities what they need and include them in the decision making process. For the librarian, whose ethical and moral commitment it is to be a service to the community in promoting lifelong learning for all, it is imperative that they become part of the planners and implementers of equitable access for all citizens.

TYPES OF ASSISTIVE TECHNOLOGY DEVICES

In the past few years there has been a large increase in the types of assistive devices available for libraries. Many of these devices are constantly being improved upon and better versions made available to the public almost daily.

It is easiest when discussing adaptive and assistive technology devices to group these devices according to their function relating to computer technology. <u>Alternative Input</u> devices allow disabled users to access their computers through means other than the standard keyboard. There are large keyboards available now for people who have limited manual dexterity; there are very small keyboards that allow use of only one hand *or* finger. Touch screens and touchpads allowing use of one finger or pointing device. Braille input with the new refreshable Braille is a convenience for blind users to navigate the Web.

Joysticks and trackballs together with on-screen keyboards enable those with limited mobility to manipulate their computer comfortably. There are even new infrared head tracking devices and sip-and-puff systems to operate computers with breaths of air.

Keyboard filters that ignore repeated keystrokes are convenient for users with muscle tremors. For those with limited hearing, there are light signals from the computer, and for the blind, there are audio signals.

Large screen monitors together with magnification software enable computer access for the visually impaired. Screen readers are a further step in allowing those with limited vision or learning disabilities to function more normally.

Speech recognition has improved tremendously over the last few years enabling a person to dictate into the computer. Text-to-speech, or speech synthesizers have also improved dramatically from tinny, mechanical voices to human-sounding voices and are available in child's voice, male or female, different languages, and different regional accents.

TTY or TDD or telephone-typewriters enable deaf persons to communicate with others by conversion modems on their computers. This is especially useful for library use. A useful number to remember is 711, which enables someone to access a public telephone relay service. The deaf person dials 711; an operator will relay the message to a hearing person.

ACCESSIBILITY OPTIONS ON WINDOWS XP

When an assistive device is needed, most people will immediately begin researching the web for a product and find many suitable items like magnifiers, screen readers, and speech recognition software.

It is however, a well-kept secret and a great wonder how many assistive options already built into Windows XP at no extra cost. Many of the same options like screen magnifiers and text-to-speech are already built into the XP system. There are options to customize display and readability: screen magnification options, as well as color options for more or less contrast; screen resolution, icon size, blink rate of the cursor can be changed (or removed altogether). Sounds and speech options: Sound volume can be enhanced; text-to-speech option is available. There are visual alternatives to sounds; obtain either visual cues or sound cues, whichever are needed.

The easiest way to access the assistive technology options is by going through the accessibility Wizard. It prompts the user if he has vision, hearing, or other difficulties, and it will set options accordingly. This is a good start, but soon the user will want more options, and then it is best to access the individual assistive modules like Mouse, Keyboard, or Speech that offer a lot more options.

Keyboard and Mouse Options:

Choose speed at which to click the mouse; click and drag without holding down the mouse button; change the size, shape and color of the pointer; track the pointer on the screen. Reversal of function of the right and left mouse buttons may be set. A great feature for those with limited physical mobility is the stickykeys which allow pressing of keys in turn, rather than together (like alt-cont-del).   Togglekeys make tones when depressed; and filterkeys set the speed with which the computer accepts depressed keys, ignoring shaky hands or fingers. The pointer may also be moved by joystick or numerical keypad.

Other great options already built-in are a separate window on part of the screen where the pointer is that magnifies letters to an extremely large degree. A voice reads what is on the screen. The rate of the voice reader may be changed to read faster or more slowly, but it remains a computer-generated type sound, very mechanical. This is one option where I think a purchased high-quality voice system is worth the investment.

An on-screen keyboard is also a built-in option so users can employ alternative input like joystick, mouthstick, or head tracking device. Care must be exercised when choosing a joystick, because most of them are configured for games, and not for computer use and may not work with an on-screen keyboard.

An Administrative option allows turning on or off of accessibility options.

TUTORIAL FOR WINDOWS XP

MAGNIFIER: Access magnifier through Start- All Programs- Accessories- Accessibility- Magnifier. Select magnifier. The magnifier can cover approximately half of the screen. Click and drag to move magnifier and re-size magnifier. On the bottom of

the screen a window with "magnifier settings" appears. Click on "magnifier settings. " Here the magnification level can be changed from 1-9. There are also options for mouse tracking: Follow the cursor, follow keyboard focus, and follow text editing. Colors can be inverted at this point.

ACCESSIBILITY OPTIONS-HANDICAP SIGN: This feature contains several useful settings. *Keyboard, Sound, Display, Mouse, and General* options are available. **Keyboard** allows setting of stickykeys that allow pressing keys in sequence instead of at once, like cont-alt-del. Toggle keys (sound keys) and filter keys which allow ignoring of repeated, unwanted strokes. **Sound** settings gives visual warning for sounds, or displays captions for sounds that it makes. **Display** tab is another useful option that allows contrast to be adjusted, and cursor and mouse blink rate. This is the setting where all the different colors and contrasts can be set. **Display-Settings** is the important module here. There are thirty different settings in the drop-down box, some quite dramatic contrast settings. **High Contrast Extra Large gives** an incredibly dramatic setting of black background with large letters.   The High Contrast box needs to be checked. **Mouse** setting on this same tab allows pointer setting speed. **General tab** has settings for alternate input devices.

All the above settings are accessed through the HANDICAP sign on the control panel.

All Programs-Accessories-Accessibilities.

This is the basic access to the **Accessibility Wizard, Magnifier, Narrator, On-Screen Keyboard, and Utility Manager.**

On-Screen Keyboard. The on-screen keyboard is available through All-Programs-Accessories-On-Screen Keyboard. An immediate flaw of this feature is that it cannot be enlarged. It remains approximately 3"x5". Its purpose is to use alternative input like a joystick to operate the letters and it can be set for single letter or number selection. Another major flaw in the system is that while the size of the letters and numbers may be selected from the "settings-font" option on the keyboard, the squares in which the letters are presented remain the same size, thereby showing only partial letters in the squares if they are made too large.

Narrator. When the Narrator button is accessed, it covers up the screen behind it that allows setting of what you want the narrator to do. This screen must be first moved aside to get to the narrator function. Under voice settings, the speed, pitch, and volume can be set.

INDIVIDUAL MODULES ON CONTROL PANEL

The above features, and many more, may also be accessed from individual modules on the **Control Panel.**

Under the **Speech** module, under the first tab, **Speech Recognition** "configure microphone" the MICROSOFT SPEECH TUTORIAL becomes available. This is they key to the speech recognition function. The tutorial allows different users to train the computer to recognize their voice, allowing dictation in the word processor. Once the computer is trained, simply access the Word Processor. Under the "tools" option, there is a "speech" setting. If "dictation" is selected and the microphone connected, the user can begin dictating immediately. The speech to text is not perfect, but if used in combination with they keyboard, much of the job may be spoken aloud and a lot of typing saved. The second tab on this module is **Text to Speech,** which offers three different voices to read aloud to the user. There is Sam, Michael, and Michelle. I think Michelle is the best of the three.

Sound and Audio Devices Module offers many settings for adding sound to functions. Various sounds may be chosen to alert the user: a sound asterisk, battery alarm, critical stop, default beep, new mail notification, show toolbar, and talking, among others. **Speaker volume and balance are adjusted with this module. This is important for the speech-to-text option for dictation.** There is a separate microphone and recording control and a separate control for music playback. On the **Audio** tab, an entire series of controls for different desktop speakers is available.

The **Display module** allows many different varieties of computer screen backdrops, including a beautiful set of tropical fish and various textures and colors that may be easier on the eyes than the default. On this setting you are also able to choose one of your own photographs for the screen. The screensaver tab allows many settings, including your own picture show. On the **Appearance** module, the option of changing the contrast and font size is also available. A screen allows trying out the various combinations before committing yourself to changing the scheme. Advanced appearance allows icon spacing and many other visual effects. **A word of wisdom about the controls here!** I changed just about every setting there is to change on this computer, and finally ran into one I could not change back to its original setting, and that is. DISABLE THE TOUCH PAD. Once you click on disabling that, it's gone and there is no way to change settings. I attached my trackball mouse and was able to fix the problem.

Mouse module offers change of right and left side clicks, many styles of pointers, many colors, and even some animated pointers and hourglasses. There is a really cute dinosaur that a child (or a paleontologist) might like.

BASIC LIBRARY LAYOUT

The most important considerations as far as the layout of assistive technology in a library is concerned are also the simplest. There must be easy physical access in the form of ramps as legally required. There must be privacy where a person's computer screen especially with large letters may not be visible by everyone else walking by. Those people with reduced hearing need headphones for privacy and not disturb those around them. A separate room with a closable door should be provided for noisy Braille printers.

Desks as well as chairs should be adjustable. There must be adequate signage for the room.

Classes in assistive technology should be offered regularly by library personnel, especially in the use of the Accessibility Options in Window XP.

The above technology is available and being used in libraries now, and at reasonable prices. However, the futurist Ray Kurzweil, inventor of some of this technology, foresees this as only a stopgap while more marvelous bio- and nanotechnology is in the process of being developed. These assistive devices now in use will no longer be needed in the future. Cochlear implants for the deaf are already in use; eye implants already enable the blind to see shapes. According to Kurzweil and Vernor Vinge we are approaching the technological singularity where technological progress, now in its exponential phase, becomes totally unpredictable. There are many new advances in technology being made every day. According to Kurzweil, the speed of computing has doubled in terms of cost every three years from 1903 to the 1950,s, doubled every two years till the 1990s and is now doubling every year. (Kurzweil reference here).

Many speculate that this is the last generation of totally human beings, that the next generation will be part machine, with ever increasing mechanical components, and with consciousness interacting directly with machines. New software called Dasher allows people with disabilities to write nearly twice as fast and more accurately by allowing a choice of letters from a screen and then offering the statistical probability of the next letter used.

A neurosurgical implant In the form of a video camera has allowed a blind person to see shapes by stimulating the visual cortex in the brain. NASA is experimenting with artificial rods and cones and artificial retinas.

Japanese scientists have grown artificial eyeballs in tadpoles using embryonic cells. A silicon device has been implanted into a human to relay neural messages via radio transmission, paving the way for use in paralyzed limbs and spinal cord injuries. At the Wayne State Eye institute, experiments are underway using drugs to manipulate light on a cellular level, possibly allowing blind people to see chemically. An eyesight substitute using sound has also been invented enabling people to interpret pitch for changing light levels. These technological marvels are not just wishful thinking, they are already in the developmental stages toward practical applications for assistive and adaptive devices. The futurists' dream has become a reality, with untold marvels an ever-present reality.

RESOURCES

AAES. Association of Access Engineering Specialists. A professional organization dedicated to improving access for people with disabilities by providing improved telecommunications and computing products. They work with the disabled community and the industry that works with accessibility issues.

www.narte.org/aaes.html is the National Association of Radio and Telecommunications Engineers. AAES is a subgroup under Nartes.
RESNA www.resna.org Rehabilitation Engineering and Assistive Technology Society of North America.

ABLEDATA (National Institute on Disability and Rehabilitation Research, US Department of Education) www.abledata.com. ABLEDATA does not sell any products but can guide and assist in finding technology for the disabled. Companies may be found by state, and conferences are listed.

Alliance for Technology Access www.ataccess.org Includes information on assistive technology, a list of vendors and accessible website design. This is a group of community based assistance for people with disabilities.   It offers technology resources, outreach, training, and technical assistance for children and adults with disabilities.

American Library Association, HP Library Technology Access Initiative.
www.hp.com/hpinfo/aboutph/accessibility/partnerships/ala/index.html

www.ada.gov , ADA Home Page (US Department of Justice).   This reference discusses design standards, publications, technical assistance, new regulations federal resources, education and peripherals like housing and health care.

Ai Squared www.aisquared.com Manufacturer of ZoomText and other assistive technologies.

I would list Barbara T. Mates as a definite resource. I have read her required reading text and several other books and papers by her. Her books contain further lists of resources, many of them available on line in electronic format. Her book, Library Technology for Visually and Physically Impaired Patrons is available from Amazon, second-hand, for around $15.00.

http://www.atnet.org/news/2006/atjv121-0506.htm Journal for Assistive Technology

The Alliance for Technology Access. ATA.   Community based information for http://wwwaugmentative.com/
Adults and children with disabilities. Includes vendors, developers of assistive Technology and support. http://www.ataccess.org/. Accessed July 12, 2006.

Several more sources for Equipment and Information

Key Foundation http://www.key.org.pl

http://en.wikipedia.org/wiki/Daisyplayer

www.**freedomscientific**.com

www.**kurzweil**edu.com/products_k**1000**.asp

www.freedomscientific.com/fs_products/software_**jaws**
http://booboo.webct.com/otln/webct_accessibility.htm

www.ipsoft.co.uk/site/accessibility.php

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