

ASSISTIVE TECHNOLOGY FOR WRITTEN COMMUNICATION

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Reports, spelling lists, journals, and exams are daily activities in the life of a typical student. Yet for the patient with A-T, these simple tasks are much more difficult. Problems with legibility, time restrictions, and fatigue are common and adversely affect the ability of these students to participate in class and to demonstrate what they have learned. Adapted pencils and slant boards do not typically ease fatigue or improve the speed and legibility of handwriting. Scribes, although a favorite among students, may hinder the student from learning spelling, punctuation, capitalization, and organization of thoughts. To provide greater independence and continued educational growth, an adapted computer is often the most effective assistive technology tool for the A-T patient.

Computers, too, have their limitations. Logistics of multiple classrooms, cost, and time restrictions continue to be a problem. However, the evolution of portable computers, scanners, highly adaptable hardware and software, and the World Wide Web have made computer access easier and an overall benefit for the A-T patient.

The Evaluation Process

The primary focus of the Assistive Technology evaluation is computer access and use. Keyboard access, mouse control, visual ability, and reading needs are explored. The evaluation process begins with an assessment of the patient's home, school or work requirements, as well as current reading and writing skills. Information regarding the benefits and obstacles associated with currently used assistive devices such as altered writing surfaces or adapted computer access is gathered. Legibility, fatigue, and speed of writing are evaluated (very young children may be observed while drawing a picture). Next, the patient is provided with a standard computer and monitor. Visual ability is informally assessed to establish a comfortable font size for reading text. Typing trials are performed while manipulating hardware and software to find those combinations that optimize speed, accuracy, comfort, and quality of output. Software to enhance reading skills is then also reviewed.

To provide greater independence and continued educational growth, an adapted computer is often the most effective assistive technology tool for the A-T patient.

Although general guidelines for hardware and software can be made, specific recommendations are dependent on age, skill level, requirements for written communication, and experience.

General Findings

The typical patient with A-T has difficulty with eye movements, fine motor coordination of the hands, and trunk control. Together, these deficits create difficulty for completing reading and writing tasks. Visual tracking is also often a factor adversely affecting reading ability. Many patients function below grade and age expectations in the area of written communication in part because of poor legibility and slow writing and typing speeds. Sometimes patients are reluctant even to attempt a writing task because of the required effort and modest results. Many patients with A-T have been encouraged to type as an alternative to handwriting. However, unless adaptations have been made to the standard computer and keyboard, the results are often discouraging. The use of an aide to act as a scribe, although efficient, encourages dependence upon others. Fortunately, it has been found that computer access may be quite beneficial when appropriate accommodations are made.

Recommendations

Although general guidelines for hardware and software can be made, specific recommendations are dependent on age, skill level, requirements for written communication and experience. A skills assessment by a specialist, and trials of hardware and software are highly recommended before purchases are made. (Be sure to specify whether purchases will be used with a Macintosh or Windows platform computer.)

Seating and Positioning For Computer Activities

Stability in a chair is a prerequisite to success with a computer. The student's feet need to be flat on the floor, the pelvis and trunk touching and supported by the back of the seat, and elbows and forearms resting on the desktop without extending outward or leaning forward. Elbows should rest at a 90-degree angle with wrists flat. A U-shaped cutout table is an excellent way to facilitate this appropriate position of the upper extremities. "Rifton" tables and chairs are recommended (1-800-777-4244), but other chairs with side-arms can also be used. Individuals with excessive involuntary movements may benefit from an adapted seating system with a seat belt to help hold the pelvis, trunk and head stable. The top of the monitor should be at the height of the forehead and should be approximately two feet away from the eyes.

Computer Keyboard Adaptations

Simple adaptations can be made within the computer's control panel to facilitate use of a standard keyboard. Unintended duplications of the same letter can be decreased by adjusting the "Key Repetition Control." If the patient types with one hand and it is difficult to hold down two keys simultaneously, the "Sticky Keys" function may be helpful. Using this feature allows the user to access commands such as capital letters and keyboard short-cuts by pressing

one key at a time instead of two simultaneously. For example, when trying to type a capital letter, the user types [Shift] then the target letter, one after the other. The target letter will appear in uppercase and the next letter typed will automatically appear in lowercase. This is more efficient than using the [Caps Lock] key because it eliminates the need for an additional keystroke to turn [Caps Lock] “off”.

Table 1: Adaptations for Standard Keyboards

FEATURE	MACINTOSH	WINDOWS PLATFORM
Key Repetition Control (Ignores brief or repeated keystrokes; slows repeat rate)	The keyboard Control Panel can be manipulated to eliminate keystroke errors due to trembling. Open the Keyboard Control Panel; go to “Keyboard”; turn “Key Repetition” off	These features are included in Windows 95 & 98 software and turned on in the Control Panel. Open “Accessibility Options”; “Keyboard”; turn on “Filter Keys”; and press “Apply”
Sticky Keys (Single Key Typing – use Shift, Ctrl or Alt key by pressing one key at a time)	Most Macintosh computers come with “Easy Access” in the Control Panel. Single Key typing can be turned on by opening “Easy Access” and then turning on “Sticky Keys”	These features are included in Windows software. Go to the Control Panel. Open “Accessibility Options”; go to “Keyboard”; turn on “Sticky Keys”; press “Apply”

Most patients with A-T will eventually benefit from an enlarged keyboard, providing improved stability, control and thus accuracy. The most useful enlarged keyboards have adjustable sensitivity to touch, mouse control options, multiple keyboard configurations, optional keyguards, and comfort in design. The *Discover:Board*, for example, fits nicely over a laptop computer keyboard if a portable system is necessary. Keyboard layout (ABC vs. QWERTY) generally depends on user preference, literacy level, and past experience. Children who are just learning the alphabet may prefer the ABC layout, while students with past computer experience may prefer the standard QWERTY design. Keyguards for these specialized keyboards are available.

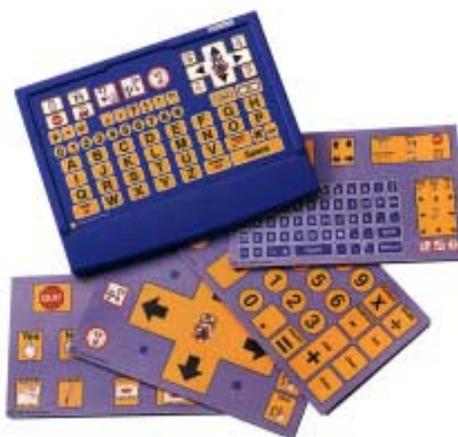


Fig. 15.1: The Discover Board

A keyguard is another useful keyboard adaptation. A keyguard is generally made of metal or sturdy plastic and is cut to allow access to the keys. Its purpose is to help minimize typing errors due to extraneous hand movements. It also allows the user to comfortably rest the hands on the keyboard without triggering unwanted keystrokes. Although keyguards on specialized keyboards are often helpful, a keyguard on a standard computer keyboard is usually not recommended as it may hamper both access and ability to see the keys.

The most useful enlarged keyboards have adjustable sensitivity to touch, mouse control options, multiple keyboard configurations, optional keyguards, and comfort in design.

Table 2: Enlarged Keyboards and Keyguards

FEATURE	MACINTOSH	WINDOWS PLATFORM
<p>Enlarged Keyboard with Keyguard *Keyguards need to be ordered separated from each company</p>	<p>1) <i>Discover: Board</i> – enlarged keyboard that speaks all keystrokes. comes with multiple overlays for variety typing needs and levels; includes software for customized settings. Don Johnston Inc. 800-999-4660 www.donjohnston.com</p> <p>2) <i>Intellikeys</i> – Enlarged keyboard with multiple overlays for variety of typing needs and levels; includes setup overlay for customized settings IntelliTools 800-899-6687 www.intellitools.com</p>	<p>1) <i>Discover: Board</i> – Same as Macintosh</p> <p>2) <i>Intellikeys</i> – Same as Macintosh</p>
<p>Keyboard Layout</p>	<p>1) Standard QWERTY keyboard layout</p> <p>2) An alphabetically ordered keyboard is available for most enlarged or specialized keyboards, or on a standard keyboard via keyboard “stickers” – available from Don Johnston, Inc. 800-999-4660 www.donjohnston.com</p>	<p>Same as Macintosh</p>

The enlarged keyboard has proven to be the most effective form of keyboard access.

Prices for recommended enlarged keyboards range from \$400 to \$500, and keyguards generally add an additional \$100. Special package rates may be available.

Some families and therapists have inquired about other forms of keyboard access, but none have proven to be as effective as the enlarged keyboard. An on-screen keyboard displayed on the computer monitor and accessed via a joystick is generally slower. A touch screen is not recommended for patients with A-T due to the requirement for eye-hand coordination and the demands of reaching against gravity. Voice recognition software is also not recommended because of the dysarthria of many patients with A-T.



Fig. 15.2: Intellikeys

Computer Mouse Control Options

Patients with A-T often complain about difficulty controlling a standard mouse, especially double clicking required for opening files and using the “drag” function. Alternative control devices that provide one-touch access for double-click, locking-drag features, and are adjustable for speed of the cursor movement are often recommended instead.



Fig. 15.3: Track Ball



Fig. 15.4: Joystick

We have found that many patients with A-T are most successful using the arrow keys on the *Discover:Board* or a joystick because of their stable base and easily adjustable controls.

Table 3: Computer Mouse Control Options

FEATURE	MACINTOSH	WINDOWS PLATFORM
Joystick	<p>1) <i>Joystick Plus</i>: Allows for easy cursor speed adjustments as well as double click and latching drag feature. Has interchangeable handles. No additional software required. By Penny + Giles (01202) 481751; Available at Don Johnston, Inc (800-999-4660) www.donjohnston.com</p> <p>2) <i>SAM-Joystick</i> – adjustable speed with drag-lock and double click buttons. Requires additional software (included); By RJ Cooper (1-800-RJCooper) www.rjcooper.com</p>	<p>1) <i>Joystick Plus</i> – Same as Macintosh</p> <p>2) <i>SAM-Joystick</i> – Same as Macintosh</p>
Arrow Keys	<p>1) Arrow keys on an enlarged keyboard to control the mouse. The <i>Discover:Board</i> has partial hands-free arrow keys (press once and let go – don't have to hold down)</p> <p>2) The numeric keypad on a standard keyboard can be used; need to hold-down the keys to operate movement; To convert to Arrow Keys go to the Control Panel, open “Easy Access”, “Mouse Keys”, “On”</p>	<p>1) Arrow keys – Same as Macintosh</p> <p>2) The numeric keypad on a standard keyboard can be used to control the mouse; Need to hold-down the keys to operate; To activate this feature go to the “Control Panel”, “Accessibility Options”, “Mouse”, click on “Use Mouse Keys”, “Apply”; Adjust speed of pointer in “Settings” menu.</p>

(Table 3 continues on next page.)

Table 3: Computer Mouse Control Options (Continued)

Keyboard Shortcuts may be used in place of a mouse when mouse control is particularly difficult.

FEATURE	MACINTOSH	WINDOWS PLATFORM
<p>Standard Mouse with extra buttons</p>	<p>1) <i>Kensington Mouse Works</i> Use the extra buttons as a lock for drag functions and double click – Available at many computer stores or at www.kensington.com</p> <p>2) <i>Kensington ValuMouse</i> -- Not available</p>	<p>1) <i>Kensington Mouse</i> – Same as Macintosh</p> <p>2) <i>Kensington ValuMouse 3 Button</i>. Use the extra buttons as a lock for drag functions and double click - Available at many computer stores, or at www.kensington.com</p>
<p>Trackball</p>	<p>1) <i>Kensington Turbo Mouse</i> This trackball comes with software which provides latching drag and double click switches, as well as adjustable speeds. Additional software required (included). Available through Kensington, Inc. (650) 572-2700 www.kensington.com</p> <p>2) <i>Roller Plus</i> – large ball with double click, latching drag, and variable cursor speed. No additional software required. By Penny + Giles (01202) 481751; Available at Don Johnston, Inc. (800-999-4660) www.donjohnston.com</p>	<p>1) <i>Kensington Expert Mouse Track Ball</i> (PC version of the same trackball). Available at most computer stores, or at PC Connection (1-800-800-1111) www.kensington.com</p> <p>2) <i>Roller Plus</i> – Same as Macintosh</p>
<p>Keyboard Shortcuts may be used in place of a mouse when mouse control is particularly difficult. Use of the "Sticky Keys" feature, noted in the section above, is helpful when using keyboard shortcuts. "Sticky Keys" eliminates the need to hold down two keys simultaneously.</p>	<p><i>Spell Check</i> [Command L] <i>Close Window</i> [Command W] <i>Open File</i> [Command O] <i>New File</i> [Command N] <i>Save</i> [Command S] <i>Print</i> [Command P] <i>Copy</i> [Command C] <i>Cut</i> [Command X] <i>Paste</i> [Command V] <i>Bold</i> [Command B] <i>Italicize</i> [Command I] <i>Underline</i> [Command U] <i>Select All</i> [Command A] <i>Reduce Font</i> [Command Shift <] <i>Enlarge Font</i> [Command Shift >] <i>Undo</i> [Command Z] <i>Escape</i> [Command .] <i>Quit</i> [Command Q]</p>	<p>[F7] [Ctrl F4] [Ctrl O] [Ctrl N] [Ctrl S] [Ctrl P] [Ctrl C] [Ctrl X] [Ctrl V] [Ctrl B] [Ctrl I] [Ctrl U] [Ctrl A] [Ctrl Shift <] [Ctrl Shift >] [Ctrl Z] [Esc] [Alt F4]</p>

We have found that many patients with A-T are most successful using the arrow keys on the *Discover:Board* or a joystick because of their stable base and easily adjustable controls. If a patient is successfully using a different device, there is no reason to change. However, these devices should be considered for first-time computer users, or if difficulties arise with an alternative device. Personal preference and past experiences play an important role in final recommendations. Prices for alternative mouse control devices range from \$30 to \$500.

Computer Visual Adaptations

Visual abilities are often overlooked during computer and writing assessments; however, due to tracking problems, this is an important feature to assess. The A-T patient generally needs to have all written text enlarged, including text on the computer screen. This can be done quickly and easily by enlarging the font size on the computer either from the tool bar or by going to “Format” and “Font” when using Windows. Before printing, the font can be changed to a standard size by going to “Edit” then “Select All” and changing the font size. The degree of enlargement is determined on a case-by-case basis. Screen enlarging software, which enlarges the entire viewing area, is not recommended because of the difficulty it creates in tracking the text that has now been moved out of the viewing area. Enlarging the font size does not create the same problem.

Enlarging the mouse cursor is also helpful for tracking the location of the mouse on the screen.

Table 4: Computer Visual Adaptations

FEATURE	MACINTOSH	WINDOWS PLATFORM
Standard Monitor	A clear color display with good clarity and contrast is required. Standard monitor (15 - 17 inches) or laptop computer with active matrix color monitor	Same as Macintosh
Enlarged Fonts	Specific size determined by testing	Same as Macintosh
Enlarged Mouse Cursor	1) <i>Biggy</i> : software to visually enlarge the mouse cursor. Available from R.J. Cooper & Associates 1-800-RJCooper www.rjcooper.com	1) <i>Biggy</i> – Same as Macintosh 2) <i>Gus! Big Cursor</i> : Visually enlarges the mouse cursor. Available from Gus! Communications www.gusinc.com (360-715-8580) 3) Windows 95 & 98 have a mouse cursor enlargement feature that enlarges the cursor to some degree. Available in the Control Panel under “Mouse”; + “Pointers”; “Scheme” 4) Free cursor alternatives on The Web; try www.softseek.com/DesktopEnhancements/Cursors/ or www.tomscursor-page.de

Enlarging the mouse cursor is also helpful for tracking the location of the mouse on the screen. Enlarged cursors are available on most computers via the “Control Panel,” through additional software, or downloaded for free from certain websites. Prices of cursor enlarging software generally start at \$100.

Writing Technology

Auditory feedback software can be set to “speak” letters, words, or whole sentences. This can increase the typing speed of most A-T patients by eliminating the need for the novice typist to look continuously from the keyboard to the monitor in order to check what had been typed. A talking “spell check” feature is also available. The enlarged keyboard, *Discover:Board*, provides auditory feedback for keystrokes (letters, mouse and cursor movements, and commands are “spoken”). It cannot speak whole words or sentences, and does not provide a spell check. Programs such as *IntelliTalk* and *Write:Outloud* are talking word processing programs, while *Read & Write* is talking software that can be used within any software application (including the Internet).



Fig. 15.5: Auditory feedback

Word prediction has been found to be beneficial for the more proficient typist because it requires the user to watch the monitor while words are “predicted” on the screen in list format. The typist may then choose a word from the predicted list by either using a pointing device (joystick) or by typing the corresponding number key. Although word prediction is intended to reduce keystrokes, this tool has not been found consistently helpful in A-T patients. It requires that the users constantly shift their gaze from keyboard to monitor, and good visual tracking is necessary to quickly read the ever-changing word list. Prices for specialized software range from \$100 to over \$1,000.

For more information regarding general software for academics or leisure activities, Educational Resources (800-624-2926 or www.edresources.com), Fastrack (800-927-3936 or www.fastrack.com), and Edmark (800-362-2890 or www.edmark.com) are good sources. Final selection of software should always be based on the user’s skill level and writing needs.

Table 5: Writing Technology

FEATURE	MACINTOSH	WINDOWS PLATFORM
Auditory Feedback of Keystrokes and Written Work	<p>1) <i>Write:OutLoud</i> – talking word processor (hear letters, words, or sentences while you type) with talking spell check and homonym features: Able to “read” scanned documents; by Don Johnston, Inc. (800-999-4660) www.donjohnston.com</p> <p>2) <i>IntelliTalk</i> – talking word processor (hear letters, words, or sentences while typing); with spell check; IntelliTools (1-800-899-6687) www.intellitools.com</p> <p>3) <i>Read & Write</i> – simplified version available for MAC (See Right); by textHELP www.texthelp.com</p> <p>4) If the <i>Discover:Board</i> is used, auditory feedback for keystrokes is a component of the keyboard</p>	<p>1) <i>Write:OutLoud</i> - Same as Macintosh</p> <p>2) <i>IntelliTalk</i> – Same as Macintosh</p> <p>3) <i>Read & Write</i> for PC – use with any word processor; talking spell check, homonym support, thesaurus, word prediction, instant speech feedback, screen reading (including menus, e-mail and internet) TextHelp www.texthelp.com</p> <p>4) <i>Discover:Board</i> - Same as Macintosh</p>
Word Prediction	<p>1) <i>Co:Writer</i> – Talking word prediction software intended to save Keystrokes; Don Johnston 800-999-4660 www.donjohnston.com</p> <p>2) <i>Read & Write</i> – multifunction software containing talking word prediction - textHELP www.texthelp.com</p>	<p>1) <i>Co:Writer</i> – Same as Macintosh</p> <p>2) <i>Read & Write</i> – Same as Macintosh</p>

The user can generally control the size, color, and speed of the text being read with screen reading software.

Reading Technology

Many patients with A-T have difficulty reading written text. Technology available to improve independent “reading” includes *Books on Tape*, available through Recording for the Blind (800-221-4792). More recently, computer software has been developed to “read” targeted text and screen menus. “Screen Reading Software” is generally designed for individuals who are blind or have very low vision. “Optical Character Recognition” (OCR) software is designed for individuals with reading difficulty due to low vision and/or a learning disability. Requirements generally include a Pentium class computer, sound card and supported scanner. To use an OCR, simply place the printed text (i.e. book, magazine, worksheet) on the scanner. The scanner takes a “picture” of the page. The software translates that picture back to words, then reads

Table 6: Reading Technology

FEATURE	MACINTOSH	WINDOWS PLATFORM
Optical Character Recognition (OCR) software	<p>1) <i>Kurzweil 3000</i> - Not available for MAC</p> <p>2) <i>WYNN</i> - Not available for MAC</p> <p>3) <i>Open Book</i> - Not available for MAC</p> <p>4) <i>Read & Write</i> - simplified version available for MAC - See Windows Platform</p>	<p>1) <i>Kurzweil 3000</i> - PC based reading system; Provides auditory and visual presentation of scanned text and images; Able to read Internet documents; Designed for student and adult users -- Available from Lernout & Hauspie (L&H) Speech Products www.LHSL.com/education</p> <p>2) <i>WYNN</i> - provides both auditory and visual presentation; Scanned pages retain original page layout; Simple to maneuver; Designed especially for students with learning disabilities; Requires additional software "Home Page Reader" to read the Internet via <i>Netscape</i>; available at Arkenstone (800-444-4443) www.arkenstone.org</p> <p>3) <i>Open Book</i> - geared toward individuals who are blind or have low vision; allows for customized screen display; from Arkenstone www.arkenstone.org</p> <p>4) <i>Read & Write</i> - use in conjunction with any word processor; also for spread sheets, desktop publishing, databases, e-mail and Internet; color highlighting of words and sentences; button to pause/ resume speech - from textHELP www.texthelp.com</p>
Screen Reading Software	<p>1) <i>OutSPOKEN</i> for Macintosh: This program reads highlighted text, and provides auditory information about on-screen graphics, tool bars, and other on-screen text. Available from ALVA Access Group (510) 923-6280 www.aagi.com</p>	<p>1) <i>OutSPOKEN</i> - Same as Macintosh</p>

those words aloud. The user can generally control the size, color, and speed of the text being read. Some programs provide more features than others, although these added features generally increase the final cost of the product. For instance, reading text in email and on the internet is a new feature of many of these systems and is reflected in the price. Prices for OCR software generally start at \$1,000. Demonstration disks are available from most manufacturers free of charge. Final selection of software should be made on a case-by-case

basis, assessing the severity and type of reading disability as well as reading requirements (what will the software primarily be used for – academics, leisure, internet access, etc.).

Final Note

No matter what combination of computer hardware and software an individual is using, several important factors are important to keep in mind. First of all, the student and staff working with the student need to be familiar with the software and equipment so that valuable class time is not wasted reading manuals and setting up the equipment. Second, compatibility with computers in other classrooms and at home may need to be considered if work will need to be finished in a different setting. Last, an easily accessible printer is important to maintain an efficient work environment. This also gives the student the opportunity to present a final product that reinforces a sense of pride in what has been accomplished.

In addition to computer access, the patient with A-T will likely require other accommodations as well. These may include a reduction in workload, increased time to complete tasks, and a scribe to assist with lengthy writing tasks. In the latter situation, it is often recommended that the scribe use the computer when taking dictation, so that the student can then independently edit and reorganize the document.

Additional Resources

For more information, Closing the Gap is a quarterly newspaper that addresses educational and vocational computer technology issues for individuals with disabilities. Each issue has reviews of new software programs and articles on new hardware technology. An annual “Resource Directory” of hundreds of hardware and software products is included with a subscription. The organization also holds an annual conference with hundreds of vendor demonstrations and informative lectures by professionals working in the field of Assistive Technology. Contact CTG at P.O. Box 68, Henderson MN 56044 or www.closingthegap.com.