

Augmentative Communication News

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For Consumers



Repetitive strain injury and AAC

Repetitive strain injury (RSI)² means damage sustained by muscles, tendons, ligaments, blood vessels, nerves, and other soft tissues as a result of activities that involve prolonged and persistent movements. Activities known to cause RSI include lifting, carrying, typing at a computer keyboard, operating a mouse or a trackball, using certain tools, working on an assembly line, practicing a musical instrument, and playing some sports. RSI develops after months or years of repetitive, stressful, or awkward movements that gradually wear down the musculoskeletal system. Carpal tunnel syndrome is the most widely publicized RSI, but is far more rare than tendon-related disorders. Because of its slow onset, RSI may go unnoticed for years. Unfortunately, the road to recovery is a long one; and damage can be permanent.³

RSI develops after months or years of repetitive, stressful, or awkward movements that gradually wear down the musculoskeletal system.

RSI and computer users

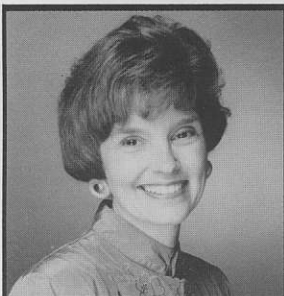
Despite growing public awareness, misunderstandings about the causes, magnitude, and severity of RSI persist.³ Recent studies suggest that between 1987 and 1993, worksite repetitive motion injuries increased almost (*cont. on pg. 2*)

UPFRONT

There are risks associated with using computer technology. Repeatedly hitting a switch or keyboard, year after year, is bound to have an effect on a person's body. If we fail to consider and manage the risks involved, many people with severe speaking and writing impairments, through no fault of their own, could be injured by the very devices and access technologies intended to help them. For a person who is unable to speak, gaining access to communication is essential. Computers with voice output and communication software enable

individuals to make requests, converse, ask questions, write, read, talk on the phone, use e-mail, tell a joke, and so on. For many, access to technology underlies access not only to communication, but also to independent living, civil rights, employment, and education. These individuals, who must use augmentative communication (AAC) devices, computers, and other assistive technologies, are at high risk for developing repetitive strain injuries.¹

Decades of research and experience have not solved all access problems for persons who could benefit from AAC. However, (*cont. on page 2*)



UPFRONT (cont. from page 1)

developers and manufacturers have made enormous technological advances, and persons with disabilities clearly are benefitting. Today, sophisticated computer applications are controlled by the blink of an eye. The purpose of this issue is to highlight risks associated with computers and AAC devices, and to advocate for prevention approaches that will protect AAC users throughout their lives. **For Consumers**

introduces information about repetitive strain injuries (RSIs), a widely acknowledged risk for long-time computer users. **Clinical News** focuses on the role positioning plays in "controllability" and on the selection of access technologies. The **Equipment** section highlights on-screen keyboards, a relatively new access option. **Governmental** discusses the current reluctance to regulate workplace accommodations related to RSI. Finally, the **University/Research** section reports ongoing work in the area of access at the University of Toronto. Thanks to Peggy Barker who collaborated with me in preparing this issue, and to Alan Cantor and the others interviewed for their insightful comments. (See **References and Resources**, page 8.)

- **Alliance '95's**, *Outcomes in AAC Conference Report* will be distributed in July to all who attended **Alliance 95**. Others may order by filling out and returning the enclosed flyer, faxing this number (408) 646-5428, or calling the ACN Hotline number (408) 649-3050.
- Mark your calendars. **Alliance '96** is scheduled from Friday evening, February 16, 1996 to Monday noon, February 19, 1996.
- Only 5 people said they were interested in ordering audiotapes to accompany each issue of **ACN**. I'm sorry, but we can't offer tapes unless the demand increases.

Sarah W. Blackstone, Ph.D., Author

For Consumers (cont. from page 1)

400 percent both in raw numbers, and as a percentage of total industrial illnesses. A reason in the U.S. is that of the 40 million people who use computers, many do so longer than three hours a day—a danger-zone limit.⁴ Symptoms directly associated with using a keyboard and mouse are typically located in the fingers, hands, wrists, forearms, elbows, upper arms, shoulders, neck, or back. They include aching, throbbing, tightness, coldness or burning, numbness or hypersensitivity, weakness, shooting pains, tingling, stinging, and night pains. Most individuals with RSI report a combination of these symptoms.

Persons with disabilities

For persons who rely on computers, the temptation to spend long hours at the keyboard is understandable. Working this way over months or years, however, creates the conditions for overuse injuries to occur. For AAC users who rely primarily on technology to interact with their families and community, the effects of chronic RSI can be devastating. How ironic that using a computer as an empowering AAC tool might also precipitate the development of a secondary disability that could render the tool useless. To date, little information is available about the prevalence of RSI in people with disabilities. No re-

search specifically addresses the risks involved for individuals with severe physical and communication impairments who use devices and computers. Our current lack of attention to the physiological risks involved in using AC devices/computers to communicate is naive, if not irresponsible.

Risk factors

Cantor,^{1,3} postulates that the risk factors for persons with disabilities are particularly high. Individuals who rely heavily on assistive devices often present complicated human-machine interaction challenges. Known risk factors thought to lead to RSIs are summarized in Table I on page 3 and are discussed below.³⁻⁷

Workstations: A computer workstation setup takes into account the position of equipment in relation to the worker, the nature of the tasks and materials, the environment (noise, light, dust, glare, chairs, tables), and the work-style preferences and abilities of the person. Adaptive seating and access techniques often are critical to all other work station components. Unfortunately, agencies that purchase computers (laptops, desktops, and communication devices) on behalf of persons with communication disabilities rarely address the risks associated with this equipment. Funding needs to be available to insure effective and safe use of the equipment. In some cases, workstation design accommodations may require as much attention as selecting, recommending, and configuring software and hardware.

Computer Work Habits: Few computer users are sufficiently aware of their posture or how much time they spend at a computer without taking a break. An "ergonomic" workstation does not, in itself, inoculate

TABLE I. Factors leading to RSI in persons who use computer-based devices
(adapted from Alan Cantor³)

Risk Factors		Preventing RSI
Workstation setups	Device/ computer workstations may consist of a desk, computer table or device mount, and a chair, plus the equipment the person needs—keyboard, monitor, CPU, printer, telephone, filing cabinets, storage shelves, and so on. In addition, environmental factors—lighting, temperature, air quality and noise—affect comfort and safety.	A properly configured computer workstation promotes good sitting posture and allows the user to work in greater comfort for longer periods. The workstation should adapt to the requirements of the human body, not vice versa.
Work habits	Rarely are people aware of their work habits. Thus, it is necessary to observe each person's work habits in real situations over time. When workstation components are inappropriately chosen or incorrectly positioned, the body learns to feel most comfortable in a biomechanically hazardous working posture.	Taking regular breaks from the keyboard gives the body time to recuperate from the biomechanical strains of computer work. Computer users should get up from their workstation (or change positions) ten minutes each hour, stand up or change positions, and stretch two or three times every hour, and pause to rest the hands and arms for five seconds every few minutes.
Posture	Poor posture is a primary risk factor in RSI. Bones out of alignment cause muscles to strain to hold the body in position, and may cause or exacerbate nerve compression or entrapment in the neck or upper body.	Fidgeting, changing positions, and moving around reduces postural fatigue. Multiple access sites should be sought to accommodate multiple positions. If a person is unable to change positions independently, this should be done for them.
Repetitive motion	Repetitive motions may cause microscopic tears in muscles, tendons and ligaments. This leads to inflammation. Debris from inflammation forms scar tissue that binds muscles and tendons. Irritated tissue contracts, decreasing range of motion.	Regular rest periods are critical. Also, using multiple access sites, or the same site in multiple ways, can decrease the stress on individual body parts.
Fitness	A fit body is less likely to develop RSI. Operating a computer is a physically demanding task. Typing gives the arms and hands a strenuous workout; and the muscular effort required to sit, even in a good posture, eventually tires the body.	Stretching keeps muscles and tendons supple. Regular, vigorous exercise improves blood circulation. Good circulation allows soft tissue to more readily absorb nutrients from the blood, and blood can more easily flush away metabolic wastes.
Increased stress	Stress is considered a primary cause of RSI, although the relationship between RSI and stress is not yet well defined.	Increasing awareness of risk factors and following prevention guidelines should minimize the effects of stress on work habits.
Exacerbating activities	Using the same body part (e.g., head, hand) in similar ways for multiple activities increases the risk of RSI.	Activities should be varied and multiple body parts used as control sites, so risks are minimized.

against RSIs. To improve AAC users' work habits, it will probably be necessary to modify their workstations and train them to use proper input (e.g., keyboard and mouse) techniques. Working "smart" and taking regular breaks underlie safe work habits.

Posture: Good posture is the ability to maintain proper alignment of the bones and length of the muscles. A person's genetic heritage and functional limitations affect posture because they impact on range of motion, flexibility, strength, balance, muscle bulk, and sensitivity to pain. Postural habits also are influenced by an individual's workstation setup. For example:

- Standard computer keyboards impair good posture. The design virtually forces cramped fingers, ulnar deviated wrists, pronated forearms, winged elbows and stooped shoulders.

- An adjustable chair may encourage better posture. However, if the person slouches, never adjusts the chair, or rarely takes breaks from typing, the chair contributes little or nothing to safety.
- A monitor that is too small or too far away from the eyes may cause craning of the neck.

For computer users, the muscles of the shoulders, neck, and arms are particularly susceptible to biomechanical stresses due to poor posture.

Humans are meant to be constantly changing positions; thus *static postures can be very debilitating*. This is of great concern to AAC users who may require static positioning and stable seating to control switches or point to keyboards. Goals are to make certain a person can change positions, as well as use multiple control sites and access methods.

Repetitive motion: People who rely on computers for writing,

reading, and communicating are obviously at risk for RSI. Injuries may develop in the hands, arms, and shoulders (for keyboarders); in the neck, jaw, and shoulders (for head- and mouth-stick users); or in the hip, leg, and foot (for toe-typists). The exaggerated lateral head motions used by some persons who scan or have low-vision can lead to neck problems. Unless people rest and the cycle of injury is interrupted, tissue fails to recover fully, and a long-term, chronic problem results.

Fitness: Persons with disabilities are interested in health and fitness. Unfortunately, their opportunities to participate in fitness programs often are quite limited. Overall flexibility and upper-body strength prepare the body for the rigors of computer work. Also, good circulation is important. When it is impaired, metabolic by-products (cont. on page 4)

For Consumers (cont. from pg. 3)

accumulate, and muscles and tendons function less efficiently.

Stress: Stress is thought to be a primary risk factor for RSI. Many persons with disabilities live with a great deal of stress. Discrimination, unemployment, lack of decision making power, a limited number of friends, equipment breakdowns, and lack of money heighten anxiety levels.

Exacerbating activities: Other activities involving the hands and body in repetitive motions can contribute to the development of RSI (e.g., signing, pushing one's wheelchair, playing video games, "channel surfing").

Preventing RSIs in Persons who use AAC

Computer overuse injuries are preventable. A proper workstation and healthy work practices mini-

mize the risks of developing RSI. Currently, there is an urgent need to (a) develop RSI prevention programs, (b) re-examine workplace, home, and classroom policies and practices to decrease the chance that overuse injuries occur, and (c) strengthen legislation and policies that protect the health and safety of all persons, including those who rely on adaptive technologies. Cantor³ suggests RSI prevention programs include:

1. Development and dissemination of reliable information about computer-induced overuse injuries in a form that is accessible to people with disabilities. It should include: causes, risk factors, warning signs, and prevention strategies.
2. Ongoing research to identify technical developments that may improve safety for computer users (e.g., modified keyboards; improved office furniture, voice recognition sys-

tems, "hyper-adjustable" wheelchairs, and multiple, easily interchangeable access methods.)

3. Regular training for individuals who use assistive devices to increase awareness and encourage safe working habits. This is especially important for those whose functional abilities limit their choices of devices, computers, and access technologies.
4. Periodic, individual workstation and work habit assessments for persons with disabilities who use repetitive motions to access equipment. Assessments should consider all forms of accommodations in an effort to improve safety and reduce the risks of RSI.
5. Information sessions for teachers, managers, and other professionals and support personnel to heighten awareness about computer overuse injuries, especially as they pertain to individuals with disabilities.
6. Formation of RSI support groups.



Clinical News One's not enough!

How should we select access technology? Why is it essential to consider multiple control sites? How do posture and vision relate to the selection of input devices for computer or AAC device access? Answers to these questions are complex, dynamic and require collaboration among skilled team members.⁸⁻¹² Selecting control sites to operate a computer or an AAC device requires consideration of (1) the effects of posture and vision on controllability, (2) potential controllable body parts in all positions, and (3) which access technologies to use with which body parts, in which positions.¹³

Effects of posture and vision on controllability

The degree of control individuals have over their bodies is profoundly influenced by their posture.¹⁴ In fact, proper positioning and seating can determine whether a person is, or is not, able to access technology and how (i.e., what kind of input devices can be used). Put another way, a person's posture affects "controllability," defined as the degree to which a person can carry out a purposeful movement.¹⁰

Because regular changes in posture are necessary, seated and lying positions, as well as standing and kneeling positions, should be considered. Herein lies

the challenge, because changes in posture affect both (1) the degree to which a person can control a particular movement, and (2) the amount of uncontrollable movements present. Strategies related to posture that may enhance controllability and limit risks are:¹³

- Providing a resting place or support (i.e., wrist rest, arm support, head rests).
- Realizing that small movements are usually easier to control than large movements.
- Being aware that there is more controllability in the middle of a person's range than on the fringes of that range.
- Enhancing sensory feedback using auditory, visual, tactile options.

A second major influence on controllability is vision and visual tracking. Direct selection devices, for example, tend to be visually demanding unless the person can type without looking (and not many AAC users can). Most individuals look at the keyboard to make accurate selections and then look at the screen to check their work. Typically when we think of someone using a computer or an AAC device, we visualize them seated at a desk or in a wheelchair, typing at a keyboard, and gazing at a computer screen. However, people can use computers in other postures. For instance, e-mail can be read to the user so she does not need to look at the screen and can even be lying down. Strategies that accommodate vision, enhance controllability and limit risks are:¹³

Table II. Controllable Body Parts and Access Technologies (by Peggy Barker¹³)

Body Part with good to excellent controllability		Standard keyboard	Large keyboard	Small keyboard	Chordic keyboard	Optical pointer held	Optical pointer secured	Touch window	Direct selection AC device	Switch array	Trackball	Mouse	Speech recognition
RANGE													
Hand & arm	large												
	small												
Head stick	large												
	small												
Head													
Voice													
Leg/foot													

- Minimize how far and often eyes have to travel.
- Reduce visual demands.
- Select font sizes and styles based on the user's ability to read at the actual angles and distances required.
- Consider both physical control and vision when laying out choices/designing the overlay.

Selection of control sites and access technologies

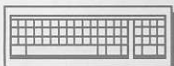
People with "normal" motor systems can and do use a wide range of controllable movements when standing, sitting, or lying down. This variability of controllable movements and postures is important because it helps reduce fatigue and protects against RSI. AAC users often have restrictive repertoires of controllable movements. And, some have to deal with uncontrollable movements in all positions. Thus, for AAC users, it is particularly advisable to identify several body parts as control sites, and to do this for each posture the person is in throughout the day.¹³

After determining the degree (high to minimal) and range (large to small) of controllable movements for each posture and control site, the team can consider different access technologies. The shaded areas in Table II list access technologies that can be used with body parts demonstrating a moderate to high degree of controllability, and a range of control from small to large. For most people the hands and head offer the highest degree and largest range of controllability and can be used with a variety of access technologies. A

person always should consider using more than one access technology to insure that their position and movements regularly change. There are several available options for body parts with varying ranges of controllability including:

- **Trackball.** For those who can stabilize their arm or hand and then use the fingers or thumb to move the ball and press the button.
- **Touch screen.** For those who can directly access the screen. Note: Some screens are not activated by force (as you would think) but by the "capacitance" of a person's body. They will not work with a non-conductive head wand or mouth stick.
- **Optical pointers** (e.g., Headmaster, Headmouse). An option for people with good head control. They can also be held or attached to other body parts.
- **Communication devices.** For those who use devices that can be configured to emulate a mouse (e.g., Liberator with the T-Tam and MIKE).
- **Keyboards** (e.g., IntelliKeys, Key Largo with Ke:nx, WinMini Keyboard, MacMini keyboard, Ke:nx On:Board.) For those who can use a keyboard.
- **Switch arrays.** For those with minimal controllability.

For a person with a low degree of controllability, only tasks that require minimal input might be considered (e.g., environmental control). If an AAC device is needed in a posture in which body parts demonstrate low controllability, then a single switch with scanning can be used.



Equipment

Onscreen Keyboards

Onscreen or virtual keyboards display an image of a keyboard on the computer monitor or screen. Onscreen keyboards provide access to all of the keys and functions of a three-dimensional keyboard, using devices that emulate a mouse (e.g., touch screen, track-

ball, switch array). These devices can then be used with an onscreen keyboard to operate word processors, graphics and drawing programs, data bases, communications applications, spreadsheets, and AAC software. Although onscreen keyboards may look just like a standard keyboard, they are more flexible and easier to configure to meet a user's abilities. We focus here on the features of

onscreen keyboards used with the Windows and Macintosh operating systems, because they take advantage of mouse technologies and the graphical user interface.¹³

Features: Onscreen Keyboards

Features of onscreen keyboards include the appearance of the keyboard, selection feedback, and strategies used to increase rate.¹³ These are briefly discussed on the next page. (cont. on page 6)



Governmental Safety at work and in school

The U.S. Occupational Safety and Health Administration (OSHA) released a draft of regulations on repetitive stress injury in March, 1995. According to *New York Times* and *Wall Street Journal* articles, the OSHA Director, Joseph Dear, acknowledged the draft released is far less stringent than earlier versions.¹⁵ Why? Because businesses and the new majority Republican Congress are opposed to ergonomic regulations. Their political pressure has softened OSHA's stand. Before, employers had to provide information about the dangers of repetitive stress to all employees. The watered down version: (1) exempts businesses with ergonomic programs already in place one year before publication of the final rules, (2) covers 2.6 mil-

lion rather than 6.1 million businesses, and (3) applies to 21 million workers instead of the 96 million covered by the earlier draft. In fact, it is likely that additional modifications will follow. The Clinton administration has stated that a regulation proposal is still many months away from being issued.

In addition to inaction in the workplace, no substantial discussions are taking place in educational settings about the risks of RSI in the U.S. and elsewhere. This is true despite the increased use of computers in our schools and the young age at which children begin to interact with computers and videogames.

Sadly, people with disabilities, particularly those who use AAC and computers to talk, write and communicate on the phone are unlikely to learn about RSI from their employers or school districts. Yet, a warning must be spread as the risks are very real.

Equipment (cont. from pg. 5)

Appearance. It is possible to change overall size, the size of each key, the spacing between keys, the color of the keys, the labels on the keys (text, icons or pictures) and the color of icons/pictures. Additional options may include:

- Saving the arrangement. Size and position of the keyboard can be saved so it doesn't have to be set up every time. Some systems power up with the keyboard ready to go; others do not.
- Resizing the targets. Larger targets can accommodate for vision and improve the accuracy of selection. Smaller targets can provide more work space for the application.
- Collapsing the keyboard. The keyboard can "go away," leaving only the title bar or a small icon on the screen. This makes more room for the application. It can be quickly recalled by clicking on the icon or title bar.
- Multiple, onscreen keyboards. Several keyboards may be active simultaneously, e.g., number pad, standard Qwerty, communication vocabulary (to hold a conversation).

Selection feedback. Visual and auditory information can reinforce the selection process.

- **Visual.** Background color can change when a key is selected, or the "pointer" can leave a trail on the screen.
- **Auditory.** Letters, words, or phrases can be spoken in a variety of voice qualities. Also, predicted words can be read to users who have visual difficulties or lower reading skills.

Acceleration strategies. Most onscreen keyboard programs offer predicted words, abbreviation-expansion/macros, and "sticky key" options. These can provide linguistic support and may increase typing speed and accuracy. Feature options include:

- Prediction lists can be moved to different locations and displayed horizontally or vertically on the screen. This can limit the visual and physical tracking required to make a choice.
- Prediction software can predict words alphabetically, by frequency of use, and their order in a sentence.
- Dictionaries of potentially predicted words can be developed from available text. The sources for text include not only files written with a word processor, but files downloaded from the Internet or a CD-ROM and imported into the dictionary.
- Some dictionaries can be exported to a word processor to be spell-

checked, and then imported back into the user's dictionary.

- Some word prediction programs not only automatically add new words to the prediction list, but will automatically purge old words that are not used. They may also allow the user to identify words that should never be purged.

Packaging. Typically, onscreen keyboards are part of a modular system that includes (1) an onscreen keyboard program, (2) computer application programs, (3) portable or stationary computer, and (4) additional input devices. When an onscreen keyboard is used with AC software, it typically provides access to words/pictograms/phrases, and provides for voice output communication. Several companies that market programs that are modular and provide onscreen keyboard, prediction and AC software, are listed on page 8.¹³

On-Line Resources

SOREHAND. To subscribe, e-mail the following message to listserv@ucsfvn.bitnet: subscribe sorehand Firstname Surname

Internet data archives contain current information about typing injuries. To access, anonymous ftp to: <ftp.csua.berkeley.edu:pub/typing-injury>.

University/Research

The Adaptive Technology Resource Centre

The Adaptive Technology Resource Centre (ATRC), located at the University of Toronto, opened in September, 1994, with goals to:¹⁶

- foster the effective use of AT in education.
- promote the integration of alternative access systems throughout the information technology infrastructure at educational institutions.
- bring together the collective skills and resources of the University to insure information technology is accessible.
- develop and share creative solutions to the challenges faced by users of adaptive technology.

In addition to providing consultation and training, the Centre does ongoing research and development. Current research projects focus on access to writing, creative expression and information as described below:

Writing and graphics

Bridging the gap between scanning and direct selection: Effective computer access through imprecise pointing. This project, directed by Jutta Treviranus, is developing access systems for individuals for whom neither scanning nor direct selection are suitable access alternatives. The objective of the project is to develop access systems that can:

- be effectively controlled through imprecise pointing,
- be mastered by children at a pre-school level,
- accommodate the user throughout a skill development continuum,
- be used to control text and graphics programs as well as the computer desktop (i.e., within a graphical user interface).

Selectable items are grouped onto a set of keys the user can accurately point to or choose

through a set of signals. As the user makes a selection, the keys expand allowing accurate selections within the confines of the person's pointing abilities. Access system software and training software will be disseminated and marketed for both Macintosh and Windows environments.

Participants who cannot manipulate musical instruments, paint brushes or other traditional tools of creative expression exploit alternative computer access systems to create computer mediated art.

Creative expression

Access To Creative Expression through Multimedia and Virtual Reality. This project operates ongoing integrated workshops which explore the use of multimedia and virtual reality technology to gain access to music, graphics, dance, video production, and other forms of creative expression. Participants who cannot manipulate musical instruments, paint brushes or other traditional tools of creative expression exploit alternative computer access systems to create computer mediated art. Strategies developed through the project are being shared with recreation and educational programs who wish to run similar workshops.

Information

W5: Windows Within the World Wide Web. This project explores and evaluates access to the World Wide Web (WWW) for people with disabilities. It also models more accessible methods of displaying information on the WWW. Through this project users of alternative access systems and researchers are:

- systematically evaluating a representative set of alternative access

strategies (e.g., screen readers, alternative keyboards, screen magnifiers, voice input devices) with currently available web browsers (e.g., Mosaic, Netscape, Lynx).

- exploring, developing, and evaluating more accessible presentation methods for HyperText Markup Language (HTML) files, the code used to create WWW pages. This includes the incorporation of established access tags (i.e., International Committee for Accessible Document Design ICADD tags), creative use of alternative labels for inaccessible media, and the use of links to access files with duplicate information but in alternative formats (e.g., descriptive text for video or graphics, graphics or text for audio files, etc.).
- providing recommendations and proposing solutions to international and national standards committees and software companies.

Panorama Enhanced: the Accessible World Wide Web Browser. This project aims to develop a browsing tool for networked environments including the Internet and the World Wide Web. It will be released on three platforms: Macintosh, Microsoft Windows, and UNIX. *Panorama Enhanced* will be a mainstream product that offers access to persons with disabilities by:

- being optimally compatible with alternative access systems that individuals with disabilities may wish to use,
- providing a large number of integrated alternative access features, such as scanning, screen magnification, and screen reading,
- allowing users to set up individual profiles and to specify desired display features or input.

For additional information contact, Jutta Treviranus, The Adaptive Technology Resource Centre, First Floor, J.P. Robarts Library, University of Toronto, 130 St. George Street, Toronto, Canada. (416) 978-5240 or (416) 978-4360. The World Wide Web Server URL for the ATRC is: <http://www.utirc.utirc.utoronto.ca/AdTech/ATRCmain.html>

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Mouse Emulation Technologies		
Tash , 70 Gibson Drive, Unit 12, Markham, Ontario, Canada L3R4C2. 416-475-2212.	Don Johnston Inc. , P.O. Box 639, 1000 N Rand Road, Bldg. 115, Wauconda, IL 60084 708-526-2682; 800-999-4660.	LC Technologies, Inc. , 9455 Silver King Court, Fairfax, VA 22031. 703-385-7133
Prentke Romich Co. , 1022 Heyl Road Wooster, OH 4469 216-262-1984.	new Abilities , 470 San Antonio Rd., Suite G, Palo Alto, CA 94306 800-988-8889	Penny & Giles Computer Products , 163 Pleasant St., Attleboro, MA 02703
IntelliTools, Inc. , 5221 Central Ave., Suite 205F, Richmond, CA 94804 510-528-0670	Madenta Communications, Inc. , 9411A 20th Ave., Edmonton, Alberta, Canada. 403-450-8926	Origin Instruments , 854 Greenview Dr., Grand Prairie, TX 75050 214-606-8740; FAX 214-606-8741
Words+, Inc. , P.O. Box 1229, Lancaster, CA 93534. 805-949-8331		
Onscreen keyboards for Windows & Macintosh		
EEK (Win): OMS Development, 1921 Highland Avenue, Wilmette, IL 60091. 708-251-5787.	Scanning WSKE (Win): Words+, Inc., P.O. Box 1229, Lancaster, CA 93534, 805-949-8331	Wivik 2.0 (Win): Prentke Romich Co., 1022 Heyl Road, Wooster, OH 44691. 216-262-1984
Kenx (Mac): Don Johnston Inc., P.O. Box 639, 1000 N Rand Road, Building 115, Wauconda, IL 60084-0639. 708-526-2682.	Doors II (Mac): Madenta Communications, Inc., 9411A 20th Ave., Edmonton, Alberta, Canada. 403-450-8926.	HandiKEY (Win): Microsystems Software, Inc., 600 Worcester Rd., Framingham, MA 01701. 800) 828-2600
WordWriter (Mac): McIntyre Computer Systems, 22809 Shagbark, Birmingham, MI 48025. (313) 645-5090		

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