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UPFRONT

Much of daily life, particularly our communication, is directly affected by an ability to hear. Yet, hearing problems are invisible and can be easily overlooked. This issue focuses on the need to consider the status of hearing and listening for each individual who uses AAC techniques. Three years ago I began working on a project entitled *Technology in the Classroom*, carried out at the American Speech-Language-Hearing Association and funded in part by the U.S. Department of Education. This project, directed by Nancy Harlan, focused on providing professionals and parents with distance learning materials so they would be more likely to use assistive technology with young children who have severe disabilities. A videotape, three modules and a supplement were developed:[1]

- Videotape: Assistive Technology: We can do it.
- Education, Cindy Cassatt-James
- Positioning and Mobility, Elaine Trefler
- Communication, Sarah Blackstone
- Listening and Hearing, Carol Flexer

Note: All were edited by Nancy Harlan and Deborah Bruskin.

I mention the project because it inspired this issue of ACN. Specifically, Carol Flexer, author of the *Hearing and Listening Supplement* made me aware of the importance of looking carefully at the listening environments of those who use assistive technology. This issue is meant to raise your level of awareness and to encourage more collaboration among AAC teams and audiologists and between manufacturers of AAC devices and assistive listening technologies. In **For Consumers** *(cont. on page 2)*

For Consumers

An Invisible Disability: Hearing and Listening

- **Hearing** refers to the ability of the ear to receive sound.
- **Listening** refers to one's ability to pay attention to sound.

A hearing loss is not an all or nothing situation. Hearing impairment occurs along a broad continuum, ranging from minimal to profound. In the United States, for example, a 1990 National Health Interview Survey reported that more than 23 million—or 94.7 per 1000 people have some degree of hearing loss.[2] Over 92 percent are functionally "hard-of-hearing," rather than deaf.[3] Although statistics on the prevalence of hearing impairment among persons who use AAC techniques is unknown, hearing impairment among persons with disabilities is many more times that found in the normal population.[4,5]

Hearing loss has been described as an *invisible, acoustic filter.*[6]

- *Invisible* because we can not see what a hearing impairment does to someone. Nor, are the benefits of assistive hearing technologies readily obvious to others. Contrast this to the visibility of a motor impairment. If someone is unable to get up the stairs, the value of a wheelchair and ramp is immediately obvious. So are the advantages of a speech output device for someone unable to talk.
- *Acoustic filter* because hearing loss interferes with an individual's ability to receive and process auditory information. Even a minimal, a fluctuating, or a unilateral hearing loss can be a significant enough *acoustic filter* to interfere. In addition, hearing difficulties may be due to background noise, an ear infection, or *(cont. on page 2)*

Augmentative Communication News

UPFRONT *(cont. from page 1)*

you'll read about hearing loss and the potential impact of hearing difficulties on people who use AAC. The **Equipment** section gives a cursory look at a range of assistive technologies currently available to augment hearing and listening, and **Clinical News** considers strategies to enhance hearing and listening in children and adults. The **Governmental** section focuses on the impact of communication access as mandated in the United States by the Americans with Disabilities (ADA) Act of 1990. **University/Research** briefly considers ideas that may be of interest to manufacturers and researchers. Many thanks to the dedicated, talented experts whom I interviewed (see **Resources** on page 8).

You may notice some minor changes in the design of ACN. What do you think? Finally, Fall is our most beautiful season at ACN's international headquarters in Monterey. We're off to enjoy it, knowing we have much to be thankful for—including your support of ACN! Thank you! Until November . . .

Sarah W. Blackstone, Ph.D.

For Consumers *(cont. from page 1)*

too many visual distractions, as well as a permanent hearing loss.

Hearing impairments are classified as follows:

Conductive: Disease or damage in the outer or middle ear which interferes with the efficient conduction of sound to the inner ear where sound needs to be received. Otitis media/middle ear infections are responsible for most conductive losses. At least 80 percent of infants and young children with disabilities may have middle ear fluid all or part of the time.[7] Middle ear fluid always causes a hearing loss, which needs to be managed along with medical treatment of the ear.[8]

Sensorineural: Disease or damage to the inner ear which results in permanent nerve loss. Both congenital and acquired impairments can cause sensorineural hearing loss. Aging is strongly associated with sensorineural losses. The prevalence in people over 65 years is estimated at 321.8 per 1000—many more times that of the general population.[2] Nearly 61% of all hearing aids are sold to elderly patients.[9] Another major cause of sensorineural hearing loss is noise-induced impairment. In the United States, for example, it is estimated that as many as 10 million people have a noise-induced hearing loss.[10] Older people who become disabled are likely to be hearing impaired!

Auditory/perceptual: Disease or damage to the brainstem or cortex which interferes with the perception or understanding of sound, not the reception of sound. People with neurologic problems and elderly people are at high risk for central auditory processing problems.[11]

Mixed: Presence of disease or damage in several locations in the auditory system.

Sometimes people can appear to hear, i.e., words are audible, but speech may not be intelligible to them.

- **Audibility** refers to the presence or absence of sound
- **Intelligibility** refers to the ability to hear word-sound differences.

In fact, hearing losses often make it difficult for a person to detect some, rather than all sounds. For example, a high frequency hearing impairment makes speech difficult to understand because the person is unable to hear certain consonants (e.g., *s, f, th, sh).* Noisy environments can also interfere. Having to strain to listen, for whatever reason, is very fatiguing. For example, try making an important phone call from a phone booth on a busy street or in an airport.

All persons experience listening difficulties from time to time. But, for those with severe disabilities, hearing difficulties are more likely to preclude participation, interaction, and the development or return of language.

Role of the Audiologist

Audiologists can provide valuable assistance to AAC teams and help to expand our focus beyond expressive output, access, and mobility to include the use of assistive technologies that enhance sensory input. Clinical audiologists assess hearing and recommend and monitor the use of hearing aids and listening devices. Initial evaluations include pure tone, speech, tympanometric and cerumen screenings; and through the use of brain stem evoked response audiometry, audiologists can test even those who are unable to cooperate. People of all ages with unilateral, fluctuating and mild losses, as well as those with moderate, severe and profound hearing impairments may be candidates for technology. Today, fitting someone with hearing aids is not the only (or even the primary) role of audiologists, and hearing aids are often not the solution. Audiologists can work with assistive technology teams to recommend solutions that benefit the individual and are integrated with other assistive devices.

Importance of the Signal-to-Noise Ratio

When thinking about hearing and listening, a key concept is the signal-to-noise ratio (S/N). It refers to the relationship between the primary or target signal (typically the partner's or person's own vocalizations) and background noise (everything that competes with or degrades the auditory signal, e.g., internal biological noises, computers, communication devices, TV, people talking, fans, traffic, wind, motors). The louder the primary auditory signal relative to background sounds, the more intelligible the signal can be for the person. People with even minimal hearing losses need a more favorable S/N ratio than people with normal hearing. The best way to improve the S/N ratio is to decrease the distance between the speaker and person. *Speaking louder does not necessarily make speech more intelligible.* To extend the distance between the speaker and the listener without significantly reducing the S/N ratio, assistive listening devices are needed. Examples are given in the **Equipment** section.

Consideration of Listening and Hearing

The field of AAC focuses primarily on solving problems with expressive communication; however, the hearing and listening needs of individuals who use AAC (whether or not they have a documented hearing impairment) should not be overlooked:

1. Many persons who use AAC techniques have documented hearing losses and/or neurological impairments,

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which place them at high risk for hearing and listening difficulties.

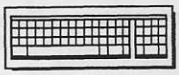
2. The impact of not receiving a clear auditory signal can be serious for people with an otherwise normal central nervous system. It can be devastating for someone with problems learning, communicating, moving, and paying attention.

3. We know people need clear auditory input to learn and participate optimally. Unfortunately, we do not know if, and to what extent, many of the children and adults who currently use AAC, may be having problems hearing and listening.

4. It is likely, under some conditions, that the speech output in communication devices and computers is not audible or intelligible to the AAC user. For example, most devices have an external speaker oriented toward the partner, which impacts on the S/N ratio for the user.

5. Most AAC users have at least one partner with a hearing impairment (e.g., spouse, grandparent). While most devices have a volume control, ear phone jack, and external speaker, few, if any, provide auditory specifications for the equipment or suggest how to adapt it for hearing impaired users or for use in difficult listening environments.

In conclusion, AAC interventions need to consider the listening as well as the expressive communication needs of the AAC user.



Equipment

Augmenting hearing with assistive technology

Assistive technology that is designed to aid people with hearing impairments and hearing difficulties is becoming more sophisticated and less obtrusive. Maximizing a person's ability to hear and listen often involves the use of one or more types of hearing technology. The purpose of devices that amplify sound is to enhance the signal-to-noise ratio so people who have a range of hearing impairments (or have difficulty hearing or listening) have access to auditory information. Hearing aids are not the only amplification technology available and may not even be the first or only choice in many situations. Multiple options are available.

Hearing technologies routinely should be considered by educational, rehabilitation, and community-based teams, particularly for people who have a known communication impairment and use AAC techniques. Unfortunately, the augmentation of hearing often receives little (or no) attention or is limited to checking existing hearing aids. Are there reasons that may account for this costly oversight to people with disabilities?

- Hearing impairment remains a hidden disability while other difficulties (e.g., mobility and access problems) are more obvious.
- Because behavior problems, slow learning, attentional deficits, and pragmatic communication difficulties observed in individuals with severe and/or multiple impairments can be accounted for in many other ways, hearing and listening problems (as a cause) may be overlooked.
- The philosophy of aggressively managing the programs of individuals with severe disabilities in less restrictive environments does not exist everywhere in the world. Thus, limited or lacking expectations continue to restrict what people with disabilities can do.

> No hearing loss is insignificant and no disability too severe to consider amplification technology.[4]
>
> Carol Flexer, Ph.D.

- Awareness, information, and understanding of assistive listening devices is limited among professionals and the general public.
- Audiologists rarely participate on assistive technology teams, even teams addressing communication needs. This is true despite the high incidence of hearing impairment in persons who have congenital and acquired communication impairments.

Table I gives an overview of the types of hearing technologies currently available that could benefit people with severe communication impairments. It includes information about populations for whom devices are designed, salient features of the devices, and comments about requirements for various devices. As with other assistive devices, amplification technologies should be recommended by qualified professionals who consider training and close monitoring an integral part of intervention. Also, effectiveness should be evaluated in light of data about the person's actual use in real listening environments. Table I is not meant to be inclusive, but to raise our level of awareness.

Many companies manufacture amplification technologies. Readers are encouraged to become familiar with device categories and then check with local audiologists to learn about companies serving your area. Two recommended resources which list products world-wide are:

- 1992 Hearing Instruments International Directory of Hearing Health Care Products. Published yearly. Available from Pauline Davies, 1 East First Street, Duluth Minnesota 55802. $15US + $3.50 shipping (anywhere) Phone (218) 723-9261. FAX (218) 723-9431

- The Hearing Journal's 1992 Hearing Health Industry World Directory. Published yearly. Available from The Hearing Journal, 63 Great Road, Maynard, MA 01754. US & Canada $18 US; Overseas $28 US. Phone (508) 897-5552; FAX (508) 897-6824.

In summary, hearing technology enhances an individual's ability to detect and pay attention to auditory information. This is, of course, critical to children developing language. However, access to speech and sound is just as important to adolescents and adults of all ages as it allows people to participate in events, maintain social contact, and acquire knowledge about the world. Technology that augments an individual's hearing should be an integral part of providing a total system of communication to persons with severe communication impairment.

TABLE I. HEARING TECHNOLOGIES: OPTIONS FOR PERSONS WITH SEVERE DISABILITIES
(Blackstone, Cherow, Edwards, Flexer, Smaldino; September 1992)

Device Type*	Population	Features	Requirements
HEARING AIDS	All ages. Minimal to profound hearing loss. Persons with all types of disabilities.	Personalized. Worn by individual. Most beneficial in quiet environments when sound source is close.	
Behind the ear/ Ear-level/Over-the ear	Well suited for children, but appropriate for all ages and most types and degrees of hearing loss.	Ear mold attached to system worn behind ear. Allows tone & output controls. Can be used with FM unit, loop.	Asessment, fitting of device, and orientation by audiologist. Aural rehabilitation by audiologist or speech-langauge pathologist. Should include data from observations in real environments. Daily care: Check the battery, ear mold, amplification level.
Body Style	Rarely used. Can sometimes get more power due to reduced feedback.	Ear mold attached to system worn on body.	
In-the-Ear	Preferred by adults. Most appropriate for minimal to severe losses.	Components built into earmold. Allows tone, output, compression controls. Some may be adapted for use with FM systems, loops.	
ASSISTIVE LISTENING DEVICES	All ages. Normal hearing to profound hearing losses. Persons with all types of disabilities.	Enhances signal - to - noise (S/N) ratio. Allows communication across distances. Optimizes listening in noisy environments and in groups. Useful at a distance and in noisy environments. Most are designed for didactic situations, not discussion groups or seminars.	
Personal FM Unit	People with hearing loss who may also have hearing aid. Useful at a distance and in noisy environments (classrooms, riding in a car, during mobility training).	Improves S/N ratio. Speaker wears microphone. Sound transmitted by radio frequencies to receiver. May connect through hearing aid or go directly to earphones.	Assessment and training in the use of the device by an audiologist or hearing aid dispenser. Should include observations in real environments. Children with congenital hearing loss will require more training than someone who has used hearing to acquire language. Daily care: Check the battery (if any), trandsducer to ear, volume, and trouble shooting list, if available.
Soundfield FM Equipment	People with normal hearing, fluctuating conductive hearing losses, unilateral hearing loss, minimal hearing loss. Hearing aid users can also use.	Improves S/N ratio. Speaker wears microphone. "Speakers" are located in class/lecture hall like a public address system.	
Mildgain Hardwired Unit	People with normal hearing, minimal or fluctuating loss who do not have personal FM systems.	Improves S/N ratio. Has wires connecting speaker & listener. Not a substitute for a hearing aid or wireless FM system.	
Infrared system	People with hearing loss who may also have hearing aid. Useful in wide area applications such as lecture halls, churches, etc.	Improves S/N ratio. Speaker wears mic & sound is transmitted by light to receiver. May connect through hearing aid or go directly to earphones. Can broadcaset in stereo. Relatively inexpensive.	
Induction loop system	People with hearing loss who may have hearing aid. Useful in wide area amplifications and where inexpensive coupling to hearing aids is needed.	Improves S/N ratio. Relatively inexpensive. Couples to hearing aid and assistive devices.	
Telecommunications	People who wish to use the phone and have difficulty hearing. All ages and disability types.	*Acoustic* - improves S/N ratio. Amplification of signal from phone. *Visual* - TDDs, phone relay systems, E-mail.	
Signal Alerting/ Warning Devices	People of all ages and types of hearing impairment needing access to sound in the environment.	Improves sound detection and allows environmental monitoring (e.g., doorbell, alarm clock, smoke detector, phone.)	
COCHLEAR IMPLANTS	People with hearing losses so profound that they can not benefit from conventional amplification.	Surgical implantation of electrode array in the cochlea to stimulate the auditory nerve.	Surgical procedure with subsequent, intensive aural rehabilitation program to teach use of new auditory information.
VIBRO-TACTILE DEVICES	People who do not benefit from acoustic may use vibrotactile stimulation. May use prior to coclear implant.	Sound activates a series of vibrators placed in various parts of the body (sternum, wrist, back of neck, abdomen) for detection of sound.	Intensive rehabilitation program to teach use of device and how to interpret stimulation.

* Other devices such as telecaption decoders may also be useful.

Note: Additional resources in North America are:

- Gallaudet University Assistive Device Center, School of Communication, 800 Florida Avenue, NE, Washington, DC 20002-3695 (202) 651-5326.
- Self Help for Hard of Hearing People, Inc. (SHHH), 7800 Wisconsin Avenue, Bethesda, MD 20814 (301) 657-2248.
- Canadian Hearing Society, 271 Spadina Road, Toronto, Canada M5R 2V3 (416) 964-9598.

Clinical News

Strategies to optimize hearing and listening

For a person to have access to auditory information, it is necessary to receive a clear auditory signal. Auditory signals are physical facts. They decay across distances and as a result of environmental circumstances. For example, if you were to sit front row center in a theater, as much as 50 percent of the acoustic signal from the stage could be lost depending upon the acoustics of the theater, position of the speaker, number of people coughing in the audience and so on. For persons with normal hearing and an intact central nervous system, a degraded signal is often more than enough for the brain to interpret what is going on. However, for those who have difficulty focusing, have a minimal language base, have had a stroke or head injury, or have a peripheral hearing impairment, a degraded auditory signal often is not enough. Many people with disabilities, even those with normal peripheral hearing, need highly redundant, easily received auditory signals to interpret speech.

We need to optimize the acoustic environments of people who use AAC to the greatest extent possible. In addition, we need to maximize their detection of sound by insuring the reception of clear signals. Finally, we need to consider enhancing auditory functions across contexts. Only after we've taken these steps and addressed expressive communication needs, can we claim to offer comprehensive communication interventions.

Optimize Acoustic Environment

Background noise can seriously impair anyone's hearing. Whenever possible, decrease the effects of noise by:

1. **Identifying and decreasing sources of noise.** Daily life is full of noisy situations, many of which we can not control. However, we often can reduce noise in our homes, schools, and work environments. Able-bodied people automatically assume responsibility for controlling their own acoustic environments.
   - When the phone rings, we shut off the TV before answering it.
   - When we can't hear the car radio, we turn up the volume.

   People who have motor impairments may not be able to do these things without the benefit of environmental control technologies. Likewise, it is important to be sensitive to the needs of young children and people with cognitive impairments who may be unaware when noise is interfering with their hearing. Someone needs to assume responsibility for getting rid of extraneous noise for them. Finally, we must be aware of noise created by assistive technology itself. Speech output devices, respirators, electric wheelchairs, and computers make noise. The impact on an individual's ability to hear and listen, particularly those using multiple technologies, should be considered.

   Comment: In many households today, the TV or radio is "on" all the time. That's not a good idea when people have hearing impairments or difficulty listening.

> We need to acknowledge the effects of hearing impairments on attitude and self esteem. The affective side of poor input may be "I must be dumb, rather than I just can't hear."
> Carolyn Edwards, August, 1992.

2. **Identifying and decreasing reverberation.** Reverberation occurs when noise is deflected from surrounding surfaces. An echo is an example. Architectural modifications (e.g., acoustic tiles) can decrease reverberation because they "absorb" noise. Some "quick and dirty" approaches also may be used.
   - Carpet decreases reverberation and can be quite effective, but it may also make it difficult for wheelchairs to move. An alternative use for carpet is to mount carpet squares on the walls.
   - "Chair footies" can significantly reduce noise in rooms without carpet (e.g., classrooms). Put socks on each chair leg or slit a tennis ball and put on each leg.
   - Corkboards or egg cartons may be stapled to portable dividers or placed on bulletin boards.
3. **Providing information to friends and family.** It helps if others are aware of how hearing difficulties, noise, and reverberation may affect the behavior, learning and communication of people who use AAC. To raise awareness, try the following.
   - Simulate a hearing loss by passing out ear plugs and generating a discussion about the effects.
   - Do an inservice about hearing, assistive listening devices, and augmentative communication devices. Involve an audiologist.
   - Monitor noise and identify noise sources. For example, use a sound level meter from an electronics store (e.g., Radio Shack) to teach acoustics. Students can measure noise levels and begin exerting control over their acoustic environment. Note: this might also be used to increase awareness of noise induced losses.
   - Remember "chair footies?" Two weeks after you put "footies" on chairs to decrease noise, take them off and ask people to evaluate the difference(s).

Finally, it is important to remind ourselves and others that what we, as individuals, may tolerate as "background noise" can be intolerable to someone else. Whether due to hearing loss, neurologic impairment, or personal preference, *noise* to one person is not necessarily *noise* to another.

Maximize Signal Detection

It is impossible to control noise and reverberation in all situations. Therefore, additional steps need to be taken to maximize an individual's ability to detect sounds and make sense of them, particularly speech.

1. **Position sound source close to person.** Positioning is especially important for people who need maximum redundancy to learn, whether or not they wear hearing aids. If a person wears a hearing aid, the speaker needs to be within 6 inches of the person's ear or hearing aid microphone at all times to be reasonably sure the person is receiving a complete auditory signal.[12]
2. **Use amplification technology to improve the S/N ratio.** Because hearing aids are most useful when the sound source is close, large rooms and noisy environments require other amplification techniques. Assistive listening devices provide direct rather than deflected sound and thus can decrease the impact of reverberation. Many can be used alone or coupled with a hearing aid.

   Success using hearing amplification devices is dependent on many things in addition to peripheral hearing: central processing problems, attention, neurological impairment. For example, many elderly people have a *(cont. on page 6)*

sensory-neural hearing loss. After a stroke, they also may have difficulty processing auditory information, particularly in noise.[13] While conventional amplification may help overcome sensitivity loss, a more successful strategy for people with auditory processing disorders appears to be the use of a remote-microphone assistive listening device.[14] Young people with neurologic impairment also may have trouble listening under some conditions. Screening for cognitive function from an audiological point of view is possible. For example:

"The importance of separating the effects of peripheral hearing sensitivity loss from auditory processing disorders, especially with regard to rehabilitation, cannot be overstated."[14]
Stach, Loisell, Jerger, 1991

- Screening Test for Auditory Processing Disorders (SCAN) Tests for Children. Now also available for Adolescents and Adults

However, author Dr. Robert Keith and his colleagues[15] report the influences of attention, cognition, and language skills must be controlled during the screening process. This is often difficult. For an excellent discussion see Brad Stach's chapter.[16]

Enhance Listening Across Contexts

In addition to decreasing noise and reverberation and increasing the S/N ratio, people need a reason to listen. First, they need to know sound has meaning. People with severe motoric or visual impairment, as well as those with hearing impairment, may have difficulty associating meaning with various sound sources. Therefore, it is important to observe what sounds currently have meaning for a person and how well speech is understood under various conditions. Even if no meaningful use of sound is observed, a trial period of amplification may show behaviors such as rocking decreasing and attention increasing.

To enhance listening across contexts, we need to know what someone does every day (and would like to do), where, with whom, and when. We also need to know the kind of loss and other auditory problems they may have, and what kind of AAC technologies and techniques they use. When looking for ways to enhance listening, an audiologist may start with contexts that are most interesting to the individual, keeping in mind the entire range of activities and contexts. For many people, a combination of devices is required to meet their hearing and listening needs across contexts and activities. Below are a few ideas about how common listening contexts could be approached:

- CAR: A noisy and difficult context because safety demands visual attention to the road. To speak with someone who uses a speech output device, a driver with hearing difficulties may find it easier to use an FM system and auxiliary microphone or a hard-wired audio input system. Adaptations in a van or bus, particularly when the person uses an AAC device and is in a wheelchair, may be critical as the distance between the driver and AAC user can be 4 or more feet. Drivers are unable to understand the speech output device, and users are unable to hear the driver. In either case, solutions can be simple and inexpensive. The microphone is placed near the device speaker and the driver wears an earphone.
- SOCIAL GATHERINGS: Even small social gatherings may be difficult for people with hearing impairment, particularly for those with auditory processing problems. Hearing aids coupled to a personal FM system, the FM system alone, or a hardwired audio system can help. Unfortunately, people are sometimes reluctant to ask others to speak into/wear a microphone, but it can make a big difference.
- CHURCH, MOVIES, CONCERT HALLS: Increasingly, assistive listening systems (e.g., loop systems, FM systems, or infrared systems) are becoming available in public places. These may either couple with hearing aids or can be used separately. When unavailable, the minister or lecturer can be asked to cooperate with those who use personal FM systems.
- WATCHING: Use of a personal FM system, hard wired, or infrared system can allow individuals with hearing difficulties to hear the TV at the same volume as others.
- THE CLASSROOM: The acoustics of a classroom affect how every child learns and every teacher teaches. Studies of noise in classrooms have shown poor S/N ratios: people chatting, chairs scraping across the floor, teachers teaching, teachers saying "keep your voices down," computers beeping, communication devices talking and so on.[12] Consideration of listening and hearing in the classroom should be part of a child's AAC intervention. The chart below describes how an educational audiologist might proceed.

Classroom Strategies

Observe the child and the situations within which he needs to function. Evaluate the kind of auditory signals the child is getting during each activity.	Listen to how teachers describe the child. What are their feelings about the child? about the kind of support from professionals?
Determine what the teacher's listening expectations are of the class, and the child who uses AAC. What kind of "crowd control" strategies are used? For example, some teachers begin whispering to get attention. This won't be effective for children with hearing loss.	Evaluate the acoustics of the classroom and the location of the child within the classroom. Preferential seating as the solution is a "hoax."[2] It assumes 1) the teacher and child are in a fixed position with focused attention and 2) other noise factors don't exist.
Don't approach the situation with an "expert" mind frame. Collaborate with the teacher to determine how best to make it work for children in the teacher's environment and within the teacher's activities.	Determine what assistive technologies, listening strategies and acoustic modifications the child needs. Implement these as soon as possible and evaluate their effects.
Observe how the child relates to peers and visa versa. Edwards points out we need to acknowledge the effects of hearing impairments on attitude and self-esteem. The affective side of poor input may be "I must be dumb." This can impact decisions about technology. For example, if interaction is limited and self-esteem is poor, the audiologist may select a Sound Field FM system, rather than a personal FM system and asking the child to introduce it to classmates.	

To summarize, effective hearing and listening strategies for people who use AAC focus on changing variables related to the: 1) person's ability to detect and understand auditory signals, 2) acoustic environments within which the person needs to function, 3) tasks they need to accomplish, and 4) technologies, particularly those that augment hearing. Audiologists in your community are the professionals to ask for help. Refer people to them if you suspect any hearing difficulties and encourage their participation on the AAC team. Under their guidance, try assistive listening devices and participate in evaluating the effects. Hearing Handicap Scales also can be very useful tools.[17] You may find, as others have, that people who use AAC and have difficulty hearing, can benefit from assistive listening technologies. Reported effects include increased vocalizations, improved speech, better peer interaction, increased attention, less fatigue, accelerated learning rates, and of course, better communication.

University & Research

What's needed & possible?

All AAC users experience difficult listening situations, even those with normal hearing. All AAC users probably have at least one communication partner with a hearing impairment. Some device users are hearing impaired. Yet, we know little about how features of speech synthesis/digitized speech affect people under less than optimal listening conditions. While questions remain unexplored, some solutions seem to be within our grasp. Already external jacks exist and many auditory scanning aids allow the user to wear earphones to enhance their ability to listen to a scanning array in private.

What if the following options were available on communication devices?

- Jacks for two to four earphones with independent volume controls.
- Ability for the user to select whether speech output would be broadcast through: 1) the external speaker, 2) one or more of the available earphones, or 3) both.

Manufacturers! These features would not only improve options for enhancing hearing and listening, they could increase the use and effectiveness of devices by addressing some other important issues.

- Privacy: When privacy is desired, earphones could be used. This would not only simulate an ability to "whisper" but more importantly allow the person to be understood.
- Disruption: Earphones could be used by the teacher and others in a small group so other students were not disturbed during the class.
- Language training: Earphones could be worn by the user during times when aided language stimulation was being used (see *ACN*, Vol. 5, #4) to enhance the auditory input, just as a pocket light is sometimes used to highlight visual input.
- Communication training: Community, school, and many home environments are notoriously noisy. Yet, communication training needs to be carried out in these environments. If the user and/or facilitator could wear earphones, it might enhance the S/N ratio and improve the effectiveness of training.

At my request, Bill Forde spoke with colleagues at Phonic Ear, Inc. Note: The company manufactures both AAC and Assistive Listening devices. "With a little work," he said, "we could put in a head set by using an interface box to split the signal (headset and external speaker)." Other short term solutions discussed were for people with hearing aids to be able to use their T switch and a teleloop to the jack. Long term, Forde would like to see FM or infrared transmitter options so the person is not hard-wired to the device. "The electronics for this is not easy, but it could be done."

Governmental

ADA: For persons with communication impairments

The Americans with Disabilities Act of 1990 is Civil Rights Legislation with implications for all people and all ages. The Act legislates against discrimination of persons who 1) have an impairment, 2) are regarded as having an impairment, or 3) have had a disability in the past. For people who are "temporarily able-bodied," the ADA will 1) raise awareness about disability issues and 2) allow communities to interact with and meet on a daily basis people with disabilities.

The ADA means the public sector and the private sector need to make accommodations and provide access to goods, jobs, services, benefits, and programs. Significantly, it recognizes the importance of communication and specifically the problems of communication accessibility encountered by persons with hearing, speech, cognitive/language, and visual impairments. The ADA mandates that a range of strategies and technologies must be available so facilities, programs, and employment are accessible to people with a range of disabilities, including those who use AAC techniques. *Communication Disabilities and the ADA: The ABC's (Accommodation, Barriers and Compliance)* funded by the Department of Justice, being carried out at the American Speech-Language-Hearing Association. The focus, is on Title II and Title III regulations of the ADA, as described:

- Products include: Fact Sheets, a Videotape, and training packets, Title II: Child care, Restaurants, Places of Lodging, Hospital and Health Sites, Retail Stores, and Places of Assembly and Title III: Law Enforcement and Emergency Services.

Title II State and local government services: Schools, libraries, parks, public transportation and other state and local agencies need to look at access to their facilities, programs, and employment. This can mean modifying space/equipment, purchasing devices, and training staff.

- **What can you do?** It's a good time to get involved because action plans currently are being drafted in most communities to address these regulations. You can make sure communication access issues are considered.

Title III Public accommodations: The private sector also needs to address access issues. To date, physical accessibility has received most attention; however, access to communication is also required. For example, theaters should provide assistive listening devices or preferential seating (at no extra cost). Although many facilities are not yet equipped, all must be working on a plan to make the necessary accommodations.

- **What can you do?** The next time you go to a movie or eat in a restaurant ask what they have done/are doing. Solutions do not need to be expensive. For example, accommodations being made by restaurants are to provide adequate lighting, a "quiet area" and picture menus. Of course, staff must be trained and these options must be advertised and made readily accessible.

Jo Williams, project Director, says the "primary problem for persons with hearing impairment is noise." Thus, improving acoustic environments and using technologies such as assistive listening systems that get rid of noise interference is a major emphasis. For persons who use AAC techniques, however, she thinks the "major barriers often are attitudinal: society has misconceptions about intellectual abilities. People feel uncomfortable, and are not taking time to interact. Also, when it comes to telecommunications, people assume that everyone who uses a TDD or relay system is deaf."

- **What can you do?** Raise awareness by asking questions and providing information to policy makers and businesses within your community. Get involved!

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