HEARING LOOP TECHNOLOGY

Hear in Places Where Hearing Devices Alone Are Unable to Deliver

BY JULIËTTE STERKENS, AU.D.

NEARLY 15 YEARS AGO, David Myers, a professor of psychology, attended a religious service in an 800-year-old Scottish abbey and struggled to hear the words. All he heard through his recently obtained hearing aids for his progressive hearing loss was the garbled sound of the minister's amplified voice as it reverberated off the walls in the old stone church. Just as he was about to give up, his wife noticed a blue sign—with an illustration of a white ear, a slash mark and a "T" in the bottom right corner—indicating that the worship space offered a "hearing loop." Myers discovered that by pressing a button and activating the telecoils on his hearing aids the words from the minister came into his ears—directly and crystal clear. Myers did not know this level of clarity and understanding was even possible.

Hearing loops, common in the United Kingdom, transmit the sound that is captured by the microphone on the presenter's lapel wirelessly to a telecoil found in hearing technology, including hearing aids and cochlear implants. A hearing loop minimizes the effects of reverberation, background noise and distance much like an FM system does in the classroom.

Hearing Loop Movement: Beginnings

When Myers, who is a professor of psychology at Hope College in Holland, Michigan, returned home, he discovered that most public venues in the United States, which are required by the Americans with Disabilities Act to offer some form of accommodation, primarily provide FM assistive technology. While FM technology can overcome the deleterious effects of distance, background noise and reverberation on speech understanding, it requires the user to pick up a handheld receiver.

Myers was so thrilled to find out about a technology that only required pushing a button on his hearing aids that he installed a loop in his TV room and began advocating for hearing loops in his community. His efforts in western Michigan, with support from local hearing health care professionals, audio engineers and hearing loop installers as well as local grant funding, quickly led to the adoption of hearing loop technology in hundreds of public venues such as meeting rooms, high school auditoriums, houses of

worship and even funeral homes in the early 2000s. Following this initial success, Myers, who by that time was joined by other ardent hearing loss advocates around the country, advocated for hearing loop technology on a national level through the use of articles in print and speaking engagements.

The Listening Bubble

The ability to hear well is sometimes depicted as though the listener is the middle of a bubble. Any sound or talking that goes on inside the bubble is something that the person can hear, or catch. Children with typical hearing can catch talking at home in the same room and sometimes from another room in the house, if there is little or no background noise. By "overhearing" all kinds of conversations in the house children learn the language that surrounds them. A child with hearing loss will have a smaller listening bubble than a child with typical hearing. It may be only a few inches from their ears or a number of feet away. While hearing aids and cochlear implants will help most children have a bigger "listening bubble" to catch language more easily, hearing aids and sound processors do not generally restore the bubble to a range experienced by listeners with typical hearing. To what extent your child's hearing bubble is increased or improved with the use of hearing devices varies depending on their hearing thresholds and type of hearing loss.

However, just because a sound is heard by the listener does not guarantee that it is understood. Researchers have found that the speech signals need to be 15 dB to 20 dB louder than the background noise for speech to be intelligible. Audiologists call this a signal-to-noise ratio (SNR) of +15 or +20 dB. Hearing aids can provide this increased audibility as long as there is no distracting background noise and the speaker is in the listening bubble range. For example, a parent can improve the SNR by always trying to talk close to the child, face-to-face, and by clearly articulating one's speech, and raising their voice slightly when not directly talking to the child. This can increase the likelihood that what the child hears is also understood and may allow the child to "overhear" speech to benefit his/her overall language and speech development.

Most hearing aid and cochlear implant users require more than a volume increase to improve comprehension. This is because the hearing loss often makes it difficult for the brain to process incomplete speech signals and/or because the users' listening bubble simply doesn't reach far enough. And remember, even people with typical hearing report difficulty understanding the words when people speak at a fast pace, with accents, or in places where there is background noise or distance involved. While late-deafened adults—who possess a large vocabulary and the ability to fill in the words they did not hear—can sometimes manage by using extra listening effort, this

Seventh-grader Jakob Cherek, who has hearing loss, poses with the hearing loop sign in the auditorium of the John Muir Middle School.
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is not the case for children still in the process of developing language. Researchers consistently report that even with appropriately fitted amplification children struggle in classrooms and other public places (Crandell & Smaldino, 2000; Glasberg & Moore, 1989). Children with hearing loss have less listening experience than adults and therefore do not have the vocabulary to fill in the gaps of what they did not hear, which affects their comprehension.

Hearing Loop Mechanism: Why It Works

The hearing loop transmits the audio, through magnetic energy, directly to the telecoil in a hearing aid or cochlear implant sound processor. The loop can be one simple loop of wire (or an array of looped wires) which surrounds a seated area, a meeting room, the back seat of a taxi cab or a check-out counter. The listener in a loop hears the speech signal at a much improved signal-to-noise ratio, which reduces the work the brain of the listener must do in order to comprehend the speech. The telecoil in the hearing aid or cochlear implant receives the sound without any background noise, reverberation or distortion.

To hear the signal from the public address system (the TV or the microphone) wirelessly in a hearing aid or cochlear implant, the hearing device must be equipped with an activated telecoil (also known as T-coil or telephone switch). Fortunately, all cochlear implants and most behind-the-ear hearing devices recommended for children offer the telecoil option. A hearing loop is essentially "hassle-free"—the hearing devices process the sound adjusted for the individual's hearing loss so it is heard as intended, and the user's hearing aids and cochlear implants become the user's assistive listening device.

In order to hear in a loop, the telecoil or "T" program in the hearing aid or cochlear implant needs to be activated. If the

MY DAUGHTER IS LYING ON MY LAP RIGHT NOW. WE ARE WATCHING "CUPCAKE WARS." IN OUR "PRE-LOOP" DAYS, SHE SAT APART FROM US ALL, ABOUT TWO FEET IN FRONT OF THE TV, SO THAT SHE COULD HEAR BETTER. **IT'S SO MUCH BETTER WITH HER ON MY LAP!**

hearing device is set to "T," the device's microphone is turned off—this means that your child would only hear the signals coming through the loop. In order to hear environmental sounds as well as the signal coming through the loop, such as TV signals, ask your audiologist to program a microphone plus telecoil or "M+T" setting, rather than a T-coil only setting. This will facilitate conversation with your child as he or she listens to TV through the loop.

Hearing Loops and Speech Development

It is important to realize that users of hearing technology report difficulty hearing in public places—no matter how well their devices work in quiet listening environments. This was confirmed by recent surveys among nearly 800 adult hearing aid and cochlear implant users (data to be published). Users were asked to rate their ability to understand speech in public places (Figure 1) on a scale of 1 to 10 (where 1 indicated "I heard nothing" and 10 indicated "I heard every word"). Hearing aid and cochlear implant users rated their subjective ability to hear with their hearing devices at an average of 4.90 (Figure 2). While listening in the loop, respondents rated their ability to hear at an average of 8.46 (Figure 3).

Further, survey respondents, whose hearing losses were mostly in the moderate to profound range, expressed a distinct preference for hearing loop technology. Because hearing loops provide the same SNR signals as the FM systems, which have been shown to maximize a student's hearing and learning abilities for success in the classroom, they provide the same benefits for your youngster in public places and venues where personal FM systems are not easily used.

Jill Villnow, a mother who installed a hearing loop in the TV room for her daughter who is deaf in one ear and has a mild hearing loss in the other, wrote me following their successful home hearing loop installation: "*My daughter is lying on my lap right now. We are watching "Cupcake Wars." In our "pre-loop" days, she sat apart from us all, about two feet in front of the TV, so that she could hear better. It's so much better with her on my lap!*"

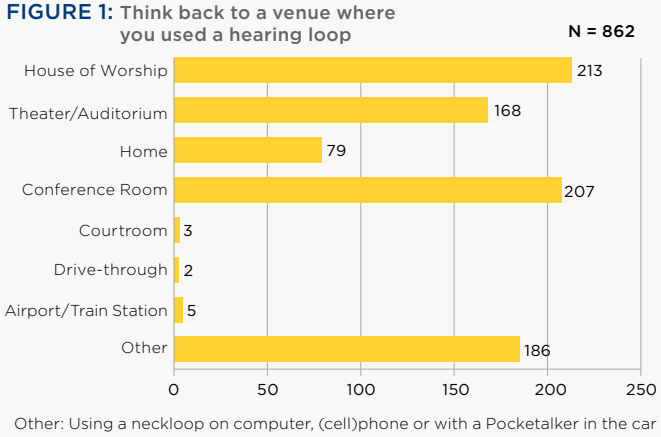
Differences Between Bluetooth and Hearing Loop Technology

There is some confusion about the benefits of Bluetooth (BT) technology versus hearing loops. While BT technology can wirelessly connect hearing aids with a smartphone, iPad or TV transmitter, BT devices are not designed for settings where there is a large audience (like a theater or meeting hall), as BT devices only connect one-to-one and cannot be shared. BT technology and wireless BT clip-on microphones can benefit users in an intimate setting between two people like in a noisy restaurant or in a car; however, they currently do not have applications in larger venues (see Kirkwood, 2014).

Installing a Hearing Loop

Installing a home TV loop is not difficult. If your house has a basement, the loop wire can be installed against the ceiling of the basement underneath the TV room; or it can be hidden in the TV room itself underneath the carpeting; or the wire can be looped multiple times around the legs of a sofa. A loop pillow can make installation very easy and makes the system more portable although the wire leading up to the chair can pose a tripping hazard.

FIGURE 1: Think back to a venue where you used a hearing loop



Other: Using a neckloop on computer, (cell)phone or with a Pocketalker in the car

FIGURE 2: On a scale of 1 to 10 rate your ability to hear in the venue using your hearing devices only (no telecoil)?

1 = "I heard nothing" 10 = "I heard every word"

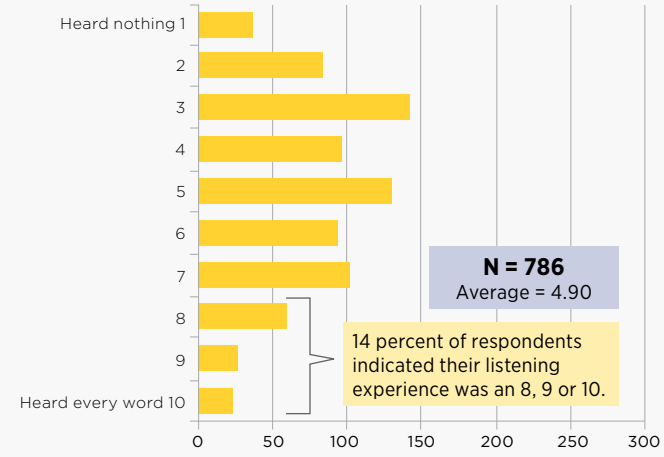
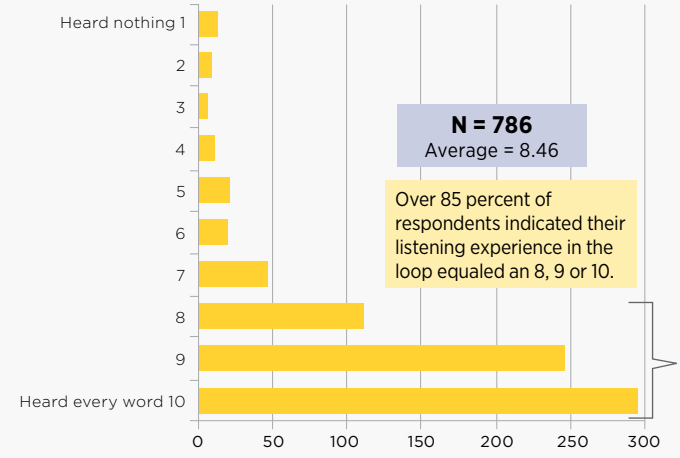


FIGURE 3: On a scale of 1 to 10, rate your ability to hear in the venue using the telecoil in the loop?

1 = "I heard nothing" 10 = "I heard every word"



In public venues such a house of worship, school auditorium or meeting room, the loop signal has to deliver the correct magnetic signal to the telecoils in all hearing aids and cochlear implants and will most likely require professional installation to ensure that the loop meets the International Electrotechnical Commission (IEC) standard. The cost of a hearing loop can vary significantly. The cost is affected by the size of the venue, the amount of metal in the structure, and the difficulty of installing the loop wire where it needs to be in order to meet the IEC standard. Trained loop installers are therefore a must. For more on IEC standard 60118-4—the induction loop performance standard—visit **www.ampetronic.com/Performance-Standards.**

Fortunately, hearing loops are becoming more common thanks to the combined efforts of consumers, hearing health care providers, and listening and spoken language professionals who are working together to make hearing access more user-friendly by installing hearing loops. You can find where hearing loops are publicly available through **www.aldlocator.com** and explore Myers' website **www.hearingloop.org**. The Hearing Loss Association of America and the American Academy of Audiology started a collaborative public education campaign in 2010 called "Get in the Hearing Loop." Visit **hearingloss.org/content/get-hearing-loop** to learn more.

Hearing loops help people with hearing loss stay connected because they are able to hear what is going on and participate fully in the world when watching TV, enjoying the arts or plays in theaters and auditoriums, or simply interacting with someone behind a ticket counter. Loops improve the quality of life for anyone whose life is touched with hearing loss. Let's all work towards a greater adoption of hearing loops. Let's loop America!

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To access the article as well as additional downloadable resources on assistive listening technology, visit ListeningandSpokenLanguage.org/HearingLoops