Cutting Through the Noise

In a high-volume world, a new effort to help soldiers — and the hearing-impaired — tune out the din

LAST YEAR, BARBARA Shinn-Cunningham invited her elderly uncle to Christmas dinner. Although in his mid-eighties, his mind was sharp, and he and his niece enjoyed a quiet chat before joining the thirteen other guests in the dining room.

The ham was served, and the room soon filled with loud, jovial conversation. Amid the clatter of silverware and the boisterous laughter, Shinn-Cunningham's uncle removed his hearing aids and shoved them into his pocket. "He never said another word, just stared straight ahead and ate," she recalls. "He was so frustrated. It was impossible for him to follow any of the conversations because his hearing aids just amplified the noise."

More than most people, Shinn-Cunningham understands what he's up against. As an associate professor of cognitive and neural systems in the College of Arts and Sciences and of biomedical engineering in the College of Engineering, she looks at how the brain manages acoustic communication, particularly in high-stress situations. Her research isn't limited to helping the hearing-impaired, though; the U.S. Department of Defense has tapped her to look at how well pilots and ground soldiers process important commands in the midst of battlefield chaos. Shinn-Cunningham is one of only six researchers nationwide selected to form the first class of National Security Science and Engineering Faculty Fellows, a distinction for which she'll receive up to $3 million of direct research support over the next five years.

Specifically, her research will examine how the brain processes multiple auditory signals. To put the situation in simpler terms, she describes a crowded restaurant or club where there are numerous conversations taking place. "The brain is taking in lots of different signals simultaneously and ultimately deciding to hone in on the most important one," she says. "Meanwhile, you're tuning out other conversations or music or noise."

The task isn't so simple for the hearing-impaired. Because hearing aids lack source-separation technology, Shinn-Cunningham explains, wearers cannot distinguish individual conversations. "It's only noise — lots of noise."

The same is true for fighter pilots and ground soldiers, but on a much more critical level. During battle, pilots and soldiers are bombarded with information. Hooked up to radio headsets, they are forced to process multiple sounds, from commanding officers' orders to bomb blasts. Amid such chaos, it's nearly impossible to decipher information rationally.

Although the military has experimented with hearing-aid devices, its efforts have been largely unsuccessful. To be fully effective, Shinn-Cunningham says, such devices must determine which signal the brain wants to focus on; essentially, they must know what the listener is thinking. The grant will allow her to use electroencephalography (EEG), a noninvasive technique that measures electrical brain activity through small electrodes placed on the scalp, to monitor the brain's responses to sounds.

Shinn-Cunningham believes such methods may constitute the future of hearing aids. "EEG isn't magic," she says. "It's actually a very crude way of reading gross electrical activity in the brain. Anything that involves muscle movement causes huge electrical activity, so let's say my eyes move to the right. The hearing-aid device would automatically hone in and accentuate the sound to my right."

But scientists must first understand the ways in which the brain separates sounds. Only then, Shinn-Cunningham says, "can we build a device that interacts with the wearers in an intelligent way."

VICKY WALTZ

NEW RESEARCH MAY LEAD to hearing aids that know what the listener is thinking.

Barbara Shinn-Cunningham is looking at how soldiers hear on the battlefield.

VERNON DOUCETTE