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Signal Processing Method For Extracting Low Frequency Sounds From Noisy Environments

One of the greatest challenges to speech recognition is accurately filtering speech from noisy backgrounds. Current techniques for noise reduction are robust against random acoustic environments, however, the average microphone tends to attenuate low frequencies and that attenuation is only exacerbated by noise. Because of the ear's anatomy, current Cochlear implants cannot process frequencies below 500 Hz and leave users struggling to hear in noisy environments. Additionally, unilateral CI users are unable to locate a sound's source because they cannot intuitively sense the difference in a sound's arrival time with only one functioning ear. Current solutions to these problems are to combine the use of a unilateral CI with a hearing aid in the other ear, which is not an option if hearing is too impaired, or a bilateral CI (implants for both ears), which is very expensive and often not covered by insurance.

Researchers at ASU have developed a signal processing method that isolates low frequency sounds and attenuates audio from peripheral directions by filtering, extracting, and amplifying phonetic signals processed from the original transmission. The processed information can then be communicated to a CI user by vibrators placed directly on the user's skin, preferably on the ear's pinna. This method has been shown to increase low frequency sensing capabilities of CI's and help unilateral CI users better locate the source of sounds.

Potential Applications

- Cochlear Implants
- Haptics
- Noise Reduction
- Security Systems Voice Recognition
- Telecommunications Speech Recognition
- Text-To-Speech Software

Benefits and Advantages

- Accuracy – Improved ability to discern phonemes at low frequencies enhances the fidelity of speech recognition software.
- Easy Installation – Simple installation of vibrators, no complicated invasive surgery.
- Easy to Learn – Tactile sensation is similar to low frequency hearing, experimental subjects saw substantial benefit with only 15 minutes of training.
- Lower Costs – Significantly less expensive than an additional CI.

For more information about the inventor(s) and their research, please see [Dr. Michael Dorman's directory webpage](#)

[Dr. William Yost's directory webpage](#)