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# Engineer Working to Improve Cochlear Implants

*Research Project Targets Difficulties Users Face in Noisy Environments*

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Having two ears is not just a matter of doubling the amount of sound you would hear with one ear. And yet you might not know that from the way today's cochlear implants for the deaf and severely hearing-impaired operate.

Kostas Kokkinakis, a postdoctoral research associate in electrical engineering at UT Dallas, is working to change that through a $225,000 project that could "greatly benefit the overall quality of life for a large number of cochlear implant users," he said.

The so-called binaural hearing that comes from having two ears is intelligent in ways that we might not generally consider. Especially in aurally complex settings such as a cocktail party or a basketball game, we're able to decode what we hear partly because our ears do the work of an audio engineer, mixing and unmixing sounds in ways that help us make sense of them.

"Even when fitted with two cochlear implant devices, it is often difficult to distinguish between the sounds you want to hear and those that you do not," said Dr. Kokkinakis, who received his Ph.D. in electrical engineering in 2005 from the University of Liverpool before coming to UT Dallas.

"This means that people will generally avoid putting themselves in situations and environments where it is a struggle to hear and in which they feel uncomfortable," he said. "In this work, we aim to use cutting-edge intelligent digital sound technology and various multi-microphone speech-processing strategies to improve speech understanding in noisy social settings and reverberant environments."

Key to the project is a technique called blind source separation, or BSS, that can be applied to cochlear implant devices that have either one or two microphones.

"BSS can efficiently capitalize on the spatial cues present in the mixtures of the audio signals received by the microphones and essentially use that information to spatially separate the target audio from background noise," Dr. Kokkinakis said. "The working hypothesis is that upon spatially segregating the target speech signal from the interfering sounds, listeners will be able

Kostas Kokkinakis works with a participant in his study to improve the usefulness of cochlear implants in such aurally complex settings as parties or sporting events.

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to benefit from a substantial increase in speech recognition."

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Forty bilateral cochlear implant listeners will participate in the three-year study.

Dr. Kokkinakis came to UT Dallas in 2005 to work on multi-microphone signal-processing techniques under the supervision of Philip Loizou, a professor of electrical engineering and director of the Cochlear Implant and Speech Processing Lab in the Erik Jonsson School of Engineering and Computer Science at UT Dallas. Cochlear implant research by Dr. Kokkinakis and Dr. Loizou will be featured in an upcoming article in *Hearing Health* magazine.

Cochlear implant technology has developed rapidly since first coming into widespread use about 20 years ago. More than 112,000 people worldwide had received cochlear implants as of December 2006, including more than 15,000 children in the United States alone, according to the U.S. Food and Drug Administration.

This project is supported by funding from the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health. More information on cochlear implants is available on Web sites for the institutes and Dr. Loizou's lab.

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