New technology helps Parkinson's patients speak louder

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Jessica Huber, at left, an associate professor in Purdue's Department of Speech, Language and Hearing Sciences, and graduate student Meghan Moran demonstrate a new technology developed in Huber's lab that helps Parkinson's patients overcome the tendency to speak too quietly. The system works by playing a recording of ambient sound, which resembles the noisy chatter of a restaurant full of patrons. A sensor placed on the neck detects that the person has begun to speak and tells the device to play the babble through an earpiece worn by the patient. Patients also wear a mask and sensors in elastic bands placed around the rib cage to precisely record respiratory, laryngeal and articulatory data. Credit: Purdue University photo/Andrew Hancock

Researchers have developed a new technology that helps Parkinson's patients overcome the tendency to speak too quietly by playing a recording of ambient sound, which resembles the noisy chatter of a

restaurant full of patrons.

"People with Parkinson's disease commonly have voice and speech problems," said Jessica Huber, an associate professor in Purdue's Department of Speech, Language and Hearing Sciences. "At some point in their disease they will have some form of voice or speech disorder that generally occurs a little later in the disease."

Parkinson's affects 1.5 million people in the United States and is one of the most common degenerative neurological diseases. About 89 percent of those with Parkinson's have voice-related change, which is related to how loudly they speak, and about 45 percent have speech-related change, or how clearly they speak.

"A major therapy is to get people to speak louder, which also may cause them to articulate more clearly," Huber said.

The most common therapy, the Lee Silverman voice treatment program, trains patients to speak louder in one-hour sessions four days a week for a month.

"Some Parkinson's patients do great with this approach, but others do not," Huber said. "They forget to keep speaking louder the minute they have left the therapy room. Lee Silverman tends to work less for people with later stages of disease or those who have some cognitive decline. So I wanted to know whether there was an easier way to cue people during therapy, rather than telling them, 'Try to be twice as loud,' or 'Try to focus on this sound meter and achieve this loudness.'"

Huber used a new approach: The patients were asked to speak louder while a recording of background "multitalker babble noise" was played. The noise is essentially the sound of a restaurant full of patrons, but without the clattering silverware and clinking glasses.

"They had an easier time getting louder when I had the noise in the room," she said. "Ordinarily, when I asked them to be twice as loud they would say they couldn't. They couldn't speak 10 decibels louder, but when I turned on the babble noise, they spoke over 10 decibels louder."

The background sound elicits a well-known phenomenon called the Lombard effect, a reflex in which people automatically speak louder in the presence of background sound.

"You go into a loud room at a party and you talk louder without even realizing it," Huber said. "We've all had the experience where the room suddenly gets quiet and you're still shouting but you didn't know you were."

Huber created a new electronic technology using this principle. The voice-activated device automatically plays the background babble when the person begins to speak. A sensor placed on the neck detects that the person has begun to speak and tells the device to play the babble through an earpiece worn by the patient.

"I got the idea that if we train them with a natural cue in their everyday environment, we will probably get better results," she said. "We ask them to wear the system for about four hours a day as they go about their daily routine."

A critical part of the research is to integrate the voice-detection sensor, called an accelerometer, developed in work led by biomedical engineering doctoral students Matias Zanartu and Julio C. Ho and biomedical engineering professor George Wodicka, head of Purdue's Weldon School of Biomedical Engineering.

"This sensor is crucial because it is essential that the background babble noise only turn on when the subject talks," Huber said.

The device prototype was built by engineering resources manager Jim Jones and senior research engineer Kirk Foster, both in the Weldon School. An earlier prototype had been built by Scott Kepner, manager of technical services, and Derek Tully, assistant manager of technical services, both in the Department of Speech, Language and Hearing Sciences.

Six patients wore the portable system for eight weeks. Data collected showed the system effectively prompts Parkinson's patients to speak louder and more clearly.

"Their speech changes significantly," said Huber, who is working with Meghan Darling, a doctoral student in Speech, Language and Hearing Sciences. "There have been times where I have called patients and they've had the device on and I didn't really recognize them. And these are patients I've known for a long time. This is beneficial also because it trains them in their everyday environment - in their homes, with their spouses, in their churches, in their social groups."

Huber determined the system works by measuring how much louder patients talked while on the device and without the device after eight weeks of training.

The researchers also are interested in examining the physiological changes elicited by the device. Patients wear a mask and sensors in elastic bands placed around the rib cage to precisely recording respiratory, laryngeal and articulatory data.

"We know the lung volume, and we know the pressure and the airflow they generate during speech, which tells us not only whether they are talking louder but how they are talking louder," Huber said. "For example, maybe they are using solely the respiratory system to get louder, or maybe it's all about the larynx."

The researchers also will test how well the system works by having people who are not speech pathologists listen to the patients pronouncing words that could be easily confused with other words.

Researchers will work in the future with patients at the Rehabilitation Institute of Indianapolis. Further research is needed to determine whether patients continue speaking louder when they are not wearing the device. The system could be further developed to use rechargeable batteries, Huber said.

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