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Technologies Eliminate Language Barriers

By Tracy Staedter, Discovery News

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Nov. 22, 2005— New kinds of speech recognition and translation systems could one day lead to tiny mouth and throat implants that would let a person instantly speak other languages.

The technologies are being developed at Carnegie Mellon University in Pittsburgh and the University of Karlsruhe in Germany by Alex Waibel, professor of computer science at both universities.

"Our vision is to create technologies that make the language barrier go away entirely," said Waibel.

Recently at Carnegie Mellon, Waibel and members of his team demonstrated speech systems that they have refined over the last two years.

One prototype translates unspoken words. An arrangement of tiny electrodes fastened to a person's cheek and throat track and measure electrical currents generated by the muscle movement of silently mouthed words and convert them into audible words in another language.

A consumer isn't going to walk around with a dozen electrodes affixed to their face, so making a system commercially viable will require more work in shrinking the components and determining the best combination and location of sensors, said Chuck Jorgensen, chief scientist for neuro-engineering at NASA Ames Research Center.

"The technical problems are very solvable from an engineering standpoint. The point that remains to be clarified is how many sensors and in what location," he said.

Another Carnegie Mellon prototype involves a pair of translation goggles that project translated words onto a virtual screen for the wearer, which Waibel compared to life with subtitles.

A more subtle approach relies on an array of ultrasound speakers that direct a beam of translated words to a listener without disrupting people nearby.

Such a system could replace the headphones worn by international audience members listening to a speech.

Software Advances

Waibel and his team are overcoming language barriers not only with innovative devices, but with the underlying software.

In the past, speech-to-speech translation systems have been limited to specific topics, such as making hotel reservations, shopping, or providing medical services.

That's because programming the software to deal with the starts and stops of spontaneous speech is a labor-intensive ordeal.

But by taking advantage of two main technological advances, Waibel and his team have designed a system that is no longer constrained by topics.

The first involves new statistical computer programs that are able to analyze language and make more accurate predictions about the meaning and how it should be translated.

For example, when translating the English word "bank," the statistical method considers such variables as the context of the word and also how frequently previous use of it might have meant either a financial institution or the side of a river.

Then, instead of programming a translation system from scratch, Waibel applied his statistical computer method to the abundant speech and language data from translated meetings at the United Nations and in European parliaments.

The computer program was able to learn from the available translation and then make accurate predictions about how additional words and sentences should be translated.

The current system simultaneously translates words from English to Spanish to German in a wide variety of situations, including lectures, television broadcasts and parliamentary speeches.

The team plans to extend the capabilities to business meetings and telephone conversations and to incorporate additional languages by next year.

In the near future, communicating in a foreign tongue may be as easy as speaking in your native language.

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