

CITY/AREA

Machine speaks tongues

3 languages exchanged by computer

By Byron Spice

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You speak only English. The person at the other end of the telephone conversation speaks only German. Yet he understands everything you say. And you understand him.

To top it off, someone who speaks only Japanese could join the conversation and understand both of you.

That is the idea behind Janus, a computerized speech translation system being developed by an international consortium that includes Carnegie Mellon University.

You understand what your German and Japanese colleagues are saying because you do not hear their voices; rather, you hear a Janus' interpretation of what they said, vocalized by a computer-synthesized voice.

The system has a limited vocabulary — about 400 words — and it stumbles when it encounters words or sounds it does not recognize. Certainly no one will be using the system to carry on extended conversations any time soon.

But Alex Waibel, senior research scientist at Carnegie Mellon's Center for Machine Translation, said those limitations were beside the point. "Do you want to wait for the ultimate system," he asked, "or do you want one that handles a limited domain but can be easily retrained?"

Named for the two-faced Roman god of beginnings, Janus clearly is designed to meet this second goal, and Waibel said it was possible that a "conversational survival" system such as Janus might be in use within five years for people who want to register for international scientific meetings, order merchandise from catalogs or make hotel, train and airline reservations.

Conceivably, the "ultimate" system to which Waibel alluded could someday be used for dubbing movies and translating newscasts as well as for general telephone conversations.

"There's a real need nowadays to communicate between people," he said. Diplomats can afford expensive, human interpreters; average mortals who just want to do business with foreigners cannot.

Computerized systems thus could encourage more international trade and tourism by helping people negotiate foreign languages, Waibel said.

They may prove particularly important in Europe, where a common market and currency will soon tie together countries whose people don't speak the same languages.

The idea is simple; the technology is tough.

Teaching a computer to recognize the spoken word is a task that scientists have struggled 30 years to master. Without the wealth of knowledge and experience of the average human, Waibel said, a computer has difficulty distinguishing "this machine can recognize speech" from "the machine can wreck a nice beach."

Once the machine has figured out the words a person has said, it still has to analyze the meaning of what the person said and find equivalent words in the target language. "It's an understanding process rather than a transcription problem," he explained.

Like other machine translation systems, Janus uses a set of rules and definitions for analyzing the original text and reconstructing the message in the target language. But to aid in deciphering the ambiguities of the spoken word, it also employs "neural networks" — computer techniques for mimicking how the mind works.

The neural nets allow Janus to learn on its own rather than relying on rigid rules alone. It thus may be able to adjust over time to different dialects and other verbal tics, Waibel

said.

The Janus collaboration began in 1988 between Carnegie Mellon and Japan's Advanced Telecommunications Research laboratories and expanded a year ago to include electronics giant Siemens A.G. and the University of Karlsruhe in Germany.

The English-German and German-English portions of the system began operating this summer; installation of the Japanese component was completed just a couple weeks ago. Thus far, it has displayed 90 percent accuracy within the constraints of its vocabulary.

Future work will focus on how to deal with "spontaneous speech" — the coughs, "uhs" and "ahs" that pepper human speech. These noises, along with background noises and the hum of the telephone itself, can confound computer systems now, Waibel said.