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3-D teleconferencing may soon be possible

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Thanks to the work of a Penn computer science professor, it may soon be possible to see a three-dimensional image of someone with whom you are having an Internet conversation.

Kostas Daniilidis, the head of Penn's tele-immersion team, is working to create a 3-D teleconferencing system with a team of professors, undergraduates and graduate students.

His work is part of the National Tele-Immersion Initiative, and similar research is being done at Brown University and the University of North Carolina at Chapel Hill.

Tele-immersion will be "an enabling technology for asking scientific questions in the social sciences and humanities," Daniilidis said.

Daniilidis foresees a wide variety of applications for the technology, from surgeons' training to virtual rehearsals of plays. A virtual operating room is currently under development at Chapel Hill.

To test the technology with long-distance conferences between universities, the researchers use Internet2, a high-speed network separate from the public Internet. But first, they must warn the network administrators that the flood of traffic is not the work of a hacker.

"There is no other application in the world... that can take such bandwidth," Daniilidis said, adding that Penn's Internet2 connection has

been underutilized. The average usage is 25 megabits per second, but during demonstrations of the technology, that figure nearly doubles.

At Penn's General Robotics, Automation, Sensing and Perception lab, the system is being tested over a local connection. The 3-D image of Engineering junior Rajat Arya was recognizable, but patches were occasionally missing and a few specks appeared to float in midair. The overall effect, however, was solid.

Arya, who is on the tele-immersion team, said the project has been an educational experience for him.

"It's neat to see theory applied," Arya said. "It all gets used. It all comes back to solid theory."

"They are not so clean like cartoons, but they are real, three-dimensional transmissions of people," Daniilidis said, comparing the technology to virtual reality systems.

To see the image in three dimensions, viewers don a set of polarized glasses. The primary participant's glasses emit an infrared signal to track their head movements, and the image moves accordingly. The effect is like changing the viewpoint in a video game.

According to Daniilidis, "the main technical trick is that you can be inserted in a place and look from everywhere."

The system makes use of several computers to merge the signals from seven cameras into a single 3-D image. The software makes it possible to view a profile of a participant, though the cameras only capture frontal views.

The technology also makes it possible to include objects in conferences that only exist on computers. Daniilidis illustrated this capability with a picture of a conference between two interior designers with a 3-D virtual model between them. He added that it is also possible to replace the background of an image with a virtual one.

It is unlikely, however, for such a system to be used outside the lab anytime soon. In addition to the immense bandwidth requirements, Daniilidis expects a commercial system to cost around $16,000.

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