Virtual Visions

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As bustling students make their daily weave through UNC's campus, many of them don't realize that cutting-edge virtual reality technology lies tucked away in Sitterson Hall.

In rooms full of cascading wires, macabre mannequin parts, glowing computer screens and strange headgear, researchers are developing an office that blurs the line between the physical and the intangible.

The "Office of the Future" project is working to merge virtual reality and video-conferencing, bringing together geographically distant people in a simulated, immersive environment. This environment, generated by ceiling-mounted projectors and cameras, creates the feel that distant people are actually in the same physical room.

Greg Welch, a UNC computer science professor and investigator for the project, said this mutual office environment of tele-immersion will be especially helpful for professional collaboration. "Occasionally, you need to communicate with someone," he said. "Usually, you use the telephone, a 2-D televideo system, or you get on an airplane and fly to them."

If professionals want to avoid the time, cost and hassle of flying, they simply will be able to go to their "Office of the Future." There they will sit down at their desks, fire up the cameras and projectors and communicate with their partners, whose own offices and bodies are projected in real time and three-dimensionally on the display screens.

Welch said the "Office of the Future" greatly outpaces the current two-dimensional televideo technology. "A lot of what we do with talking to people is 2-D televideo, which is subtly difficult to use," he said. "When the other person holds something up, they have to remember to turn it. It requires a mental overload."

The "Office of the Future" remedies this problem. By wearing a tracking device called a HiBall, which utilizes infrared technology to determine the position of the user's eyes, the professionals can change their viewpoints of their partners and their partners' offices, simply by moving their own heads. If the professionals want to see a diagram in their partners' offices that are blocked by the partners' bodies, they can lean to the right and get a clear view of the diagram.

The professional also can interact with the partner on a higher level through virtual models that are displayed in each office. Both partners can manipulate the three-dimensional model to make collaboration easier.

"Beyond simply wanting to talk to people, the interaction with the 3-D graphics have applications that allow you to see virtual objects and synthetic models," Welch said. "In the office, you're working by yourself or one or two other people. If you're doing 3-D graphics to design a submarine, you want to collaborate with a fellow engineer."

The two engineers could be in their two separate offices, yet working on the same virtual three-dimensional model of the submarine, trying out different hull designs or placing the missiles in different locations.

While the researchers still have some kinks to work out of the prototype office, Welch said the technology is basically ready for commercial use. "We have the prototype system in place," he said. "Someone could come up with enough money and commercialize it."

Welch said the "Office of the Future" could now be used commercially in limited application if the buyer wanted to just use it for across-the-desk virtual teleconferencing. "Even the basic office of the future idea is not that far away if you put money aside."

But the technology that plays into the development of the "Office of the Future" is not limited to teleconferencing applications.

The "Office of Future" project was formed at UNC in 1996 as part of the National Science Foundations Science and Technology Center for Graphics and Visualization. In 1997, the research members expanded to include the National Tele-Immersion Initiative. Participating STC members include UNC, whose primary investigator is Henry Fuchs, and Brown University, and the NTII team includes Advanced Networks and Services and the University of Pennsylvania.

Welch said the "Office of the Future" is actually an umbrella project for other research initiatives, such as tele-immersion and enhanced human-computer interaction. The "Office of the Future" will not only serve as a portal to other offices and a typical work space, but it also will be integrated with a professional's computer desktop.

"We want a better working environment while working with computers," Welch said. "Now we're working on little monitors. Today's computer desktop is more like a tray on an airplane. We like desktops where we can spread papers out, where you can look at things spatially."

In the "Office of the Future," all of the everyday real surfaces of objects in the office also can be used as spatially immersive display surfaces. Graphics and text can then be projected onto these objects. "Objects are going to integrate with your computer," Welch said. "Your regular trash can become your computer trash can."

Welch said tele-immersion technology also will be valuable for medical applications. "It can be used for surgical training and peer-to-peer training," he said. "Surgeons are mostly trained by apprenticeship."

Surgeons traditionally videotape medical procedures and then have other doctors or medical students watch the tape afterwards. But using this method, viewers can't change their viewpoints, and much of the footage can be confusing. "Two-dimensional images of open abdominal cavity are impossible to understand."

Taking advantage of tele-immersion technology, cameras can capture surgical procedures, and projectors can then render a model of the three-dimensional image in real time to medical students halfway around the world. "You can walk up behind the doctor, virtually of course, and see what's going on while the patient is lying there," Welch said.

After the surgery is over, the specialist surgeon who performed the procedure can then play back the model. Surgeons can go in a second time and record themselves in the model, talking about what they were doing at the time and even adding in virtual blood pressure charts.

"You can send it to medical students around the world, and it's better because you can do it in slow motion, you can stop it, you can change the viewpoint," Welch said. "It's a combination of a time

machine and 3-D interaction tools. It becomes an immersive storybook."

And Welch said the day when these advancements become a reality is not too far away. "The technology is here to do it."