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### New Mexico Professor Creates Software for Virtual Worlds

BY CAROL GOODALE

Donning special gloves and headsets with built-in visual and audio components, medical students in Hawaii and New Mexico enter a virtual operating room to hone their surgical skills.

Thousands of miles apart, they work together to treat a patient with head injuries—actually, a virtual patient with a body that responds to treatment as a living person would.

Though these surgical team members are geographically separated by thousands of miles, they can hand instruments back and forth, consult with each other, or even repeat a procedure if a mistake is made. (Mistakes on a virtual patient are never fatal.)

The complex computing processes used to build this virtual operating room are possible because of the work of IEEE member Thomas Caudell. Caudell has created the computer program called "Flatland," now supporting a number of research projects at the High Performance Computing Center of the University of New Mexico (UNM) in Albuquerque, USA, where Caudell is a professor in the electrical engineering department.

The operating room is part of Project TOUCH, an acronym for Telehealth Outreach for Unified Community Health. Project TOUCH is an initiative to improve the medical education of physicians. The project is a multi-year collaboration between the medical schools of the University of Hawaii-Manoa in Honolulu, USA, and UNM. This year, Project TOUCH received a US\$1 million grant from the U.S. Health Resources and Services Administration.

Caudell's field of study was originally astrophysics when he graduated with a Ph.D. from the University of Arizona, Tucson, USA, in 1980. But that changed when he began working for Boeing Corp. in Seattle, Wash., USA. At Boeing, Caudell first began working with the development of virtual reality systems in manufacturing and engineering processes.

Inspired by his research at Boeing, Caudell wanted to "take the biggest step I could" into the development of virtual reality. He spent more than six years



developing Flatland, the complex program that creates and runs the virtual operating room. Flatland also supports a number of other projects at the UNM High Performance Computing, Education, and Research Center in Albuquerque. Caudell leads the Scientific Visualization and Visualization Environments research area at the center.

Caudell named his main research project at UNM the Homunculus Project after the ancient philosophical term *homunculus* meaning "little man in the brain," he says. That little man, so our ancestors thought, controlled the workings of the human brain, and Caudell sees the complex data processing supported by his research as a way to learn more about how the brain works.

"I am very interested in how brains work as a model for artificial neural systems I want to be able to design, analyze, and simulate systems with brains designed on the principles of biology," says Caudell. "My point is I want to have us not only simulate neural systems, but also be able to understand them to the fullest extent possible. And I want to improve the human/computer interface to get into the data better."


To learn more about that interface, one component of the Homunculus Project integrates science, art, and technology. It brings artists and musicians UNM School of Fine Arts into the computer lab to research new ways to represent complex data in images and sounds.

"I've always liked interdisciplinary areas," says Caudell. "Moving into the gaps between disciplines really forces you to learn new things."

Caudell also has been instrumental in moving the IEEE to the forefront of the virtual reality field. In 1993, encouraged by other IEEE members, Caudell helped organize the IEEE Virtual Reality Annual International Symposium, the first of its kind and now a leading conference in the field. The last meeting was in March, 2000. As he continues to expand his work, Caudell says his hope is, "that we can improve the human computer interface, and that virtual reality will amplify our ability to understand the workings of the brain itself."

For more information about Caudell's work, visit [http://www.hpc.unm.edu/research/scientific\\_visualization/index.html](http://www.hpc.unm.edu/research/scientific_visualization/index.html).

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