UNIVERSITY *of* WISCONSIN
LA CROSSE

Distinguished Lecture Series in Computer Science

Tuesday, April 1, 2003

Henry Fuchs, Ph.D.

Henry Fuchs is the Federico Gil Professor in the Computer Science Department, as well as an adjunct professor of biomedical engineering and adjunct professor of radiation oncology of the University of North Carolina at Chapel Hill. Fuchs' research includes virtual reality as it relates to medicine through three-dimensional biomedical imaging, as well as head-mounted displays. He is also actively involved in research projects in tele-immersion and tele-collaboration. He is one of the inventors of Pixel-Planes — a family of high-performance graphics engines. He has served as a member of the National Research Council for Computer Science and Telecommunications Board (1993 to 1996), associate editor of ACM Transactions on Graphics (1983 to 1988), guest editor of the first issue of ACM Transactions on Graphics, and is currently on the editorial boards of Transactions on Visualization and Computer Graphics and the Virtual Reality Society Journal. Among his numerous awards, Fuchs received the prestigious Computer Graphics Achievement Award from ACM/SIGGRAPH in 1992, the 1992 National Computer Graphics Association Academic Award, and the Satava Award at the 1997 Medicine Meets Virtual Reality Conference. In 1997 he was inducted into the National Academy of Engineering and the American Academy of Arts and Sciences. He has been a fellow in the Association for Computing Machinery since 1995.

Schedule of Events

9 a.m. **Registration**

9:30 a.m. SYMPOSIUM: **"Augmented Reality Displays for Minimally Invasive Surgery: Enabling Doctors With Superman's X-ray Vision"**

Minimally invasive procedures, such as needle biopsies of the breast or laparoscopic gallbladder removal, involve much less pain and faster recovery than traditional "open" procedures, but are more difficult for the physician due to restrictions on visibility and manipulation. Scientists attempt to ameliorate some of these difficulties by producing a "live" synthetic view into the patient during the procedure, a view vaguely reminiscent of one seen through the large incision of a conventional open procedure. The physician wears custom goggles with a miniature display in front of each eye and a miniature video camera in front of each display. Depending on the application, imaging data for patient's internals comes either from a laparoscope (modified to provide streams of depth images) or from a clinical ultrasound imaging system. Tracking of the user's head and hand-held imaging devices (the laparoscope or the ultrasound transducer) enables the system to provide most major 3D depth: occlusion, stereopsis, and head-motion parallax. Early tests suggest that this method may afford more accurate needle positioning than that achieved with conventional clinical displays. In the future, systems with such improved visualization and intuitive hand-eye coordination may enable physicians to safely perform more complex minimally invasive procedures, ones that today require large open incisions. There may also be non-medical applications — for jet-engine mechanics, firefighters, police, even drivers of cars with GPS navigation systems.

11 a.m. **Reception for Henry Fuchs**

4 p.m. KEYNOTE: **"Immersion and Tele-immersion for the Office of the Future"**

Envision an office of the future in which the user's computing interface is more closely integrated to the local physical environment than today's conventional computer display screens and keyboards. In such an augmented computing environment the user would be "immersed" in much the same way that the user is immersed in the local physical environment. Using multiple video projectors and digital cameras much like today's conventional light bulbs, every visible surface in the office could be used for display and each such surface's location and color could be continuously acquired for both local processing and for transmission to distant locations. These capabilities may enable a more comfortable and efficient computer-augmented local environment. They may also enable distant collaborations to become more like working in adjacent offices connected by large, open windows.

With collaborators at the University of Pennsylvania, Brown University, Advanced Network and Services, and the Pittsburgh Supercomputing Center, scientists at Chapel Hill have been working to bring these ideas to reality. Depth maps are calculated from streams of video images. The resulting 3D surface points are displayed to the user in stereo. The user wears a small tracking device on the head, allowing the system to render the left and right eye images with the proper "point of view."

Among the applications being pursued for this tele-presence technology is advanced training for trauma surgeons by immersive replay of recorded procedures. Other applications involve display onto physical objects, to allow more natural interaction with them — "painting" a birdhouse, for example. In the future, continuous 3D recording and processing capability may allow closer integration of the user's physical and computing environments, enabling one's computer to answer such queries as "where did I put that book?"

More generally, scientists hope to demonstrate that the principal interface of a modern computing environment need not be limited to a screen the size of one or two sheets of paper and a keyboard and mouse. Just as a useful physical work environment is all around the office worker, so too can an ever-more-ubiquitous computing environment be around them, integrated intuitively with their physical surroundings.

5 p.m. **Informal Questions/Social**

All events in UW-L's Valhalla, Cartwright Center-Gunning Addition

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