

# Computer Briefs

## Virtual Reality

### THE ANNUAL HAPPENING

Every January for the past 7 years, I make the trip from my home near Washington, D.C. to California to attend a professional meeting entitled “Medicine Meets Virtual Reality.” As a person who grew up during the 1960s, I would better describe this symposium as a “happening.” Once a year, a visionary collection of physicians, surgeons, engineers, computer scientists, anatomists, artists, and educators come together to discuss and experience what health care practice and health care training might look like and perhaps become in the not too distant future. The subject of the meeting is the application of virtual reality or immersive technology techniques to health care practice and training.

### VIRTUAL REALITY DEFINED

What is virtual reality? Some would say that virtual reality is an advanced imaging technology through which viewers are made to feel as if they are part of the generated image. I believe that this is only one aspect of virtual reality. True virtual reality would include the presentation of all sensory information to make the subject believe that he or she is part of and can interact with a synthetic world. I use the term subject because a proper term has not yet been coined. Virtual reality is a total experience. The subject is not just a viewer, or a listener, or a feeler, or a taster, or even a sniffer. The subject is not an observer of the environment but can interact with the environment. Perhaps the new term should be *immersant*, or one who is totally immersed in a synthetic, stimulating and reactive sensory environment. The “Holideck” experience of Star Trek fame is probably the best known example of such a synthetic, immersive, virtual reality environment.

**Virtual reality is a total experience.**

The technologies needed to provide a virtual experience to the immersant have become known as immersive technologies. The idea of using immersive technologies to create a realistic synthetic environment is not new. At the turn of the last century (that’s 1900), stereo photograph viewers were very popular. This technology and technique was later mass marketed as Viewmaster.

### THE DEVELOPING TECHNOLOGY

In the 1950s, the immersive environment was best represented by Cinerama, a three-screen movie experience that also included seven sound channels including two that were positioned off of the screen to enhance the audience’s immersive experience. Today, through improved optics

and large film format, the immersive environment can be experienced through IMAX. There is also at least one IMAX film that is presented with stereo vision. At home, stereo sound recordings became available in the late 1950s, and stereo FM radio broadcasts were initiated in the early 1960s. The “stereo seat,” the one place in the room where the quality and directionality of the sound was most perfect and totally immersive, was born. The immersive environments produced by these film and recording technologies, however, are not true examples of virtual reality. The viewer or listener is merely an observer who is unable to interact with or change the environment or in some other way participate in the environmental experience.

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## THE TRUE EXPERIENCE

In a true virtual reality experience, the movements of the immersant are unobtrusively tracked, and the visual scene is changed by a computer in a realistic manner as appropriate to these movements. The immersant can see and pick up a virtual object and feel its size, shape, and weight. Walking up to a virtual wall means being unable to pass through it, just like a real wall. This sense of touch and feel is provided by haptic devices. Such devices have until now been very expensive and quite fragile, a laboratory or research device at best. Logitech has recently introduced a haptic mouse that allows the user to feel what is displayed on the computer screen. If the pointer on the screen comes to a box, the mouse will not move through it but must be guided around it. If a spring is displayed on the computer and the user mouse clicks on the unsecured end of the spring to “pull” it, the user will feel the tension of the spring through the mouse as the mouse is used to extend the spring.

## APPLICATION TO HEALTH CARE

I began by referring to a yearly happening called Medicine Meets Virtual Reality. What do you get when you intersect the domain of health care with the domain of immersive technology? When you intersect an aircraft pilot with virtual reality, you get the flight simulator. Could we not cross surgery with an immersive environment and get a patient-specific surgical simulator in which our specific patient would appear before us holographically so we could interact with it and rehearse the procedure before actually performing it? Patient-specific endoscopy and colonoscopy simulators based on Visible Human Project data already exist and are being used as training aids. Patient specific virtual colonoscopy and endoscopy are in preliminary clinical trials. Data are provided by the patient’s spiral CT. The colonoscopy takes place on a computer screen after the patient goes home. The colon can be observed from two orientations, facing inward as is the usual observation point for colonoscopy as well as facing outward, impossible with current colonoscopes. No, you cannot do a virtual biopsy, but you can move through the colon wall and observe and measure the suspected tumor from all sides. Because the procedure is truly noninvasive, watchful waiting becomes meaningful.

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## AUGMENTED REALITY

The techniques of the immersive environment can also be applied within our real environment, a domain being termed “augmented reality.” Suppose you are an obstetrician doing a fetal sonogram. Instead of looking at a monitor and imagining the position of the fetus within the mother’s womb, why not put on a special pair of glasses and look through the mother’s abdominal wall and see the fetus in its proper position—like Superman’s x-ray vision. The same technology has been applied to echocardiology.

According to the morning chronicle, physicians making house calls are coming back. There has been much talk over the past few years of house calls being made through telemedicine. Many primary care practitioners, however, know that it not just seeing and talking to the patient that creates the diagnosis, it is also touching the patient. One physician told me that a diagnosis can be made or broken by a careful, educated thump on the tummy. The haptic branch of immersive technology is working on this type of problem, being able to feel a remote environment in real time.

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So why do I travel across the country each year? To look over the technical horizon and imagine the delivery of health care in some not too distant future. n

Michael J. Ackerman, Ph.D.

Assistant Director for High Performance Computing and Communications

National Library of Medicine

Bethesda, MD 20894

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