ED386178 1995-06-00 Virtual Reality: An Overview. ERIC Digest.

ERIC Development Team

www.eric.ed.gov

Table of Contents

If you're viewing this document online, you can click any of the topics below to link directly to that section.

ERIC Identifier: ED386178
Publication Date: 1995-06-00
Author: Franchi, Jorge
Source: ERIC Clearinghouse on Information and Technology Syracuse NY.

Virtual Reality: An Overview. ERIC Digest.

INTRODUCTION

Virtual Reality (VR), a technology that began in military and university laboratories more than 20 years ago, may be called Artificial Reality, Cyberspace, or Synthetic Reality. VR is a computer-created sensory experience that allows a participant to believe and barely distinguish a "virtual" experience from a real one. VR uses computer graphics, sounds, and images to reproduce electronic versions of real-life situations.

Virtual Reality is not a computer, but a technology that uses computerized clothing to synthesize reality. Most current VR systems provide only visual experiences created by computer-assisted design (CAD) or other graphics/animation systems, but researchers are working on interface devices that add sound and touch. Eventually, VR may be delivered through direct computer-to-brain connections.

HOW DOES VIRTUAL REALITY WORK?

A breakthrough in Virtual Reality came with the development of a head-mounted display with two tiny stereoscopic screens positioned just a few inches in front of the eyes. The most popular VR system is one designed by field pioneer, Jaron Lanier (1989). The system features a head-mounted display called the EyePhone. Users also wear a DataGlove that generates movement and interaction in the virtual environment's estimated system price: $205,000.
Movement in Cyberspace is simulated by shifting the optics in the field of vision in direct response to movement of certain body parts, such as the head or hand. Turn the head, and the scene shifts accordingly. The sensation is like being inside an artificial world the computer has created.

The EyePhone uses a set of wide-angle optics that cover approximately 140 degrees, almost the entire horizontal field of view. As the user moves his head to look around, the images shift to create an illusion of movement. The user moves while the virtual world is standing still. The glasses also sense the user's facial expressions through embedded sensors, and that information can control the virtual version of the user's body.

A group at NASA developed a system of helmet, glove, and a monochrome three-dimensional reality. The DataGlove, a key interface device, uses position tracking sensors and fiber optic strands running down each finger, allowing the user to manipulate objects that exist only within the computer simulated environment.

When the computer "senses" that the user's hand is touching a virtual object, the user "feels" the virtual object. The user can pick up an object and do things with it just as he would do with a real object. The DataGlove's most obvious application will be in robotics, particularly in the handling of hazardous materials, or by astronauts to control robot repairers from the safety of a spaceship, or from a space station, or even from Earth.

APPLICATIONS OF VR

Applications for VR are many. Surgeons may soon use VR to "walk" through the brain or rehearse a surgical operation on a virtual patient. Just as flight simulators are now an integral part of pilot training, so surgical simulators will revolutionize medical training.

VR now makes possible telepresence, scientific exploration, and discovery. For example, the Jason Project for school children features both telepresence (the feeling of being in a location other than one's actual location) and teleoperation (controlling a robot submarine) (McLellan, 1995). The Jason Project, now in its sixth year, was designed to generate excitement about studying science, mathematics, and technology. NASA has a telepresence educational program that uses the Telepresence-controlled Remotely Operated underwater Vehicle (TROV) deployed in Antarctica. By means of distributed computer control architecture developed at NASA, school children in classrooms across the United States can take turns driving the TROV in Antarctica.

Someday scientists expect to explore celestial bodies and check out lakes beneath the Antarctic ice pack using VR applications. Disabled persons, through prosthetic interfaces, may one day use telerobotics to do tasks that are now only a dream; three-D sound may one day provide great applications for the blind.

Whether VR can be an effective tool for education or training depends partly on one's definition of VR and partly on one's goal for the educational experience. It may not be worth the cost if the goal of the educational experience is simply to memorize facts. However, if the goal of the educational experience is to foster excitement about a subject, or to encourage learning through exploration, or to give students a taste of what it is like to be a research scientist, then VR may be worth the expense.

DRAWBACKS OF VR

Despite enormous potential practical application, VR, in its current state, has drawbacks. It is still extremely expensive, the graphics are still cartoonish, and there is still a slight, but perceptible time lag between the user's body movements and their translation in Cyberspace. The equipment the user must wear, such as head gear, gloves, and other devices, needs refinement. At this early stage in the development of VR, no one knows what the long-term effect of using head-mounted displays might be on human eyes or what the possible psychological effect might be from spending too much time in Cyberspace. People using VR head gear sometimes complain about chronic fatigue, a lack of initiative, drowsiness, irritability, or nausea after interacting with a virtual environment for a long time. We do not know how much each of these symptoms depends on the characteristics of the VR systems themselves, or on the characteristics of the individuals using the systems.

THE FUTURE OF VR AND FUTURE POLICY DIRECTIONS

The Electronic Industries Association, a Washington, DC-based trade group representing hundreds of defense contractors nationwide, conducted a study that projected annual sales of virtual reality technology. Results project growth in defense and nondefense areas, ranging from about $100 billion in 1994 to $280 billion in 2003.

The National Research Council (NRC), conducted a study on Virtual Reality and its applications. "The federal government has a rare and important opportunity to foster careful planning for its research and development," concludes the committee in its report (Durlach, 1995). Among the committee's suggestions:

--Develop a comprehensive national information system to provide coverage of research activities and results on virtual environments in a user-friendly way.

--Establish a few national research and development teams, each focusing on a specific application. The teams could be made up of members from government, industry, and academia, and funding could be provided jointly by both the federal government and the private sector.

--Federal agencies and offices could consider experimenting with VR technology in their own workplace.

--The federal government could also explore the opportunities for early development of standards to promote compatibility of hardware, software, and networking technology.

Ten years ago VR was a science-fiction fantasy. Today it is a developing technology seen primarily in research labs, theme parks, and trade shows. Tomorrow it may be as common as television. Lanier (1989) likes to say that "VR is a medium whose only limiting factor is the imagination of the user."

BIBLIOGRAPHY

Ditlea, S. (1989, November). Inside artificial reality. "PC Computing," 91-102.
Durlach, N., & Mavor, A. S. (Eds.). (1995). "Virtual reality: Scientific and technological challenges." Washington, DC: National Academy Press.

Emery, G. (1990, December). Close encounter of the virtual kind. "Insight," 30-31.

Foley, J. D. (1987). Interfaces for advanced computing. "Trends in Computing," 62-67. (Reprinted from the October 1987 issue of "Scientific American," 257(4), 126-135. (EJ 359 987)

Fritz, M. (1990, June). Eyephones, datasuits, and cyberspace. "CBT Directions," 28(2), 11-17. (EJ 420 905)

Fritz, M. (1991, February). The world of virtual reality. "Training," 45-50.

Furness, T. A. (1988, May). Harnessing virtual space. "Society for Information Display (SID) International Symposium, Digest of Technical Papers," (1st edition). Playa del Rey, CA: Society for Information Display.

Gay, E. (1994, Winter). Is virtual reality a good teaching tool? "Virtual Reality Special Report," 1(4), 51-59.

Helsel, S. K. (Ed.). (1991, January/February). Definitions: Plethora of definitions. "Virtual Reality Report," 1(1), 3.

Interview with Jaron Lanier. (1989, Fall). "Whole Earth Review," 64, 108-119.

McLellan, H. (1995, January/February). Virtual field trips: The Jason project. "VR World," 3(1), 49-50.

Merril, J., Millman, A., Raju, R., & Roy, R. (1995, January/February). Window to the soul. "VR World," 3(1), 51-53.

Merril, J., Roy, R., Merril, G. & Raju, R. (1994, Winter). Revealing the mysteries of the brain with VR. "Virtual Reality Special Report," 1(4), 61-65.

Weimer, D., & Ganapathy, S. K. (1989, May). "A synthetic visual environment with hand gesturing and voice input." Holmdel, NJ: AT&T Bell Laboratories.

Zimmerman, T. G., Lanier, J., Blanchard, C., Bryson, S., & Harvill, Y. (1987). "A hand gesture interface device." Redwood City, CA: VPL Research, Inc.

This ERIC Digest was prepared by Jorge Franchi, Research Analyst, Office of Institutional Research, Valencia Community College, Orlando, FL. franchj@mail.firn.edu

----

Developed with funding from the Office of Educational Research and Improvement, U.S. Department of Education, under Contract No. RR93002001. Opinions expressed do not necessarily reflect the position or policies of OERI or the Department.

Title: Virtual Reality: An Overview. ERIC Digest.
Document Type: Reports---Evaluative/Feasibility (142); Information Analyses---ERIC Information Analysis Products (IAPs) (071); Information Analyses---ERIC Digests (Selected) in Full Text (073);
Available From: ERIC Clearinghouse on Information and Technology, 4-194 Center for Science and Technology, Syracuse University, Syracuse, NY 13244-4100 (free while supplies last).
Descriptors: Computer Graphics, Computer Simulation, Computer Uses in Education, Futures (of Society), Policy Formation, Professional Training, Sensory Experience, Surgery, Use Studies

Identifiers: ERIC Digests, National Research Council, Scientific Expeditions, Virtual Reality
###

[Return to ERIC Digest Search Page]