

Chapter 15 Virtual Realities

Definition

- A class of computer-controlled multisensory communication technologies that allow more intuitive interactions with data and involve human senses in new ways
- An environment created by the computer in which the user feels immersed in the present (Jacobson)

Virtual reality . . .

- Was devised to enable people to deal with information more easily.
- Provides a different way to see and experience information
- Is a tool for model building and problem solving
- Evokes a feeling of immersion, which is a critical feature distinguishing virtual reality from other types of computer applications. (a perceptual & psychological sense of being in the digital environment presented to the senses)
- Was created by Jaron Lanier, one of the developers of the 1st immersive interface devices

History

- 1960s – Ivan Sutherland created a head-mounted display but chose not to continue with this work because of primitive computer graphics
 - Morton Heilig patented Sensorama, a totally mechanical VR device that included 3-dimensional, full-color film together with sounds, smells, and the feeling of motion. Not a commercial success but reflected vision.
 - GE developed a simulator that was adapted for lunar-mission simulations and for a city planning tool in a project at UCLA
- 1970s – Air Force established a laboratory in Ohio to develop flight simulators and head-mounted displays that could facilitate learning and performance in sophisticated, high-workload, high-speed military aircraft. Resulted in the Supercockpit. Tom Furness, who directed the Supercockpit, is now director of the Human Interface Technology Lab at the U of Washington. (flight simulators have been used for pilot training since the 1920s)
 - researchers at MIT developed spatial data management system using videodisc technology
 - Myron Krueger designed responsive but nonimmersive environments that combined video and computer and he termed it artificial reality
- 1980s – technologies underlying VR came together at the NASA Amers Lab in California with the development of a system that utilized a stereoscopic head-mounted display and the fiber-optic-wired glove interface device.

Different Kinds of VR

- Jacobson proposes that there are 4 types of VR
 - Immersive VR
 - Desktop VR

- Projection VR
- Simulation VR
- Thurman and Mattoon present a model based on dimensions which includes a scale featuring 3 categories:
 - Batch processing
 - Shared control
 - Total inclusion
- Brill's model features 7 different types of virtual reality:
 - Immersive first-person
 - Through the window
 - Mirror world
 - Waldo world
 - Chamber world
 - Cab simulator environment
 - Cyberspace

Brill's model

- Immersive first-person
 - Provides an immediate, first-person experience
 - User is placed inside the image
 - The image is assigned properties that make it look & act real.
- Through the window
 - Also known as desktop VR
 - User sees the world through the window of the computer screen and navigates through the space with a control device like a mouse
- Mirror world
 - Provides a second-person experience in which the viewer stands outside the imaginary world but communicates with characters or objects inside it.
- Waldo world
 - Is a form of digital puppetry involving real-time computer animation
 - User wears an electronic mask or body armor with sensors that detect motion, a puppeteer controls, in real time, a computer animation figure on a screen or a robot
 - A "virtual actor" wears a "Waldo" that tracks the actor's eyebrows, cheek, head, chin, and lip movements, allowing these features to control the corresponding features of the computer-generated character with their own movements
- Chamber World
 - Small virtual-reality projection theater controlled by several computers that gives users the sense of freer movement within a virtual world than the immersive VR systems.
- Cab simulator environment
 - Another type of first-person VR technology that is an extension of the traditional simulator
 - Many applications in training and entertainment

- ♣ Police officers to practice driving under high-speed & dangerous conditions
- ♣ Military training – simulation games
- ♣ Flight simulators for entertainment
- Cyberspace
 - Term thought of by William Gibson in the science fiction novel *Neuromancer* (1986)
 - Global artificial reality that can be visited simultaneously by many people via networked computers
 - Linked to the idea of telepresence (the feeling of being in a location other than where you are) and teleoperation (you can control a robot or another device at a distance).

Virtual Reality in Education

- Offers educational potential in the areas of:
 - Data gathering & visualization
 - Project planning and design
 - Design of interactive training systems
 - Virtual field trips
 - Design of experiential learning environments
- Offers professional applications in:
 - Medicine
 - Aviation
 - Robotics
 - Business
 - Architectural
 - City planning
 - Interior design
 - Product design
 - Law enforcement
 - Entertainment
- East Carolina State University has established a VR and Education Lab (VREL) which has goals:
 - To identify suitable applications of VR in education
 - Evaluate VR software & hardware
 - Examine the impact of VR on education
 - Disseminate this information as broadly as possible
- When this chapter was written, most of the educational applications of VR had been developed for professional training in highly technical fields such as medical education, astronaut training and military training
- VR-based training is safer and more cost efficient than other approaches.

Research Agenda

- Current research has focused on refining and improving the technology & developing applications.

- In 1993, Thurman suggested that VR researchers need to focus on instructional strategies because “device dependency is an immature perspective that almost always gives way to an examination of the effects of training on learners, and thereby fine-tunes how the medium is applied.” At that time, not much research had been done to rigorously test the benefits & limitations of learning and training in VR.
- Any research agenda for VR needs to take into consideration existing research in related area that may be relevant
- Waldern (1991) suggest that the following issues are vital in VR research & development:
 - Optical configuration
 - Engineering construction
 - Form
 - User considerations
 - Wire management
 - Safety standards
- Waldern thinks that if ergonomics, health & safety factors are incorrect that the design will be a failure because people will choose not to use it.

Theoretical perspectives

- To try to understand this emerging technology and how it can be applied in education and other fields, theorists have looked to many other sources:
 - Ecological Psychology Perspective – J. J. Gibson
 - Computers as Theater Perspective – Brenda Laurel
 - Spacemaker Design Perspective – Randal Walser
 - Constructivist Learning Perspective – Meredith & William Bricken
 - Situated Learning Perspective – Hilary McLellan

Design models and metaphors

- Wickens & Baker proposed a model of VR parameters that should be considered for instructional design.
- Five components of VR
 - Dimensionality
 - Motion
 - Interaction
 - Frame of reference
 - Multimodal interaction (enhanced sensory experience)

Conclusion

- VR has much potential & implications
- Research & development is still in the early stages since VR has only been around for a decade (1996).
- Needed research is broad in scope
- Research can be expected to expand as the technology improves and becomes less expensive