Professional Practice - IV

Presentation on

Virtual reality

Virtual Reality: A Short Introduction

Terminology

❖The term 'Virtual Reality' (VR) was initially coined by Jaron Lanier, founder of VPL Research (1989).

❖ Other related terms include 'Artificial Reality' (Myron Krueger, 1970s), 'Cyberspace' (William Gibson, 1984), and, more recently, 'Virtual Worlds' and 'Virtual Environments' (1990s).

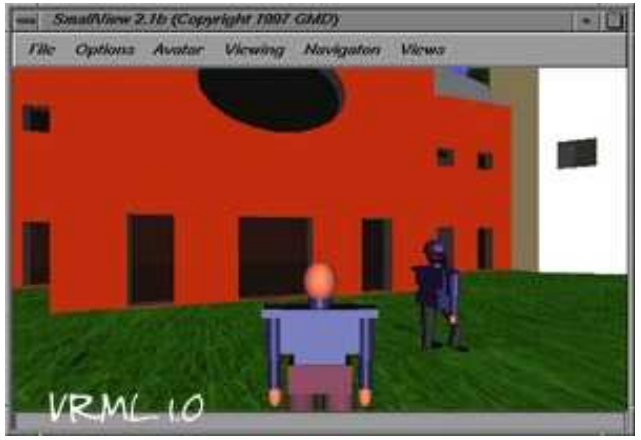
❖Today, 'Virtual Reality' is used in a variety of ways and often in a confusing and misleading manner. Originally, the term referred to 'Immersive Virtual Reality.' In immersive VR, the user becomes fully immersed in an artificial, three-dimensional world that is completely generated by a computer.

Presently there are numerous different types of VR systems, but most can be classified into one of the following three categories; Desktop VR, Video Mapping VR, and Immersive VR.

Desktop VR (Window on a World)	***Video Mapping VR***	***Immersive VR***
Desktop VR is when a computer user views a virtual environment through one or more computer screens. A user can then interact with that environment, but is not immersed in it. All of the mastheads on this website are from Desktop VR environments.	Video Mapping VR uses cameras to project an image of the user into the computer program, thus creating a 2D computer character. Although fully immersed in the environment, it is difficult to interact with the user's surroundings.	Immersive VR uses a HMD to project video directly in front of the user's eyes, plays audio directly into the user's ears, and can track the whereabouts of the user's head. Then a dataglove (or datasuit) is used to track movements of the user's body and then duplicate them in the virtual environment. When the user cannot distinguish between what is real and what is not, then immersive VR has succeeded.

To run the most basic VR system one must have the following:

- one or more powerful computers
- sensors (or input devices)
- display arrangements
- virtual environment rendering software



Applications of Virtual Reality

- Medicine
- Science
- Education and Training
- Entertainment
- Tools for the Handicapped
- Robotics
- Military
- Sports and Fitness
- Art
- Architecture
- Business

Medicine

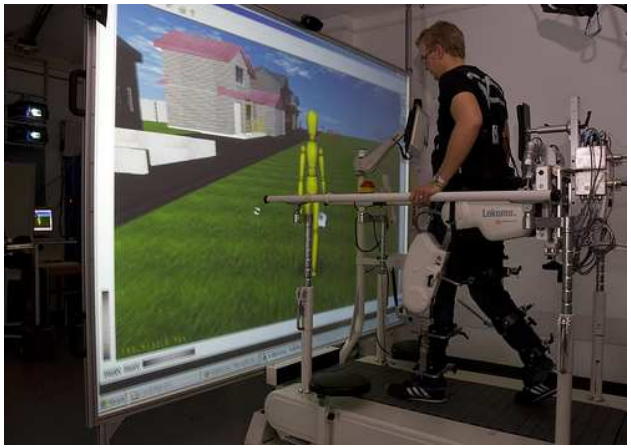
❖Motion analysis using VR sensors can be used to help train athletes to prevent injuries.

❖Rehabilitation and physical therapy can be enhanced by the use of VR sensory equipment to pinpoint motor control problems.

❖The study of the human body can be facilitated by the use of 3D models of the body in which medical professionals or students can move to observe functions. .

❖New drugs can be tested in VR by examining how they will react or bond with molecules.

❖Surgeons could conduct robotic surgery from anywhere using telepresence techniques and be protected from the risks of exposure during operations.



Science

❖Many scientific models could be better understood if they could be viewed in 3D.

❖Mathematicians could visualize three-dimensional equations.

❖Researchers could create interactive simulations of scientific phenomena.

❖Students could learn about scientific concepts by experiencing them in VR.

❖Chemists can study molecular structure and interactions without actually mixing chemicals

Education and Training

❖VR is an effective aid to teaching which allows students to visualize information and to interact with information in a multisensory immersive environment.

❖Virtual classrooms allow students to attend classes without actually being there.

❖VR provides the tools to visualize and manipulate abstract information making it easier to understand concepts.

❖Simulators can be used for training (i.e. flight simulators for pilots, virtual cars for driver training).

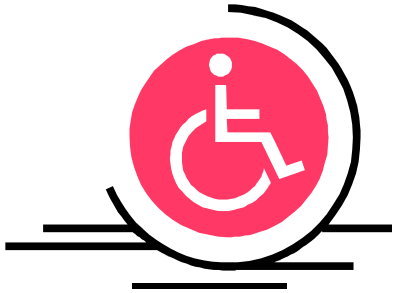
❖Battlefield simulations can be used to train soldiers.

Entertainment

❖VR is used in video games where the game player becomes part of the action.

❖Movies and television shows are using more VR (Earth 2, Tek Wars, Star Trek).

❖Sports such as golf and racquetball can be played in VR.



Tools for the Handicapped

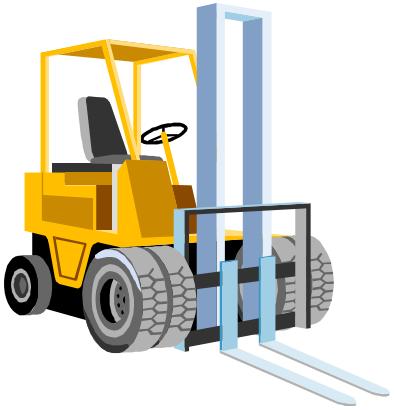
❖The input devices used in VR provide mechanisms for handicapped persons to communicate and navigate.

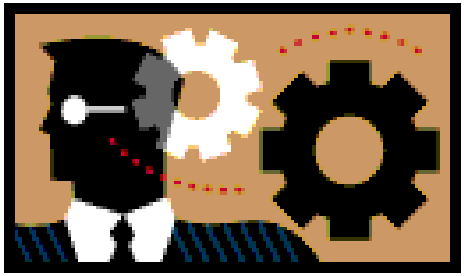
❖Physically handicapped individuals can participate in virtual activities such as sports or dancing.

❖Accessibility to structures can be tested by doing a walk through a virtual building examining the spacing dimensionality and reachability of objects.

Robotics

❖Robots can be controlled from a remote location.





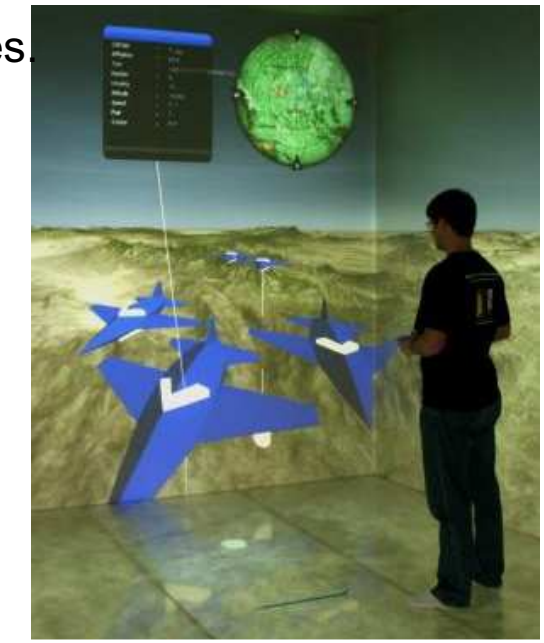
Military

❖Military training and operations was one of the first practical applications of VR (flight simulators, development and testing of combat strategy).

❖VR allows avoidance of exposure to hazards such as firing of real weapons, or performing dangerous maneuvers.

❖Control of weapons after firing them by telepresence from a safe distance reduces risks (smart bombs).

❖Optically combining critical information such as altitude, airspeed and heading with an unobstructed view through the forward windscreen of a fighter aircraft allows the pilot to fly without having to look around the cockpit at gauges.

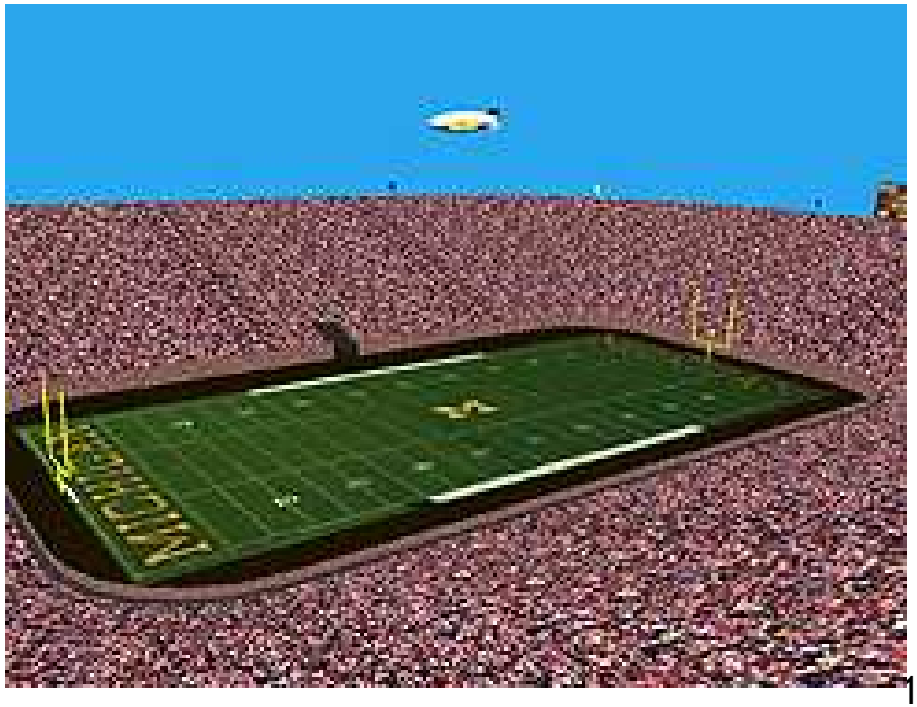


Sports and Fitness

❖VR can be used to enhance the experience of indoor exercise by creating realistic simulations (a bike ride through the country on a stationary exercise bike).

❖Realism is created by the use of tactile and/or force feedback which compensates for muscular movement or indicating contact with objects.

❖Golf can be played on a VR course.



Art

❖A virtual theatre can have participants involved in the play controlling the plot by selecting from a set of scripts.

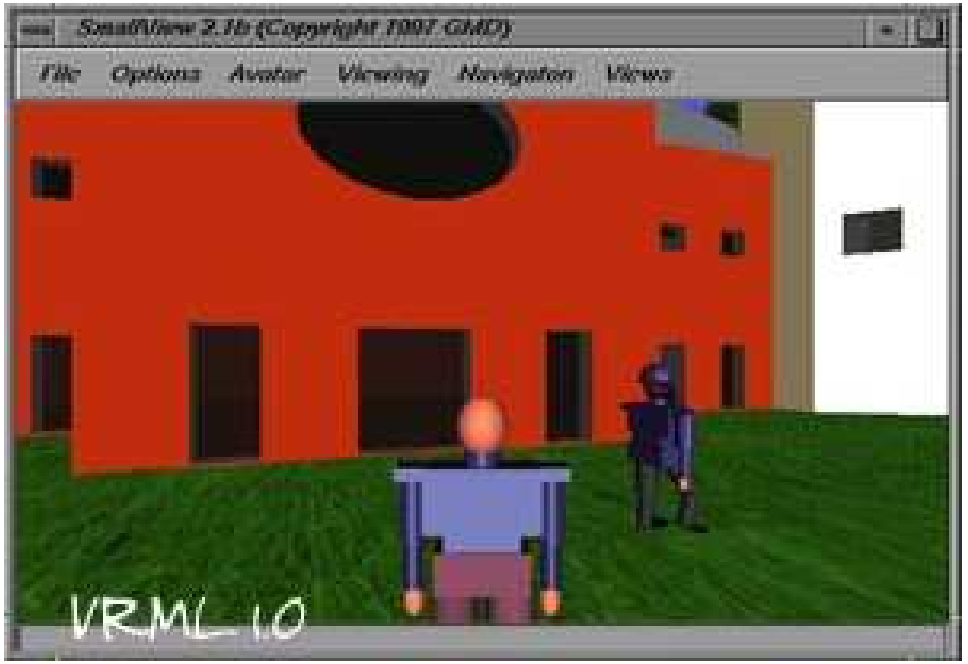
❖One could visit a museum or art gallery using VR.

❖Instead of passively viewing a piece of art, one could become a part of it.

Architecture

❖VR offers the potential to enhance architecture by allowing a simulated walkthrough of a virtual space before the expensive construction is undertaken.

❖Problems can be found and fixed before they become real.



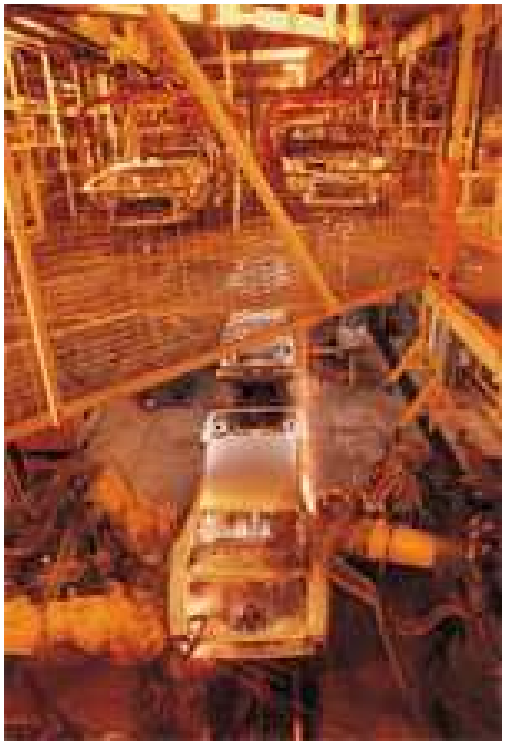
Business

❖A virtual spreadsheet where information can be interactively modified and examined could allow businesses to experience what if scenarios.

❖Information can be visualized in 3D.

❖Virtual prototyping can save time and money in the development of new products.

❖Virtual meetings.



Future scope

Future:
Where are we going?

1999	10% of the world's computing power was non-human
2029	99% of the world's computing capacity will be non-human

❖In the past, computing power has doubled approximately every 18 months, a trend that is known as Moore's Law.

❖(Webopedia 2004) If this is the case then we should have a computer powerful enough to run immersive VR programs in our own homes by the year 2037.

❖ With the advancements in nanotechnology and quantum computing (where computers mimic the human brain's processes) this figure could be expected to grow exponentially.
❖Today VR technology is still in its infancy, and there are damaging flaws. Graphics, no matter how impressive, are not lifelike.
❖Time lags are far too long. Optic and auditory hardware are not 100% realistic. Users can walk into walls or pick up an object without feeling a thing.
❖ The equipment is still far too expensive for everyday use.
❖But each and every one of these drawbacks is the subject of intense research and work; the problems are being overcome, and VR is poised for its major breakthrough. (Sherman and Judkins 1992)

❖When we use the human brain as the standard for computing ‘real-life’ scenarios we can estimate when VR systems can do the same.

❖The human brain can perform 20 quadrillion calculations per second, while the most powerful supercomputer in the world today, The Earth Simulator in Yokohama, Japan, can perform 35.86 trillion calculations per second. (www.cnn.com 2004)

Bibliography

•**REFERENCES**

•**The Encyclopedia of Virtual Environments** (EVE) at the University of Maryland at College Park is a collection of information about the many applications and components devices and technologies which comprise Virtual Environments.

•**Case Study 10: Virtual Reality Technology** contains a definition of virtual reality and a general list of current applications of V R.