

# Virtual Environments - Basics -

# What Is Virtual Reality?

A Web-Based Introduction  
Version 4 – Draft 1,  
September, 1998

Jerry Isdale

<http://www.isdale.com/jerry/VR/WhatIsVR.html>

**Virtual Environments** allow humans to visualize, manipulate and interact with computer models and extremely complex data. Computer generated visual, auditory, force or other sensory outputs to the human user can be mixed with the sensor based models of the real world to generate a virtual (world)environment within the computer.

- ❑ This “virtual environment” (VE) may be a CAD model, a scientific simulation, or a view into a database.
  
- ❑ The *users can interact and directly manipulate objects within VE.* Some virtual environments are animated by other processes, physical simulations, or simple animation scripts.
  
- ❑ VE technology has already found *applications* in industrial design, communications, telerobotics, scientific research, medicine, training & education, and entertainment.

# Types of VR Systems

... according to [Isdale]

- ❑ **Window on World Systems (WoW)**, or Desktop VR.
- ❑ **Video Mapping** .... variation of the WoW approach where the user watches a monitor that shows his body's silhouette interaction with the world.
- ❑ **Immersive Systems** .... completely immerse the user's personal viewpoint inside the virtual world. These "immersive" VR systems are equipped with a *Head Mounted Display (HMD)*, or a 'Cave' or room in which the viewer stands. The "Holodeck" used in the "Star Trek: The Next Generation" is an extrapolation of this technology.
- ❑ **Telepresence** .... links remote sensors in the real world with the senses of a human operator. *Applications* => remote sensors might be located teleoperated robots for fire fighting, space or undersea operations. Surgeons are using instruments on cables having a video camera at the point of operation.
- ❑ **Mixed Reality**, or Seamless Simulation, ... mixes the Telepresence and Virtual Reality systems. The computer generated inputs are merged with telepresence inputs and/or the users view of the real world. *Applications* => surgeon's view of a brain surgery is overlaid with images from earlier CAT scans and real-timeultrasound. A fighter pilot sees computer generated maps and data displays inside his HMD.

## Virtualized Reality

- ❑ **Prof. Takeo Kanade**, Robotics Institute,  
Carnegie Mellon University, Pittsburgh, PA, USA  
<http://www.cs.cmu.edu/~virtualized-reality/>

*“In contrast to virtual reality, in which synthetic environments are created, Virtualized Reality is based on events taking place in the real world, which are captured and processed by computer manipulation”, [Kanade].*

- ❑ **Prof. Pierre Boulanger**, Canadian Working Group on  
Virtualized Reality Systems, NRC-IIT, Ottawa, ON, Canada  
<http://www.virtualizedreality.org>

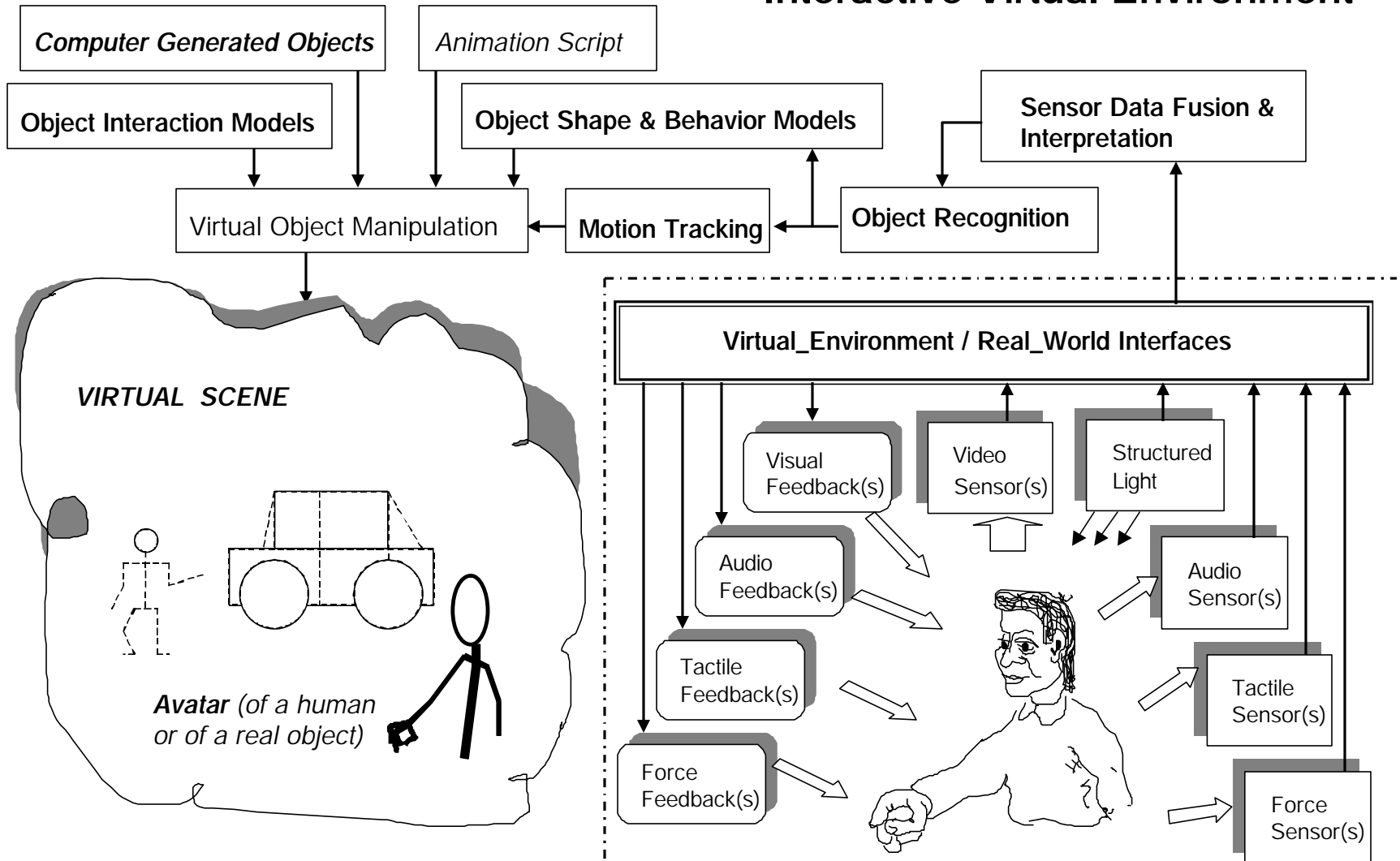
*“Virtualized reality is a generalization of the standard visual simulation paradigm where the model and the actions used in the simulated world are extracted from various sensors and information retrieval systems. The resulting visual simulation aims at an exact representation of the real world allowing for photo realistic rendering, telepresence, remote control, and intuitive information queries” , [Boulanger].*

## **Virtualized Reality Systems**

are based on the integration of the following areas [*Boulanger*]:

- High speed networking and distributed real-time database
- Immersive display systems
- Network based remote sensing
- 3D sensors such as: 3D body trackers, color range sensors for short and long distances, and various input devices
- Advance VR graphic libraries and modeling utilities
- High speed graphic machines and parallel computers
- Virtual Simulation Based on Physical Modeling

# Interactive Virtual Environment



# Augmented Reality & Computer Augmented Environments

- **Prof. Jim Vallino**, Departments of Computer Science and Software Engineering  
Rochester Institute of Technology, Rochester, N, USA  
<http://www.cs.rit.edu/~jrv/research/ar/>

“The basic difference between the Augmented Reality and the Virtual Reality is the immersiveness of the system. Virtual reality strives for a totally immersive environment. The visual, and in some systems aural and proprioceptive, senses are under control of the system. In contrast, an augmented reality system is augmenting the real world scene necessitating that the user maintains a sense of presence in that world. The virtual images are merged with the real view to create the augmented display. There must be a mechanism To combine the real and virtual that is not present in other virtual reality work” [Valino].

# Augmented Reality & Computer Augmented Environments

- ❑ **SONY Links on Augmented Reality Projects**

<http://www.csl.sony.co.jp/project/ar/ref.html>

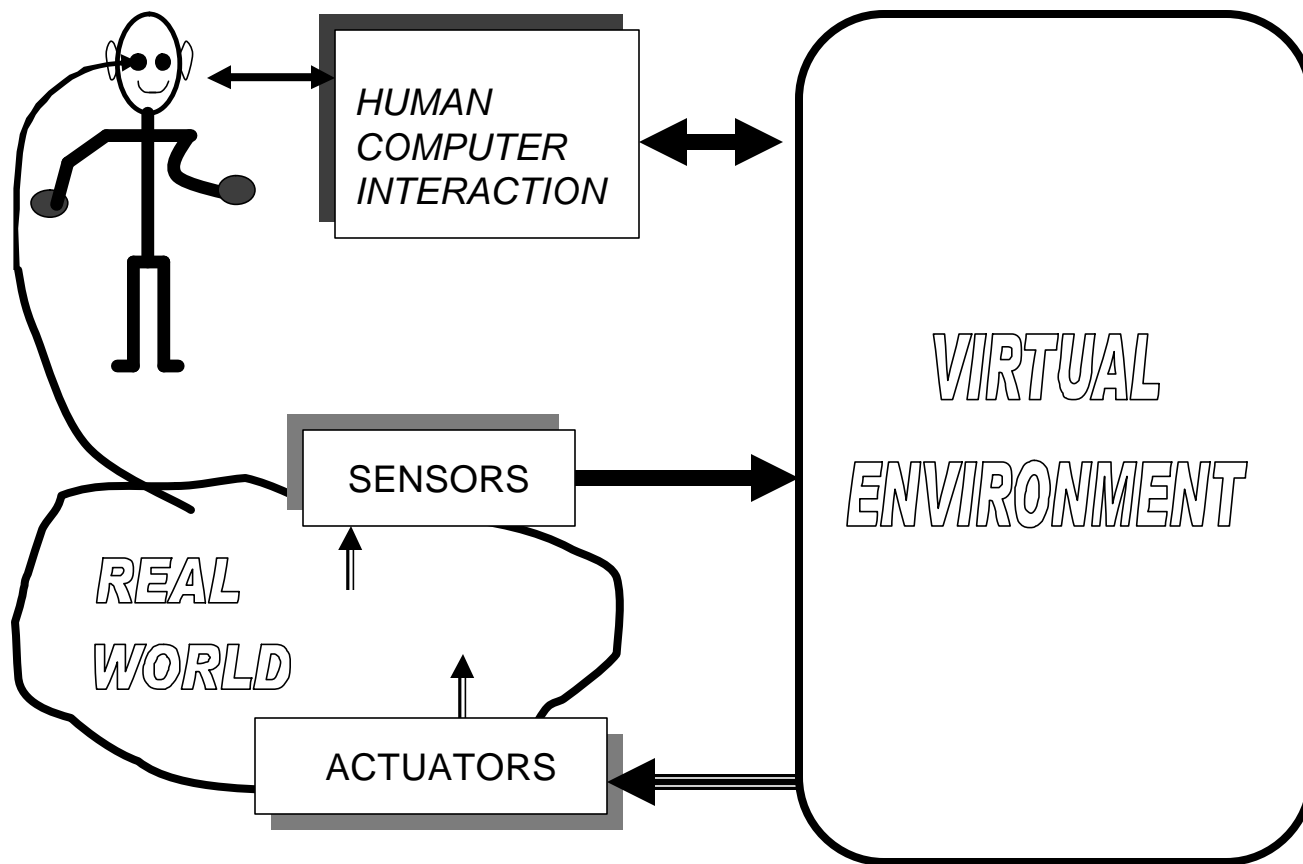
- ❑ **US Department of the Navy, Office of Naval Research,**  
“Battlefield Augmented Reality System (BARS)”

<http://ait.nrl.navy.mil/vrlab/projects/BARS/BARS.html>

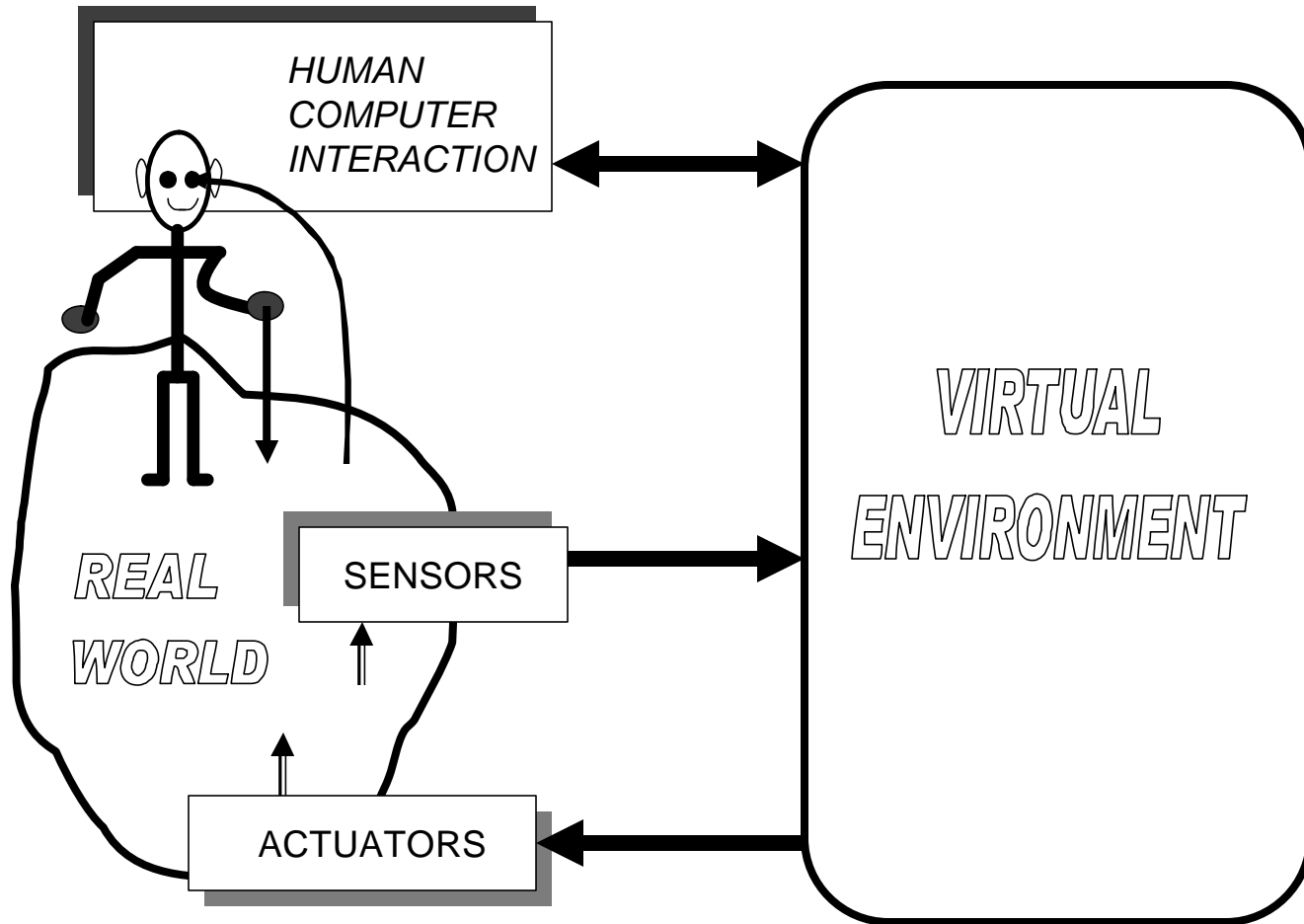
- ❑ **US National Tele-Immersion Initiative**

<http://www.advanced.org/teleimmersion.html>

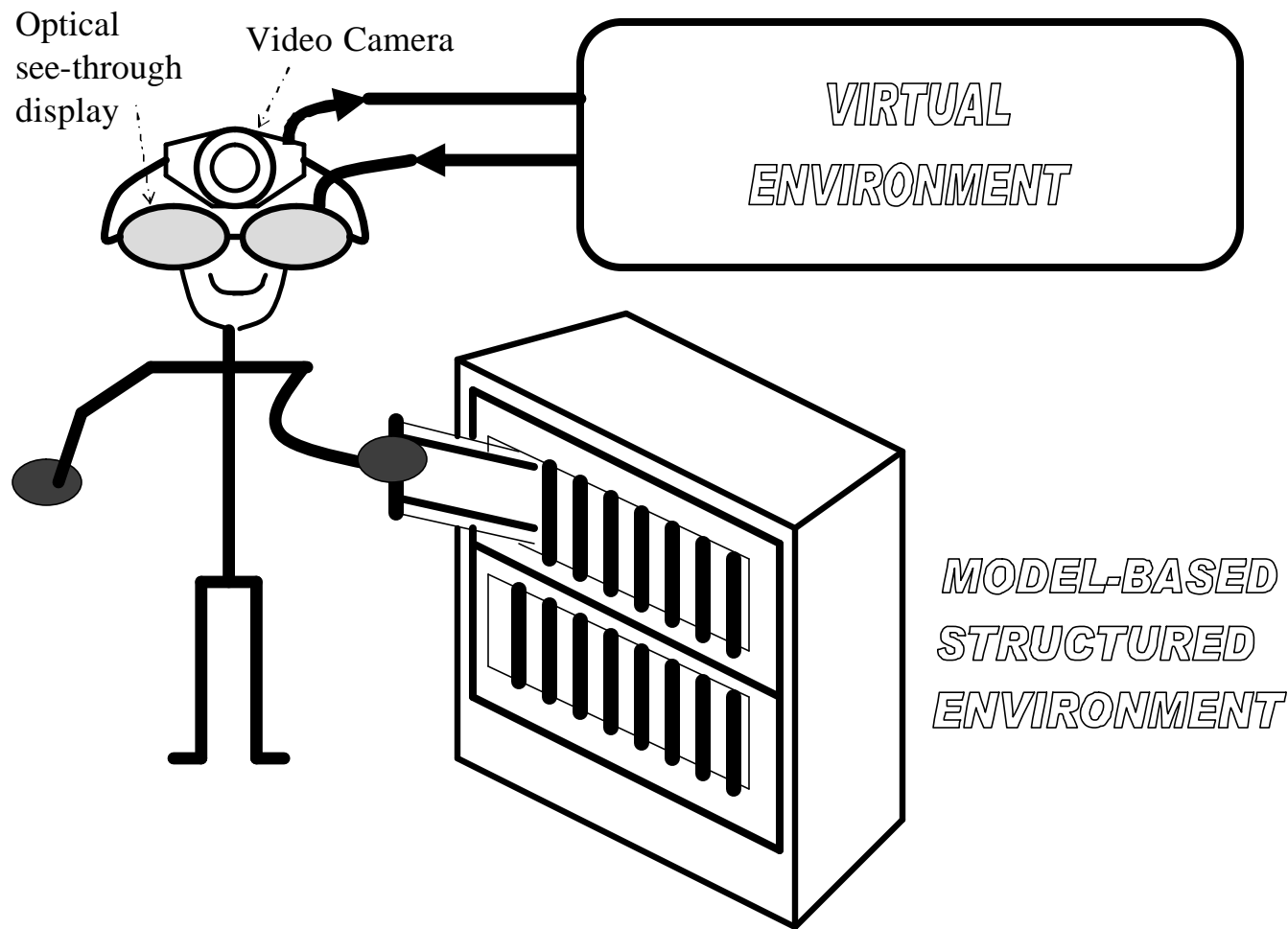
“Tele-Immersion (National Tele-immersion Initiative - NTII) will enable users at geographically distributed sites to collaborate in real time in a shared, simulated environment as if they were in the same physical room. This new paradigm for human-computer interaction is the ultimate synthesis of networking and media technologies and, as such, it is the greatest technical challenge for Internet2”.



Interfacing virtual environments with the real world and human operators



Human interaction with the real world and VE in augmented virtual reality applications



Human operator using augmented virtual reality in a structured real world.