Force Feedback
In
Virtual Reality

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Virtual Reality

- The impression of being present in a virtual environment that does not exist in reality is called **virtual reality**

- The user has impression of presence in that world and can navigate through it and manipulate objects being in that world

VR History (1)

- VR can be viewed as an evolution of simulator technology

- 1950s 'Sensorama' - an "Experience Theatre" (Morton Heilig)

- "The Ultimate Display", Ivan Sutherland, 1965

- "Artificial Reality", Myron Kreuger, e.g. "Critter"

VR History(2)

VR on the Net

Virtual Reality Modelling Language

- First International Conference on the World Wide Web (May, 1994), Mark Pesce and Tony Parisi present "Labyrinth", a tool for visualising the Web
- A consistent cyberspace defined using VRML is proposed to improve navigation of the Web, but discussion and activity that followed resulted in a specification for a common language for defining 3D scenes rather than an interface to the Web

VR Application Areas (1)

- Medical application in Virtual Reality
- Science application in Virtual Reality
- Art application in Virtual Reality
- Entertainment application in Virtual Reality

VR Application Areas (2)

Medical application in Virtual Reality

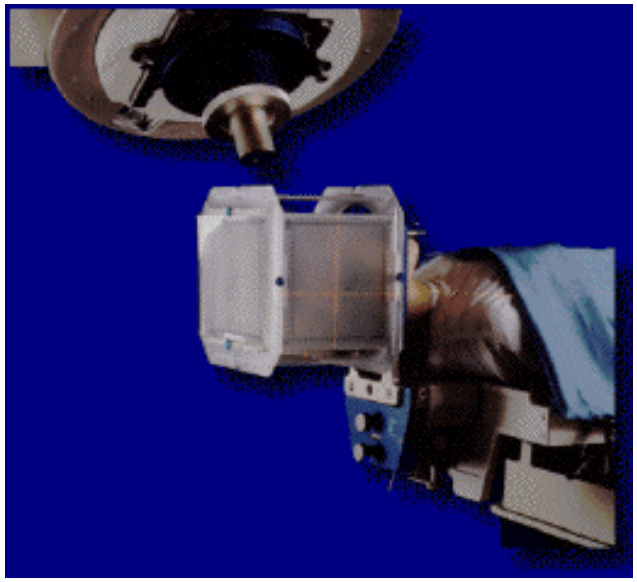
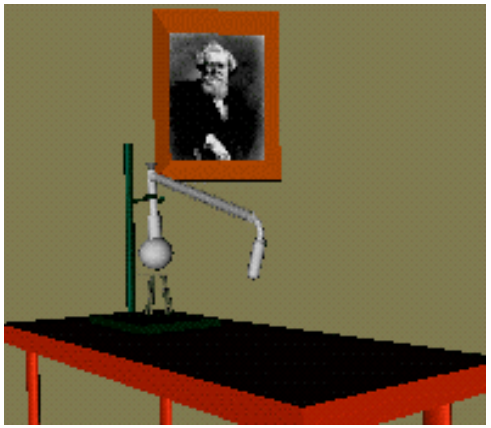


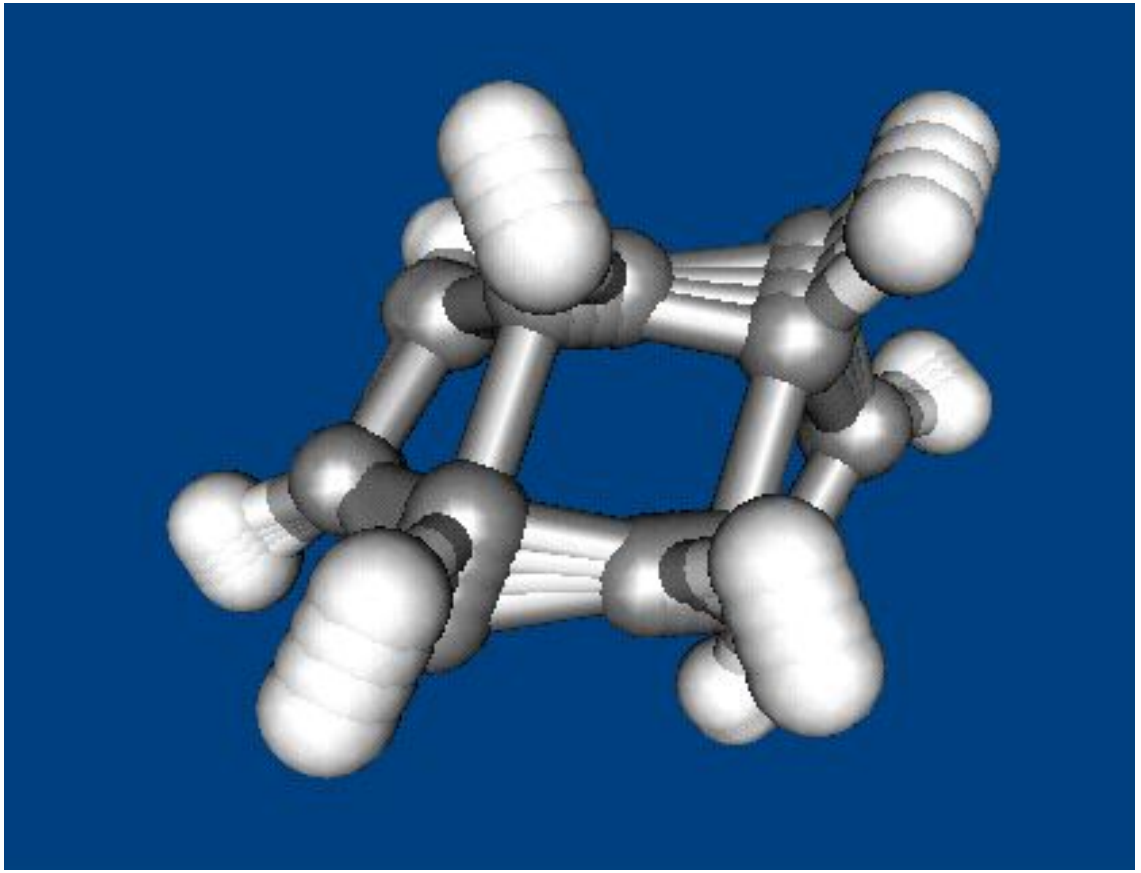
Photo Source(Department of Informatics, Umeå University, Sweden)

VR Application Areas (3)

Science application in Virtual Reality

Photo Source(Department of Chemistry, Imperial College, London)

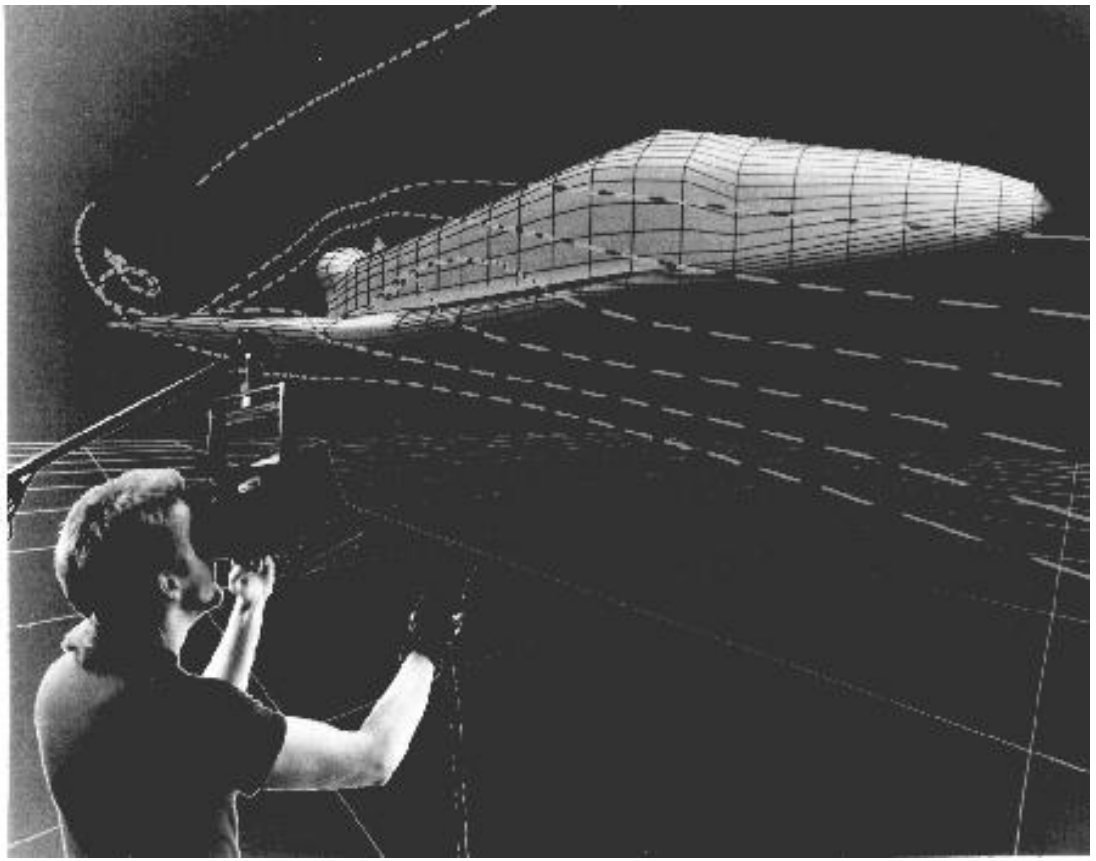




VR Application Areas (4)

Manufacturing application in Virtual Reality

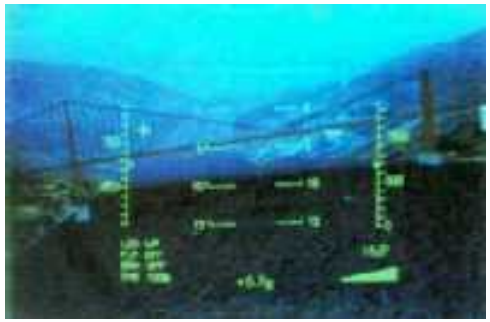
Photo Source(**NASA**)



VR Application Areas (5)

Entertainment application in Virtual Reality

Photo Source(Atlantis Cyberspace)



VR Application Areas (6)

- small TV screen for each eye
- slightly different angles
- 3D effect

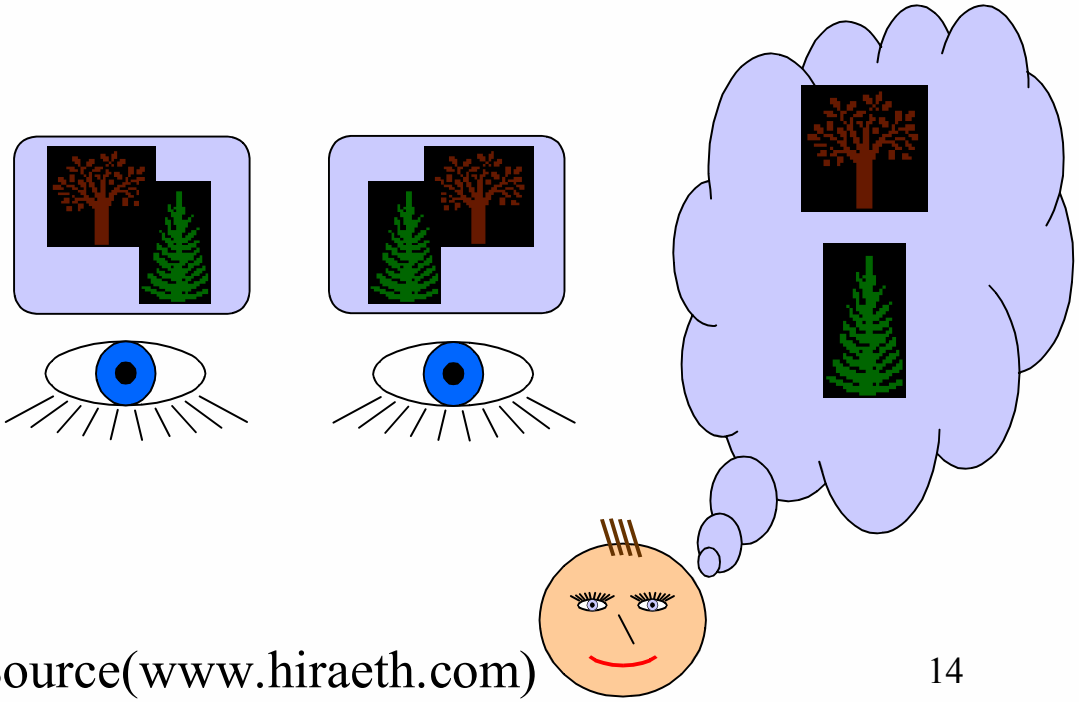


Photo Source(www.hiraeth.com)

VR Softwares

- 3D Modeling
- 2D Graphics
- Digital Sound Editing
- VR Simulation

VR Hardwares

- Navigation Devices
- Gloves
- Head-Mounted Displays

VR Types

- Desktop VR

  ordinary screen, mouse or keyboard control

  polemous mouse, steering wheel, joystick

- Impressive VR

  helmet/goggles, data glove

  body suit, trampoline!

VR Systems

- Stereoscopic Display Application
- Video Mapping
- Mixed Reality

Force Feedback

- Force Feedback provides direct perception of three-dimensional (3D) objects and directly couples Input and Output between the Computer and User.
- Force Feedback helps to guide manipulation of Objects.
- Force feedback is important when user applies a force to move the object.

Force Feedback Devices (1)

- The force feedback device, or haptic display, is usually robotic manipulator with which a human operator interacts physically, usually through a handle, stylus, finger-pad or some other form customized interface.
- Modeling of the haptic display is often overlooked when building a haptic simulation.

Force Feedback Devices (2)

- R & R Chair
- Intensor
- Interactor Vest
- Force FX
- Bass Shakers

Photo Source(Virtual Realities, Inc)

Force Feedback Systems (1)

- Force feedback systems combine output of forces from the system, with input of positions and forces to the system.

- This means that the user feels the force of objects in response to the forces he applies.

Force Feedback Systems(2)

• Objects have apparent weight and inertia. To work, they require a structure again which forces can be generated.

• This is sometimes achieved by means of an exoskeleton that fits over the hand or glove, or by means of a specialised "gantry" through which all manipulations must be made.

Force Feedback

Main Approaches

- **Hydraulic**
  expensive, dangerous, and dirty
  high control bandwidth (10 KHz)
- **Pneumatik**
  cheap, Safe, clean
  lower control bandwidth (10-20 Hz)
- **Electrical (motorized)**
  best of both Worlds (~4KHz bandwidth)
- **Magnetostrictive** (change shape in magnetic field)
- **Shape memory alloy 5**

Force Feedback Concerns

- **Safety**

  force-Feedback achieved via robotics with a human in the loop fail-Safe is a must!

- **Update rates**

  too low can impact the “stiffness” of surfaces

  decouple the force loop.

- **Force model**

  facilitates realistic haptic rendering

References

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  http://ovrt.nist.gov/projects/mfg/mfgVRcases.html
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THE END