



CGG
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Hardware for VR



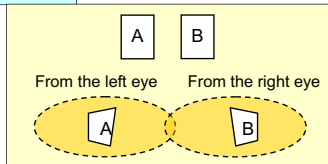
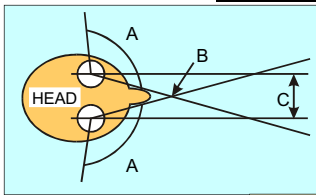
Hardware for Virtual Reality

- VR Devices
- Human factors
- VR Applications

VR devices for:

- **Sight** (display technologies)
- **Hearing** (3D sound, voice synthesis)
- **Touch** (force & tactile feedback)
- **Interaction** (input & tracking devices)

3D vision = stereoscopic viewing



Display principles

- **Stereoscopic filters**
(color or polarized light)
- **Flicker Lens** (shutter glasses)
- **Head Mounted Displays**
(stereo image & stereo sound)

←→
Static viewer position versus tracking

Stereoscopy

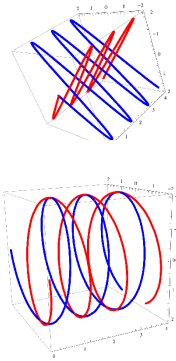
- **Passive**
 - Anaglyph
 - Polarized light
 - Infitec
- **Active**
 - Shutter glasses
- **Autostereoscopy**



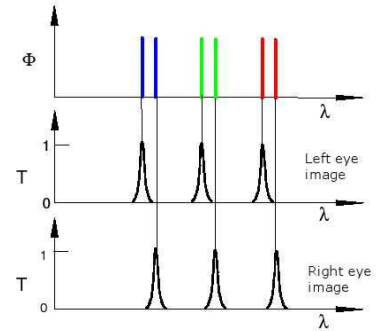
Anaglyph



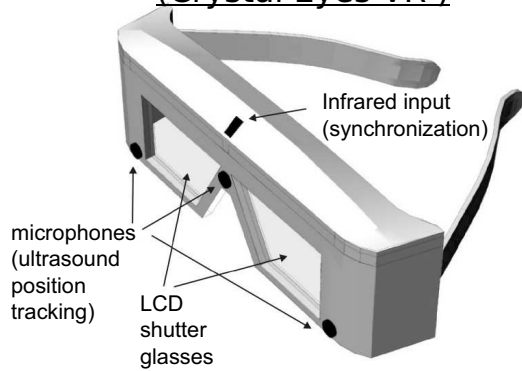
Polarization



Infitec



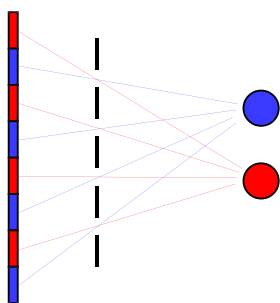
Shutter glasses (Crystal Eyes VR)



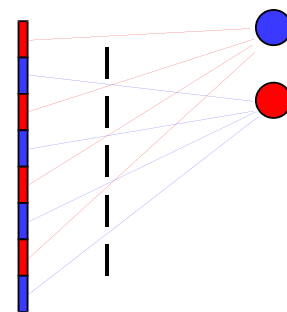
Shutter glasses



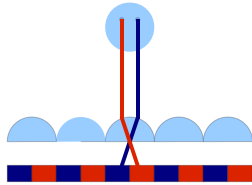
Parallax barrier



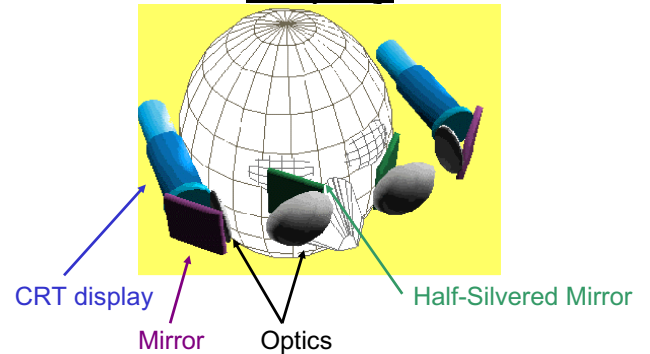
Parallax barrier - bad



Lenticular stereo



HMD: Head Mounted Display



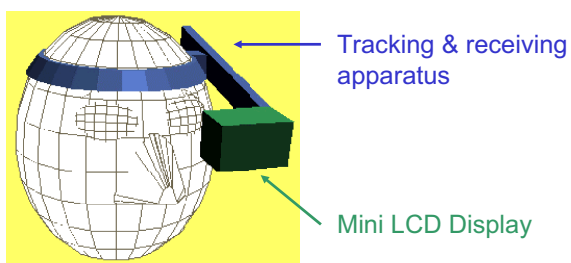
HMD (2)



Augmented reality

- **Optical see-through**
- **Video see-through**
- **Virtual Retinal Display**

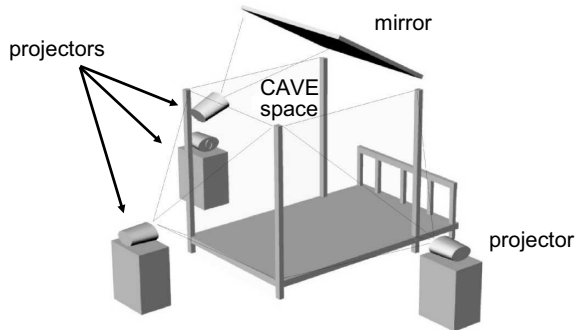
Display for augmented VR



Immersive projection techniques

- **CAVE**
(Cave Automatic Virtual Environment)
1992, Univ. Illinois, 10x10x10 feet,
crystal eyes
- **Immersive Wall, Workbench**
for cooperating teams,
large screen(s), crystal eyes, gloves

CAVE

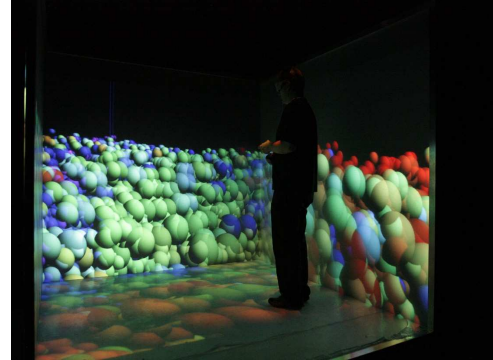


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CAVE (2)

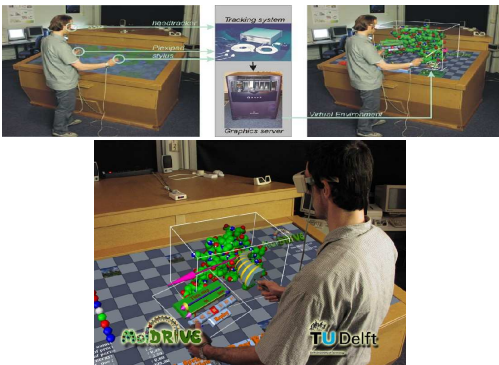


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Workbench



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Special devices for immersive VR

- **Simulated rides** (motion seat)
- **Flight simulators** (motion platform)
- **VR cabins/cinemas** (motion platform, multiple screens)

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Virtusphere



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Hearing

- **3D sound synthesis** (distance, echo)
- **Voice synthesis** (MUDVR)
- **Voice recognition** (input devices)

“I have got an e-mail”

“I have got any male”

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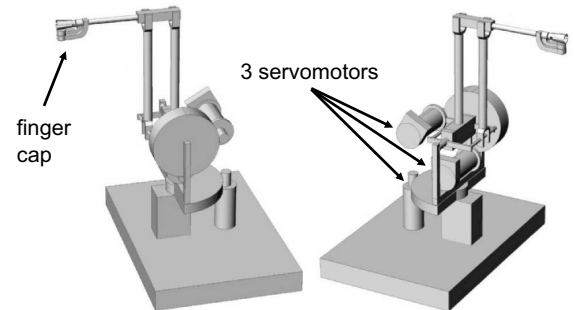
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Touch (haptics)

- Force feedback



Phantom



Falcon



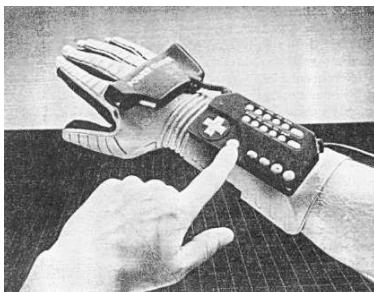
Falcon (Navit inc.)

Gloves

- Input devices
(navigation and controlling via gestures)
- I/O devices: force feedback

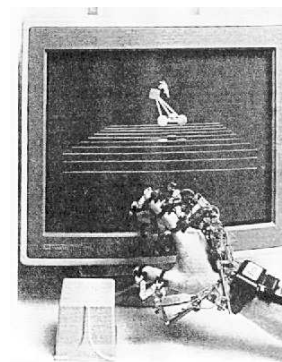
←→
Gesture recognition: *static* versus *dynamic*

Simple data glove (Mattel)



Power Glove

Force feedback glove



Dexterous Hand Master

Other gloves



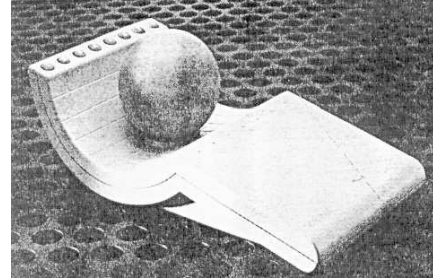
P5 glove

5DT glove



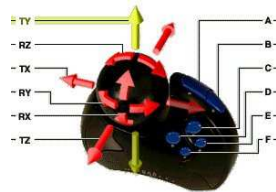
Shapehand

Force & tactile devices



Force Space Ball

Spaceorb



Space Navigator



Space Pilot



Tracking devices

- Mechanical
- Optical
- Electromagnetic
- Acoustic
- Gyroscopic

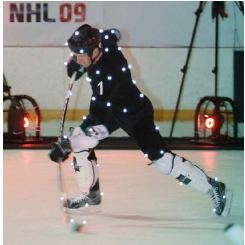


Multiple sensor devices: **Data suits**

Mechanical tracking



Optical tracking

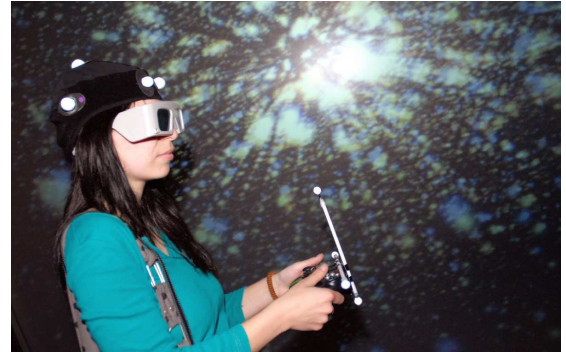


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Optical tracking (2)

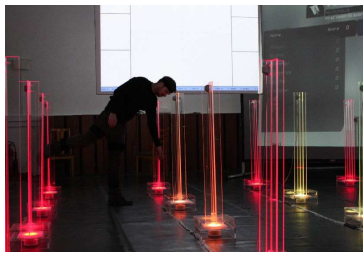


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Electromagnetical tracking



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End of this part

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