

PSYC305
Applied Cognition & Neuroscience
Mātai hinengaro whaipāinga

Lecture 22: Cognition & Design

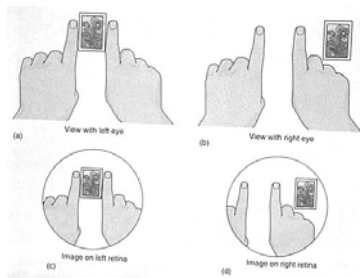
Topics:

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 Psychology Dept.
 The University of Waikato

1. Stereoscopic vision
2. Virtual Reality systems

Binocular Disparity and Stereopsis

•Binocular depth cue (involves both eyes).



Each eye sees the world from slightly different viewpoints



Examples of stereoscopic pairs

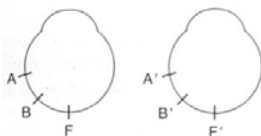


Binocular Disparity and Stereopsis

•Binocular depth cue (involves both eyes).

Corresponding Retinal Points

For every point on one retina, there is a corresponding point on the other. These two points connect to the same places in the visual cortex.

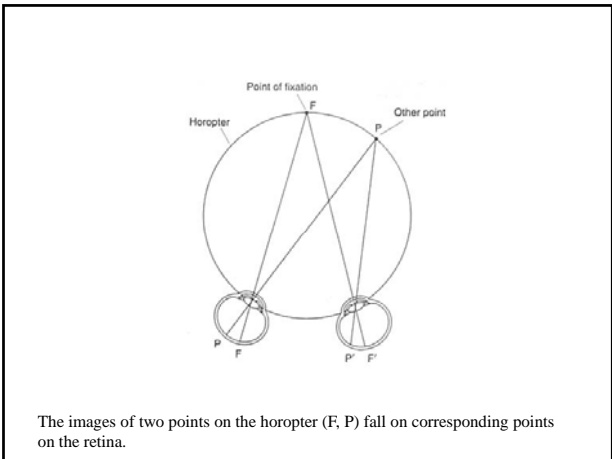
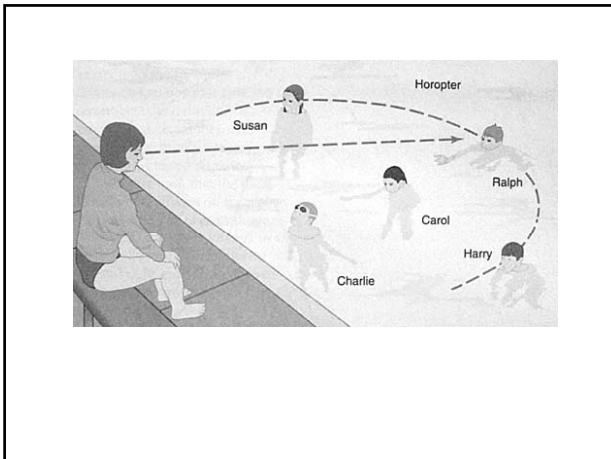


Binocular Disparity and Stereopsis

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Horopter

An imaginary surface that passes through the point of fixation. Objects falling on this surface result in images that fall on corresponding points on the two retinas (see next slides)



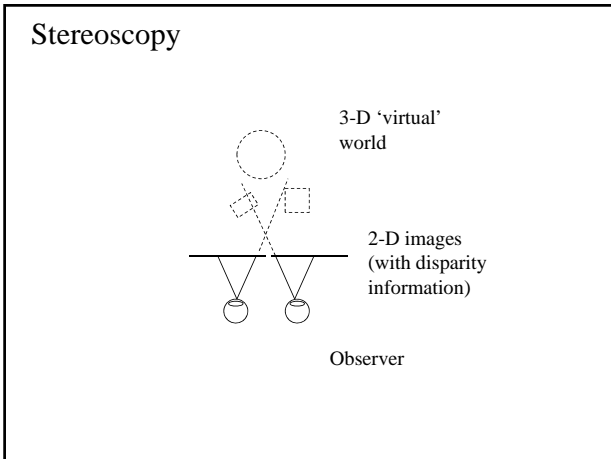
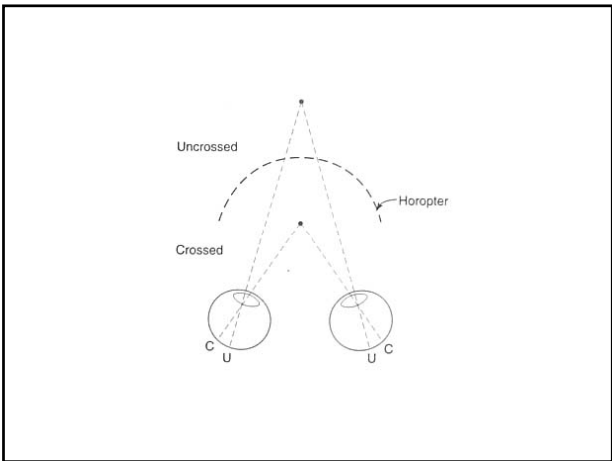
**Binocular Disparity and Stereopsis
(continued)**

Key to binocular depth perception:
 The further an object is from the horopter, the greater is the **angle of disparity**.

Objects located in front of the horopter produce **crossed disparity**.

Objects located beyond the horopter produce **uncrossed disparity**.

(See next slide)



The first stereoscope

Sir Charles Wheatstone
 1802 -1875

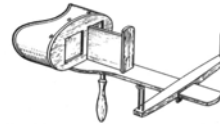
Contributions to the Physiology of Vision.—Part the First. On some remarkable, and hitherto unobserved, Phenomena of Binocular Vision. By CHARLES WHEATSTONE, F.R.S., Professor of Experimental Philosophy in King's College, London.

Received and Read June 21, 1838.

WHEN an object is viewed at so great a distance that the optic axes of both eyes are sensibly parallel when directed towards it, the perspective projections of it, seen by each eye separately, are similar, and the appearance to the two eyes is precisely the same as when the object is seen by one eye only. There is, in such case, no difference between the visual appearance of an object in relief and its perspective projection on a plane surface; and hence pictorial representations of distant objects, when those circumstances which would prevent or disturb the illusion are carefully excluded, may be rendered such perfect resemblances of the objects they are intended to represent as to be mistaken for them;

<http://www.stereoscopy.com/library/wheatstone-paper1838.html>

Stereoscopes and photography



A hand-held stereoscope. This instrument was a popular source of entertainment during the nineteenth century. (from Gelboed, 1962)



Stereoscopic movie posters from 1952



Anaglyph 3-D stereo examples

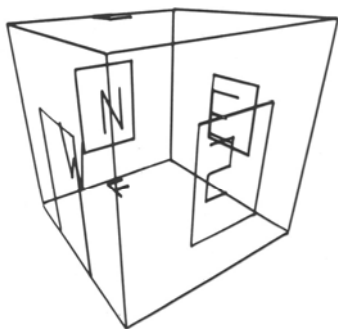
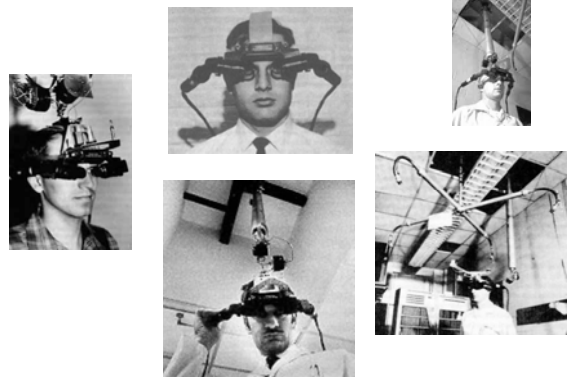
2. Virtual Reality

Virtual reality (VR) is a technology which allows a user to interact with a computer-simulated environment, be it a real or imagined one.



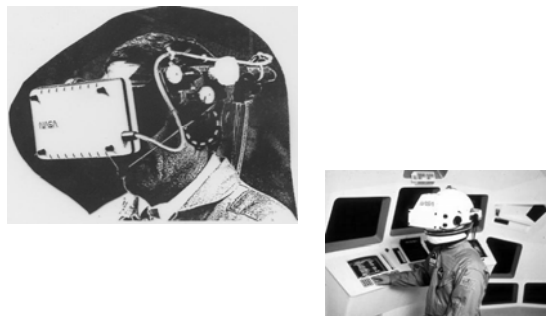
Morton Heilig's *Sensorama*

Ivan Sutherland's head mounted display (1968)



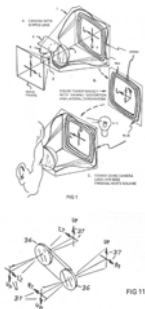
A computer-displayed perspective view of the "room" as seen from outside

NASA Ames virtual reality helmets (1985 -)



Key elements of VR systems:

Wide angle optics



High resolution displays



Head tracking systems



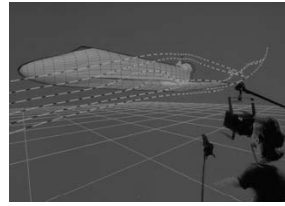
<http://www.youtube.com/watch?v=Jd3-eiid-Uw>

"The technology of the 1980s was not mature enough," explains Stephen Ellis, who leads the Advanced Displays and Spatial Perception Laboratory at NASA's Ames Research Center. VR helmets and their optics were too heavy. Computers were too slow. Touch-feedback systems often didn't work. The only thing consistently real about VR were headaches and motion sickness--common side effects of '80s-era helmets.

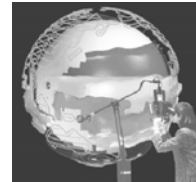
Twenty years later, things have improved. Computers are thousands of times faster; VR peripherals are lighter-weight and they deliver a greater sense of feedback and immersion. And, importantly, researchers are beginning to understand crucial human factors; they're eliminating nausea and fatigue from the VR experience.

http://exploration.nasa.gov/articles/21jun_vr.html

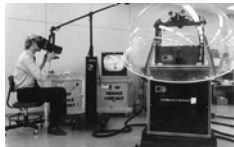
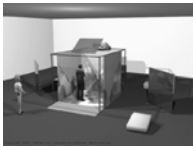
'Data glove'



'Boom' systems



'CAVE' systems



Telepresence/teleoperator systems



VR Applications:

<http://coe.sdsu.edu/eet/articles/VRApps/start.htm>