

CST3140: Novel Interaction Technologies

Week 4 Lecture:
Virtual Reality

What is VR?

- Interactive computer-generated experience taking place within a simulated environment
- Incorporates mainly auditory and visual feedback
- May also allow other sensory feedback like haptic (the science of touch)
- Virtual reality headsets or multi-projected environments
- Simulates physical presence in an imaginary environment
- Ability to "look around" the artificial world, move, interact with virtual features or items

• Wikipedia

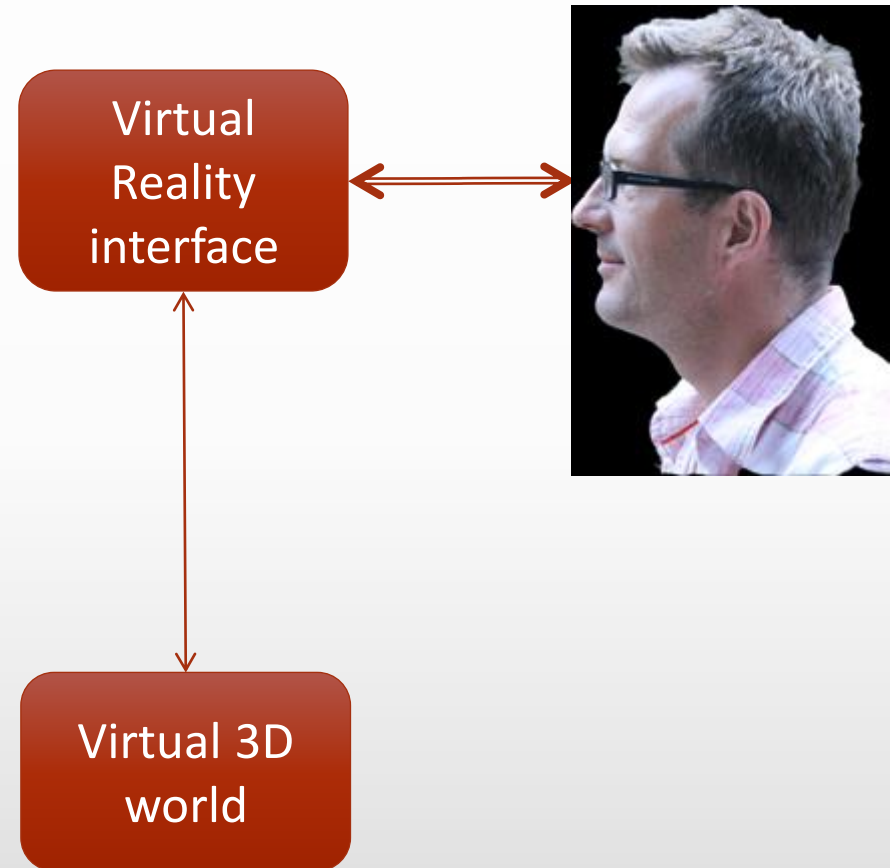
Virtual Reality

- Key aim: to create sense of 'presence' and 'immersion' in a simulated virtual world
 - Users feel like they're really there!
- How can this be done?
- Typically through
 - Displays that create the illusion of 3D
 - Other forms of feedback
 - Interaction in 3D
- How does all of this work?



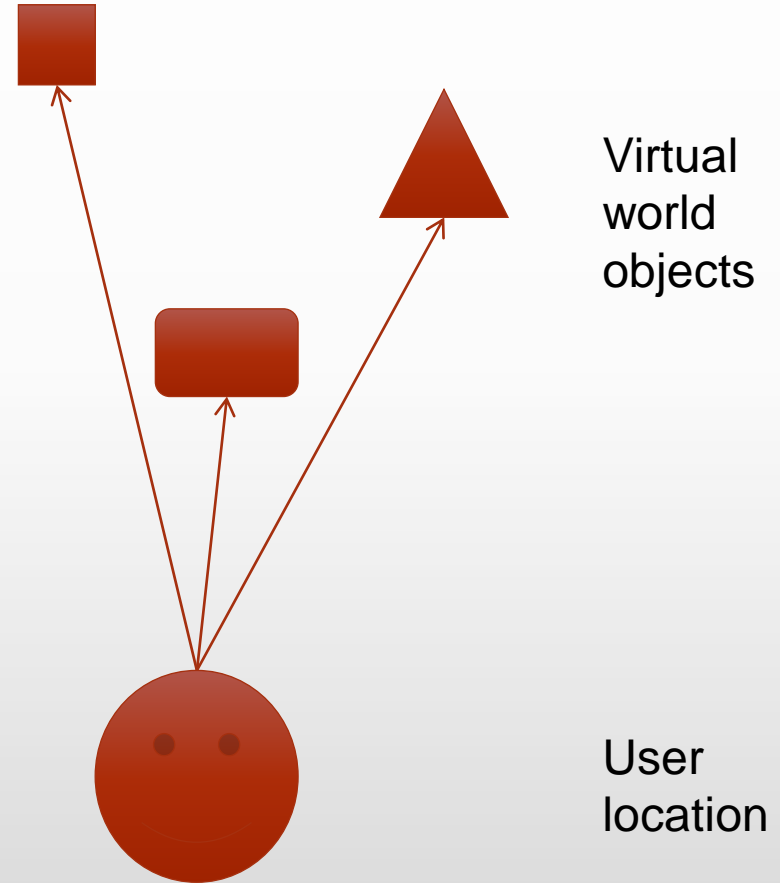
Virtual Reality

- Virtual world – digitally represented, internal to computer
- Presented to user
 - e.g. through 3D display
- User interacts
 - E.g. through 3D controls



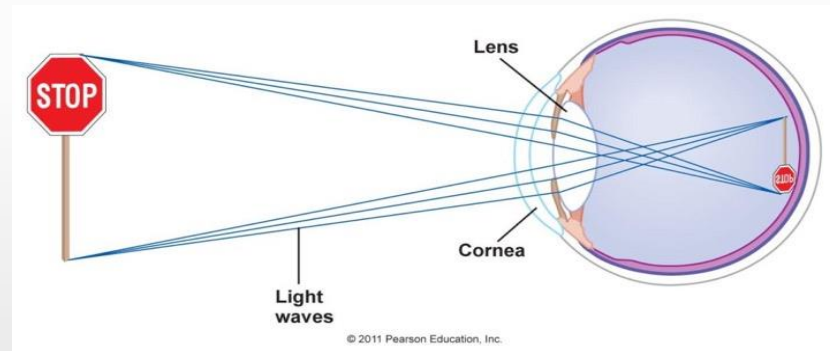
Creating the Illusion...

- Objects located in virtual world space
- User located in virtual space too
- System calculates what the user would see from that location
- 'Real' user sees view of virtual world



Visual Perception

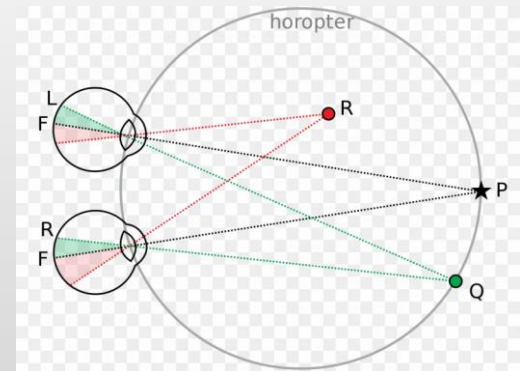
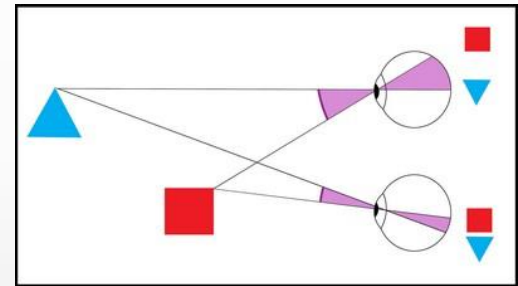
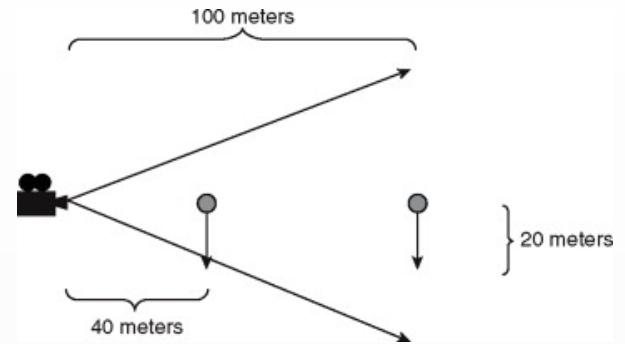
- How do we perceive 2-dimensional scenes?
- Light reflected from objects focused to form an image on the retina



https://www.youtube.com/watch?v=i3_n3lbfn1c

3D Vision

- We use lots of methods to see depth
 - Motion parallax
 - Focus
 - Perspective, size
 - Convergence
 - Stereopsis



How do we see in 3D



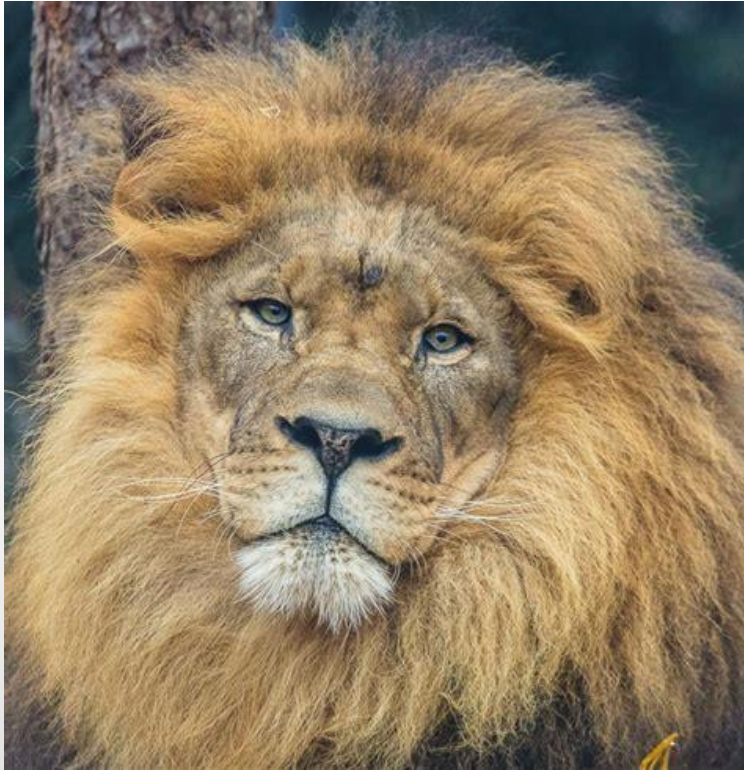
<https://www.youtube.com/watch?v=mKGWAIHkmyk>

Displaying virtual objects

- Typically using specialised displays
- Create a sense of 3D
- How do we perceive objects in 3D space?
- In other words, do we judge the distance of objects?



Example of 3D images



The traditional way of creating a **3D image** is to capture two photos from slightly different angles to simulate the way our eyes perceive depth. If you're shooting a stationary subject, that can be **done** by simply moving the camera slightly to the side in between shots.

VR Technologies

- 'Immersive VR'
 - Stereoscopic displays used to create the impression of true 3D
 - Create an enclosing virtual environment
 - Highly compelling and immersive



https://www.youtube.com/watch?v=VH_H4qSzJ_Q

VR Technologies

- Samsung gear – phone-based AR
- Google Cardboard



Oculus Quest 2 - \$299



Sony PS VR - \$349.99



HTC Vive Cosmos - \$699

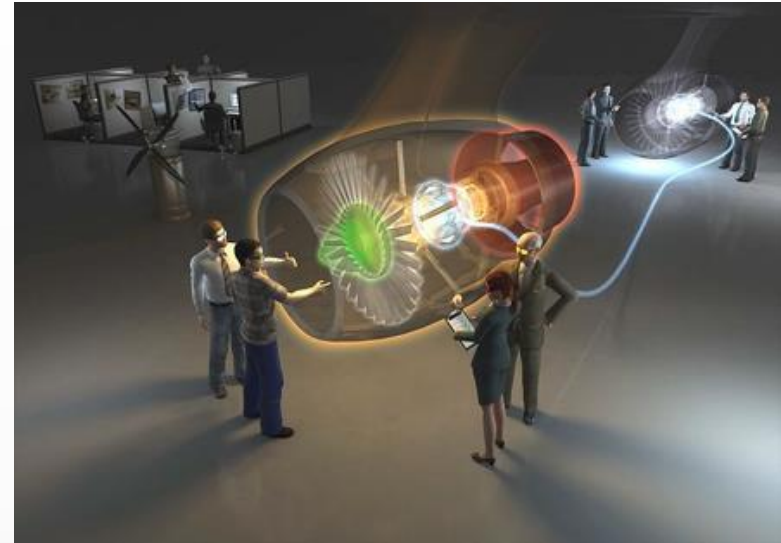
VR Technologies

Other variants aim to make improvements – e.g.

- Less cumbersome technology
- Offer possibilities for collaborative use

CAVE: More immersive experience

<https://www.youtube.com/watch?v=STMcWUtQr1Y>





VR Interaction

- How to interact in an immersive 3D environment?
 - With a mouse?
 - Specialised VR input device
 - 3D mouse?
 - Data glove
 - Allows gestures as input

VR Interaction

- How does the user get feedback about interactions?
 - Visually? Acoustically?
 - Good for navigation and movement, but what about interaction with objects?
- What about in the real world?
 - Tactile and haptic feedback



VR Feedback

- VR typically gives poor feedback about physical objects
 - Walking through virtual walls
 - Crashing into real objects
 - Getting feedback about objects picked up or touched
 - High-tech solutions get complex



VR Applications

- Training and education
- Games
- Entertainment
- Medicine, therapy, rehabilitation



Commercial VR

Research prototypes look clumsy
but many products offer VR

With glove input

- Force feedback, simulated tactile feedback, etc

- E.g. VRGluv:

- <https://www.vrgluv.com/> - videos



VIRTUALIZE YOUR HANDS



FEEL EVERY INTERACTION



MOVE FREELY IN VR





Summary

- VR – a step beyond TUI?
 - 3D interaction and feedback
 - But no physical representations
- But some similarities
 - Interaction in physical space
 - Internal model coupled to digital representation
 - Raises some important questions for evaluation
 - E.g. how can we assess 'immersion', 'presence', 'realism', etc? what factors create these aspects of user experience?