Announcements

- MP1 is released, due on Sep 11 @11:59pm.
- Work in groups - groups of 2 for MPs
- Groups of 3-5 for projects.
- Form groups by Sep 18, answer piazza@21

- Today: LaValle Ch2, start on Ch 3.

Mike Peretz
VR System: Hardware, Software and Perceptual Psychology

Virtual World

Display

artificial stimuli

Organism

Rendering

Virtual World (VWG) Generator

Physical World
Rendering hardware (displays):
- Visual: Tubes, plasma, LCD, OLED, projectors, retinal...
- Audio: speakers, bone conductors
- Touch: controllers, Oculus Touch, HTC Vive, kinect
- Smell? Taste? Vestibular? not yet

Lens:

Tracking hardware:
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- 
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Controllers: xBox...
- keyboard, mouse, gloves...

Computer:
- CPU
- GPU
Tracking is: Updating Virtual World according to configuration changes of the sense.

HMD vs Cave

HMD vs Headphones
Tracking Hardware: IMUs

- **Used for**: tracking, rotation only
- **Consists of**:
  - gyro \( \frac{\text{rad}}{\text{sec}} \) \( \vec{\omega} = (\omega_x, \omega_y, \omega_z) \)
  - accelerometer \( \frac{m}{\text{sec}} \) \( \vec{a} = (a_x, a_y, a_z) \)
  - magnetometer \( \vec{m} = (m_x, m_y, m_z) \)
- **Common in**: airplanes
- **Cost**: $ - $$$
Tracking Hardware: IMUs

Gyroscope: \( \omega = (\omega_x, \omega_y, \omega_z) \)

Accelerometer: \( \ddot{a} = (\ddot{a}_x, \ddot{a}_y, \ddot{a}_z) \)
Tracking Hardware: IMUs

Magnetometer
\[ \vec{m} = (m_x, m_y, m_z) \]

inclination angles

declination angles
VR System: Software
Software: VWG

Types of self motion:

- The user moves physical self
- The user moves virtual self only

Comfort?
Software: VWG

Gaming engines
- Unity
- UE3

Google street viewer

Robot + camera

- powerful computer
- locomotion
- ever more work
- patching images
VR System: Hardware, Software and Perceptual Psychology
What is Reality?

The Matrix: Prison for your Mind - The Rabbit Hole

1:24 in the clip
What is Reality? Sensation and Perception

How do we perceive how far things are?

Depth perception

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visual ability to perceive objects in 3D and distances to objects

Cues: binocular monocular
Depth Perception

Both views are merged in the brain to form a single image.