Lecture 8

VR (Virtual Reality)
AR (Augmented Reality)
Learning Objectives

- Understand the Reality-Virtuality Continuum
  - Identify where AR and VR sit on the continuum
- Insight into technology behind AR
- Insight into range of applications for AR
- Insight into technology behind VR
- Insight into range of applications for VR
Reality-Virtuality Continuum

- Consider potentials and issues for each technology
Augmented Reality

- Definition
  - Combines real and virtual objects in a real environment
  - Registers (aligns) real and virtual objects with each other
  - Runs interactively, in 3D, in real time

FIG. 1: Conceptual demonstration of virtual line and 1.5 mm real gap at a short view distance with ARCam

FIG. 2: Conceptual demonstration of virtual line and 1.5 mm real gap at a long view distance with ARCam
Best AR apps (?)

(www.iphoneness.com; www.tomsguide.com; www.digitaltrends.com)
Enabling Technologies

- Displays
  - Aural display
  - Visual display
    - Video see-through
    - Optical see-through
    - Projective
  - Display positioning
    - Head worn
    - Hand-held
    - Spatial
Enabling Technologies

- Tracking sensors and approaches
  - Modelling environments
  - User movement tracking
    - Mechanical, ultrasonic and magnetic
    - GPS
    - Radio
    - Inertial
    - Optical
    - Hybrid

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<th>Technology</th>
<th>Range (m)</th>
<th>Setup time (hr)</th>
<th>Precision (mm)</th>
<th>Time (s)</th>
<th>Environment</th>
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Enabling Technologies

- User interface and interaction
  - New UI paradigm
  - Tangible UI and 3D pointing
  - Haptic UI and gesture recognition
  - Visual UI and gesture recognition
  - Gaze tracking
  - Aural UI and speech recognition
  - Text input
  - Hybrid UI
  - Context awareness
  - Human-machine symbiosis
    - Biometric devices
Applications

- Personal information systems
  - Personal assistance and advertisement

Names & faces cued by conversation
Applications

- Personal information systems
  - Navigation
Applications

- Personal information systems
  - Touring

Auckland Museum

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Bekele et al (2018)
Applications

- Industrial and military applications
  - Design

Helmet Design
Applications

- Industrial and military applications
  - Assembly
Applications

- Industrial and military applications
  - Maintenance

Car Maintenance
Applications

- Industrial and military applications
  - Combat and simulation

http://www.freefalcon.com/
Applications

- Medical applications
Applications

- Entertainment
  - Sports broadcasting
Applications

- Entertainment
  - Games
Applications

- In the office
  - Collaboration
Applications

- In the office
  - Education and training
Limitations

- Portability and outdoor use
- Tracking and (auto)calibration
- Depth perception
- Overload and over-reliance
- Social acceptance
Virtual Reality

- Humans immersed in a virtual world
  - Achieved with either:
    - Immersive environment
    - Non-immersive environment

- Early days
  - Sensorama (1955, 1962)
    - Replay, 3D with smell, movement, etc
  - Sword of Damocles (1968)
Immersive Environments

Oculus Rift
Non-immersive Environments
Applications

- Simulation

Drunk driving sim
Applications

- Training
Applications

- Social media/Communication
Applications

- Games

World of Warcraft
Limitations

- Maintenance of the illusion
- Immersion time (motion sickness)
- Portability
- Tracking and Calibration
References

- Wikimedia Commons: http://commons.wikimedia.org/