

# COMP210: Interfaces & Interaction

## 1: Human-Centred Design for AR/VR

# Virtual and Augmented Reality Overview:

## Learning Outcomes:

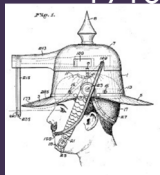
- ▶ **Explain** the difference between augmented & virtual reality.
- ▶ **Discuss** the various forms of haptic feedback.
- ▶ **List** and **describe** the key components that make up the hardware side of reality systems.

# A Word of Warning

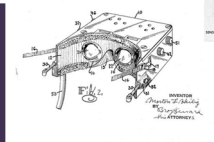
AR/VR are both emerging technologies and thus, they borrow language from other similar disciplines such as game development, film studies and 3D design. This appropriation of lexicons can be confusing and there will be some overlap in relation to key terms and definitions.

# History of AR/VR

1916



1960



1960



1988



**Figure:** Left to Right - Pratt's head-mounted targeting interface, Heilig's Stereoscope TV Apparatus & Sensorama, NASA's VIEW System

# Forms of Reality

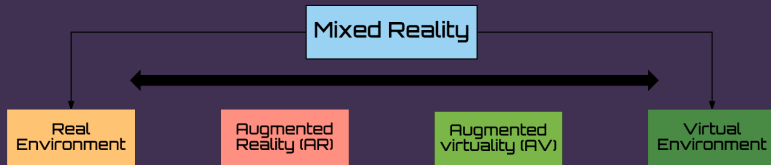


Figure: The Virtuality Continuum - Milgram & Kishino

# Reality Systems - Hardware

## Display Types:

- ▶ Head-Mounted Displays
- ▶ World-Fixed Displays
- ▶ Hand-held Displays

**Audio:** Spatialised Audio is preferred

- ▶ Headphones - more immersive.
- ▶ surround sound speakers.

# Head-Mounted Displays (HMD)



# World-Fixed Display

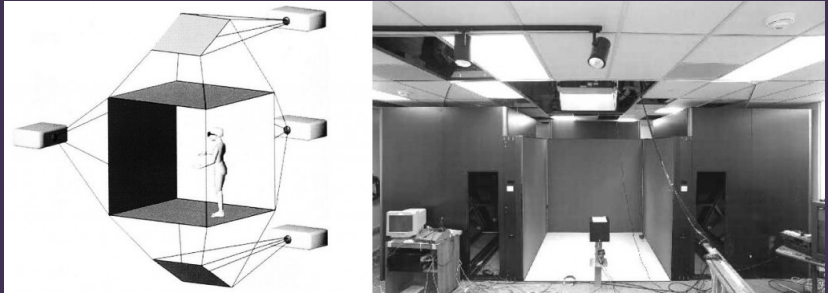


Figure: Cave VR environment: A lifelike visual display is created by projectors positioned outside the CAVE and controlled by physical movements from a user inside the CAVE.



# Hand-held displays

Have a guess at the example I chosen?

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Figure: Pokemon Go

# Tracking

- ▶ Accelerator & Gyro embedded in HMD
- ▶ Leap motion - Hand Tracking
- ▶ Eye Tribe (Foveated rendering)
- ▶ Fiducials Markers
- ▶ Kinect2 - Skeleton Tracking
- ▶ Valve's Lighthouse Tracking Sensors

# Haptics

Haptics are the artificial forces between virtual objects and the user.

**Passive** - real-world physical objects that match the shapes of a virtual objects. (Doors, ledges, pillars... )

**Active** - Haptics can be dynamically controlled by the computer to provide a feeling of a wide range of simulated virtual objects.



Figure: University of North Carolina - Pit Experiment

# Tactile Haptics

- ▶ Vibrotactile - vibration passed directly or indirectly to the skin
- ▶ Electrotactile - electrodes passing current through the skin
- ▶ Proprioceptive force - provides a sense of limb movement and muscular resistance

# Self-Grounded vs. World-Grounded Haptics

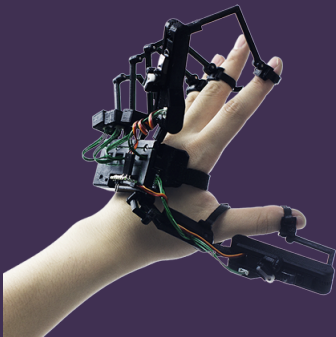


Figure: DexmoF2 & Sensable's Phantom Haptic System

# Motion Platforms

A motion platform is a hardware device that moves the entire body resulting in a sense of physical motion and gravity.

These systems can convey a sense of orientation, vibration, acceleration and jerking.

(Examples)







# Human-Centred Design:

## Learning Outcomes:

- ▶ **explain** the importance of placing the user at the centre of the design process
- ▶ **briefly** describe and compare different user-centred design techniques
- ▶ **demonstrate** a knowledge of the principles of user-centred design.
- ▶ **acknowledge** that sophisticated/eloquent solutions are less important than great user experiences.

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- ▶ Change is inevitable.
- ▶ Failures are an inevitable outcome of creativity and innovation.



# Iteration

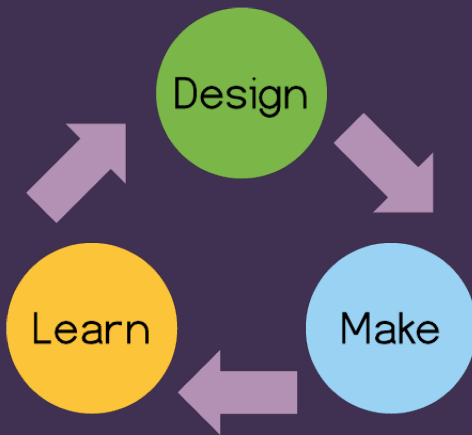


Figure: The Iteration Cycle

# Design/Define Stage

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- ▶ Vision
- ▶ Objectives
- ▶ Key Players
- ▶ Time & Costs
- ▶ Risks
- ▶ Assumptions
- ▶ Constraints
- ▶ Personas
- ▶ User Stories
- ▶ Story Boards

# ASK QUESTIONS

- ▶ Feedback is crucial at the define stage.
- ▶ Ask lots of questions.
- ▶ Do not trust assumptions.
- ▶ Common misconception.

# Analysis Paralysis

# Make Stage

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- ▶ Use Cases
- ▶ Block Diagrams
- ▶ Sketches
- ▶ Prototypes
- ▶ Class Definitions
- ▶ Hardware and Software implementation

# Prototypes

A prototype is a simplistic implementation of what is trying to be accomplished without being overly concerned with aesthetics or perfection. Design prototypes are defined by their level of fidelity, or resolved finish.

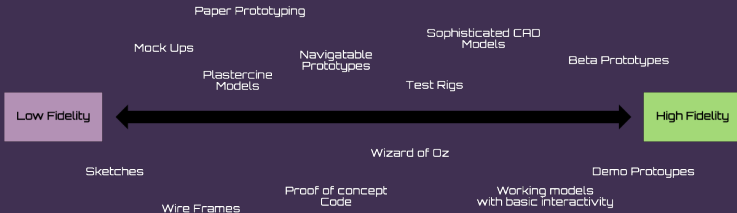


Figure: The Prototype Continuum



# Learn Stage

Utilises VR experts, subject matter experts, experiment design experts, statisticians and the end-user to ensure that you are doing the right things to maximise learning.

This is the stage that we are mostly concerned with when approaching assignment COMP210 1.

# Research Factors

- ▶ Lab vs. field
- ▶ Granularity
- ▶ Summative or formative
- ▶ Objective vs. subjective

# Research / Evaluation Methods

## Qualitative vs. Quantitative

# Qualitative

Research that aims to gain a deeper understanding of underlying reasons, opinions, and motivations and provide insights into a particular scenario or problem. Qualitative Research is primarily exploratory research and usually leads into quantitative research

# Quantitative

Research that aims to quantify the problem or scenario through collecting numerical data that can be analysed and interrogated using statistics. Quantitative research is great for quantifying opinions, behaviour, attitudes and other defined variables.

# Methods

- ▶ Usability Testing
- ▶ Eye Tracking
- ▶ Cognitive Walkthrough
- ▶ Heuristic Evaluation
- ▶ Focus Groups
- ▶ Task Analysis
- ▶ User-Experience Questionnaire
- ▶ Task and reaction measurement Galvanic Skin Response
- ▶ Observation Studies
- ▶ Think-aloud protocols

# Socrative

Room: WN2DMYEVN