

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

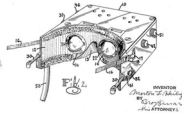
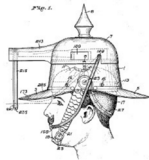


Figure: Left to Right - Pratt's head-mounted targeting interface, Heilig's Stereoscope TV Apparatus & Sensorama, NASA's VIEW System

Forms of Reality

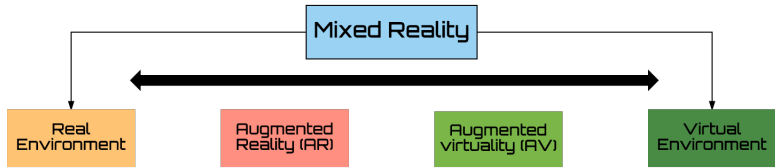


Figure: The Virtuality Continuum - Milgram & Kishino

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

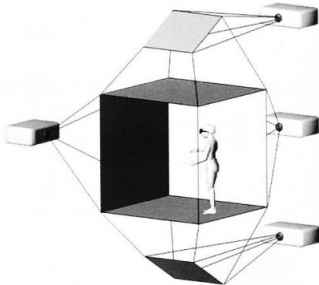


Figure: Cave VR environment: A lifelike visual display is created by projectors positioned outside the CAVE and controlled by physical movements from a user inside the CAVE.

Hand-held displays

Have a guess at the example I chosen?



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.



Nature Reviews | Neuroscience

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

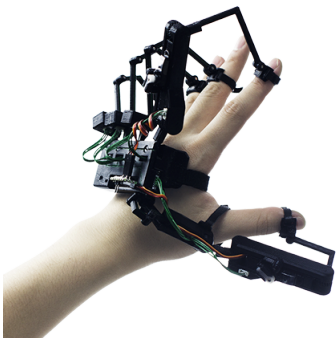


Figure: DexmoF2 & Sensable's Phantom Haptic System

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.

Continuous Discovery

Continuous discovery is the on-going process of engaging users during the design and development process.

- ▶ You can never know everything in advance of a project.
- ▶ Waiting until the end of a build to find out that something doesn't work is unsustainable.
- ▶ Change is inevitable.
- ▶ Failures are an inevitable outcome of creativity and innovation.

Iteration

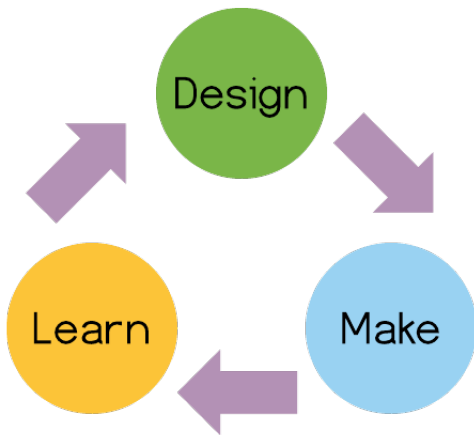


Figure: The Iteration Cycle

Design/Define Stage

This stage attempts to answer the question, 'what do we want to make?' and includes everything from the high-level vision to listing requirements. All parts of the define stage should be described from the users point of view and easily understood by all.

- ▶ 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

This stage answers the question, 'how do we make it?' and then proceeds to make it. Each iteration of the make stage should take the project from basic sketches and minimal prototypes, closer and closer to the final product.

- ▶ 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.

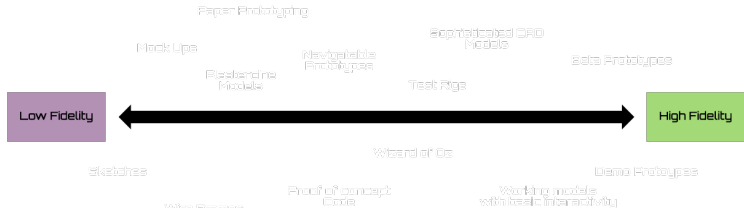


Figure: The Prototype Continuum

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