Rendering in VR

Computer Graphic Seminar

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Introduction

- What is Virtual Reality
- Why have Virtual Reality
- Concepts: Immersion, Perception, Perceptual Modalities
- Adverse heath effects
- Latency
- High-Level Concepts of Content Creation
- Interaction
- Iterative design
- Future of VR
- Key Components in VR

What is Virtual Reality

https://www.youtube.com/watch?v=eHy90mzN3XI

History

The Sensorama was able to display stereoscopic 3-D images in a wide-angle view, provide body tilting, supply stereo sound, and also had tracks for wind and aromas to be triggered during the film.

The current age of virtual reality

The current age of virtual reality began in 2010, when American teenager Palmer Luckey created the first prototype of a VR headset that would evolve into the Oculus Rift.

The current age of virtual reality

Oculus Rift

Sony PlayStation VR

HTC Vive

Why have virtual reality?

Architecture

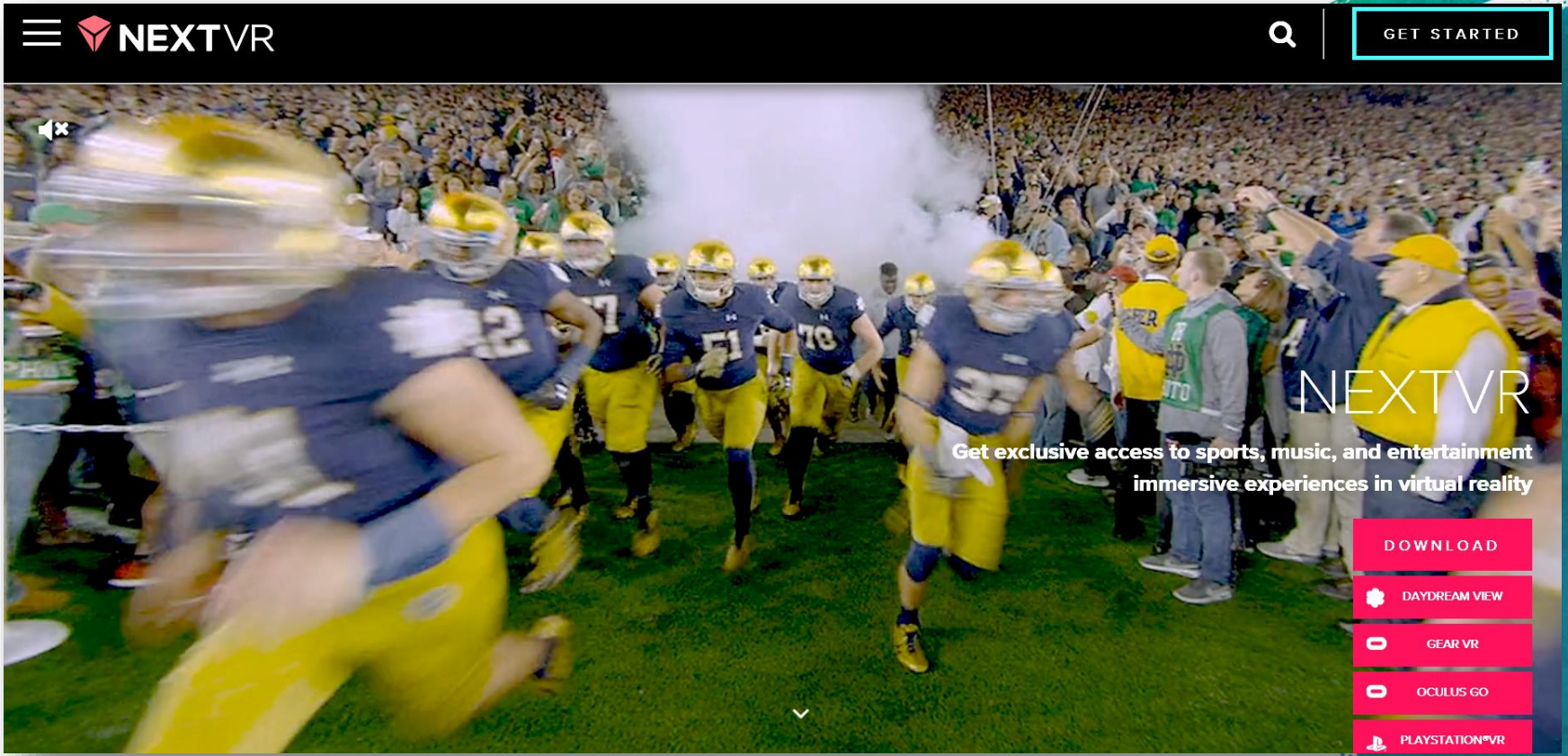
Sport

Medicine

The Arts

Entertainment

Sports and Music



Immersion, Presence and Reality trade-offs

Immersion:

Is the objective degree to which a VR system and application projects stimuli onto the sensory receptors of users in a way that is extensive, matching, surrounding, vivid, interactive and plot informing

Presence:

In short, is a sense of “being there” inside a space, even when physically located in a different location.

Trade-offs:

Things close to reality not necessarily being better. Trade-offs of trying to replicate reality vs. creating more abstract experiences.

Virtual reality immersion

- ***Mental Immersion*** **-** A deep mental state of engagement, with suspension of disbelief that one is in a virtual environment.
- ***Physical Immersion*** - Exhibited physical engagement in a virtual environment, with suspension of disbelief that one is in a virtual environment.

Types of Virtual Reality

Non-Immersive

only a subset of the user's senses are stimulated, allowing for peripheral awareness of the reality outside the virtual reality simulation

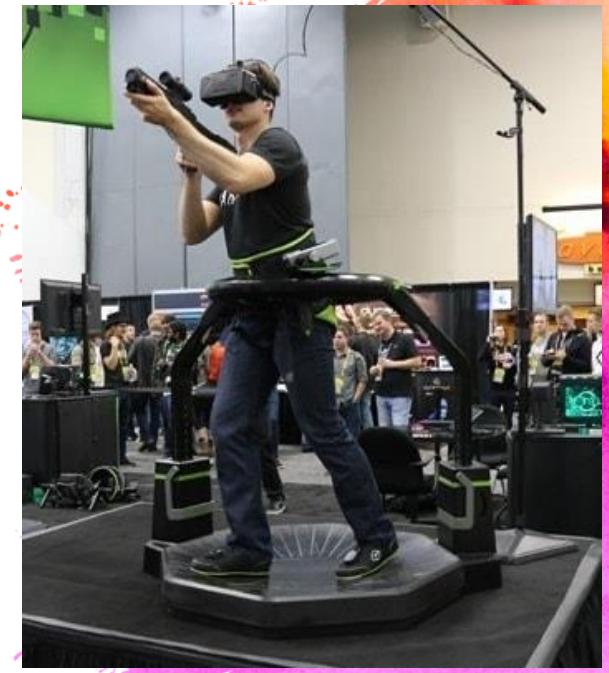
Semi-Immersive

Semi-immersive simulations closely resemble and utilize many of the same technologies found in flight simulation

Fully-Immersive

In a fully-immersive simulation, hardware such as head-mounted displays and motion detecting devices are used to stimulate all of a user's senses

Types of Virtual Reality



Perception

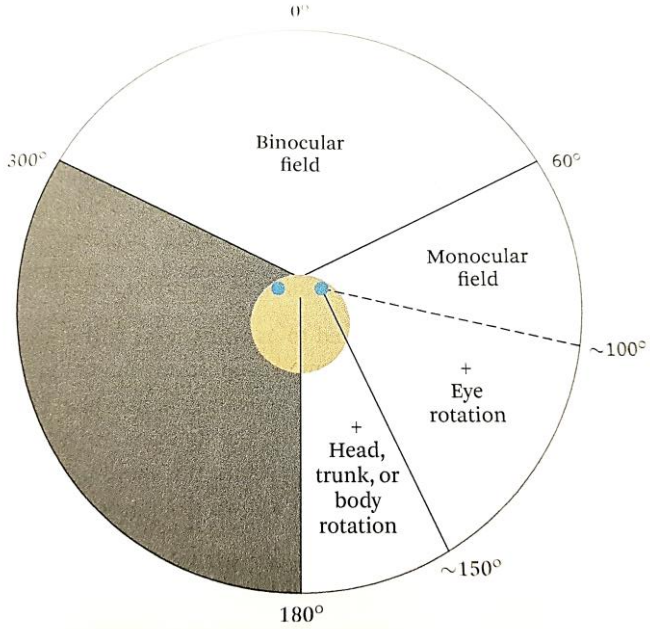
We see things not as they are, but as we are – that is, we see the world not as it is, but as molded by the individual peculiarities of our minds
– G.T.W. Patrick (1890)

We interact with the world through sight, hearing, touch, proprioception, balance/motion, smell and taste

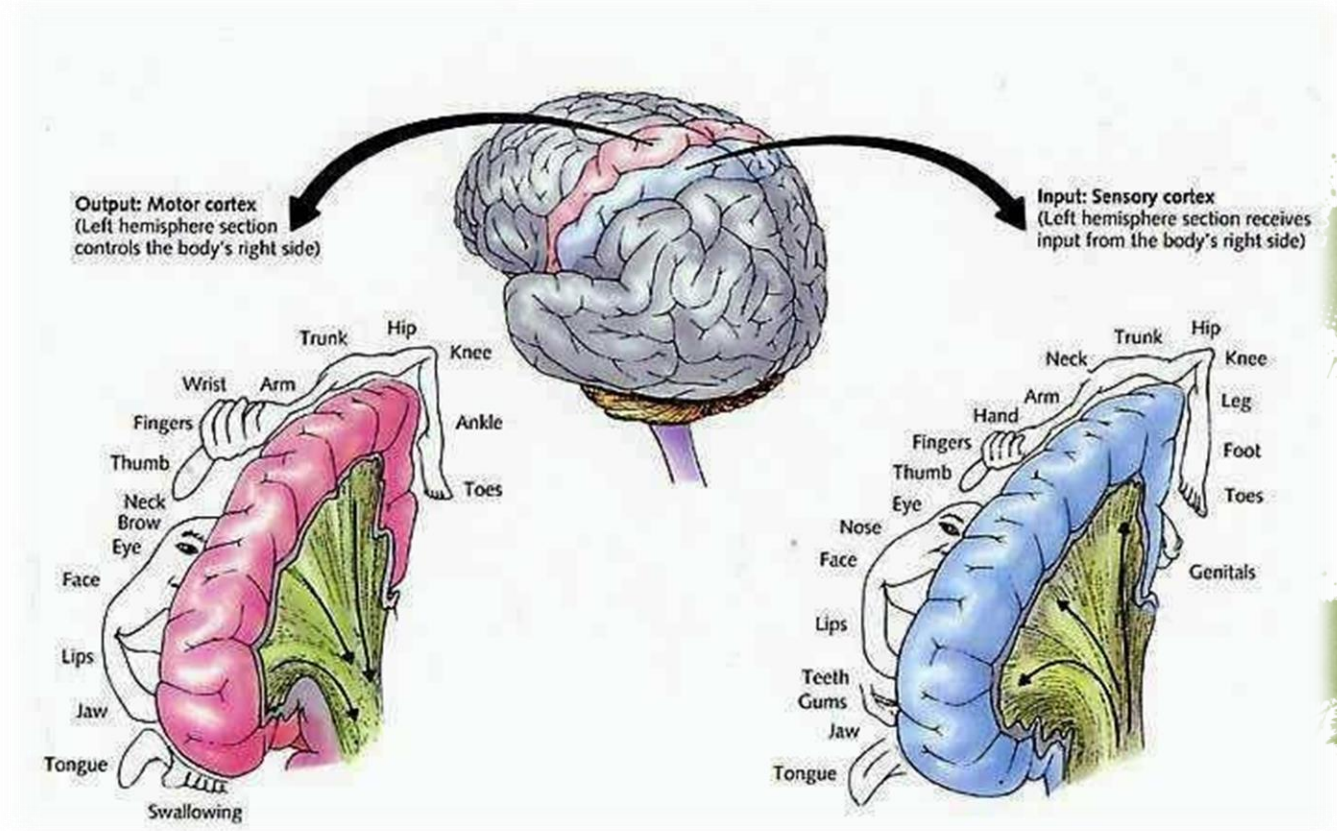
Perceptual Modalities - sight

The field of view is the angular measure of what can be seen at a single

point in time



Perceptual Modalities - touch



Adverse heath effects

Motion Sickeness refers to adverse symptoms and readily available observable signs that are associated with exposure to real and/or apparent motion.

The most commen negative health effect resulting from VR usage

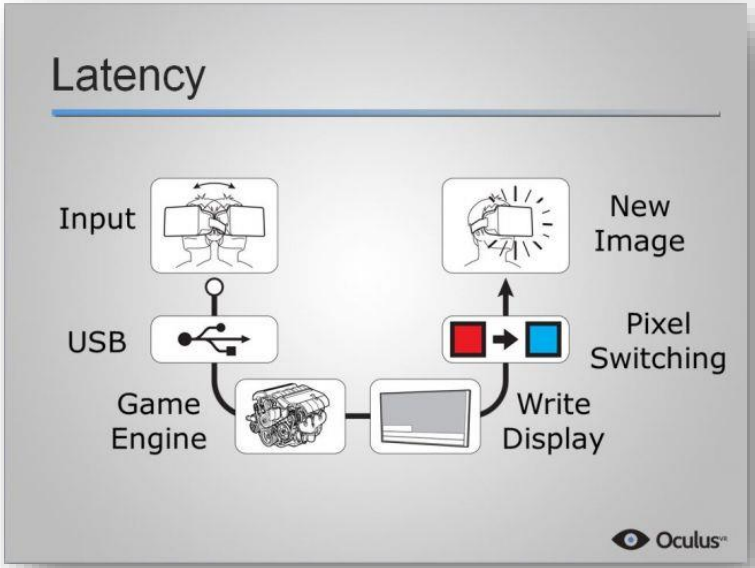
Symptops: discomfort, nausea, dizziness, headaches etc.

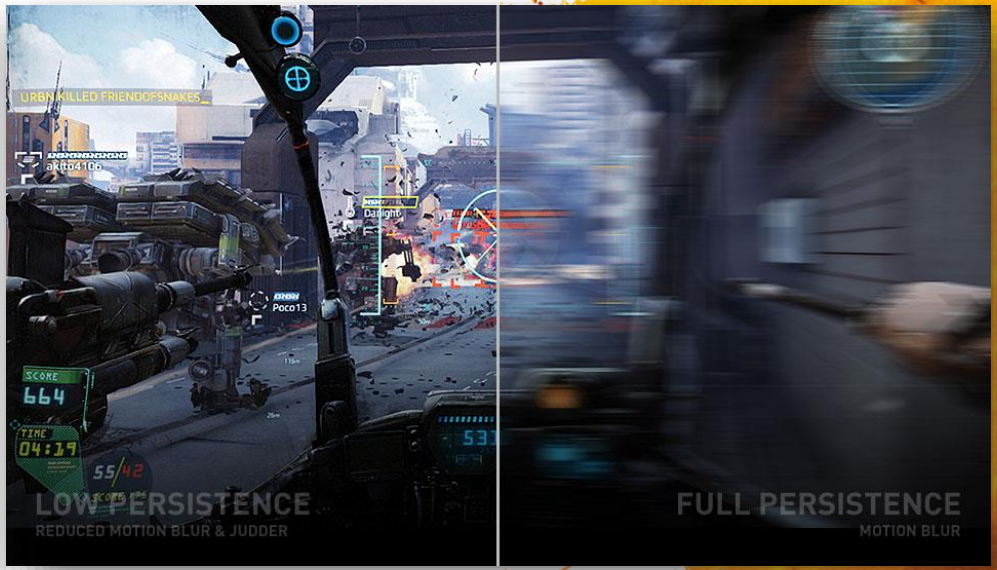
Hardware challenges

Physical fatigue, headset fit, injury and hygiene

Latency

Latency is the time a system takes to respond to a user's action, the true time from the start of movement to the time a pixel resulting from that movement responds

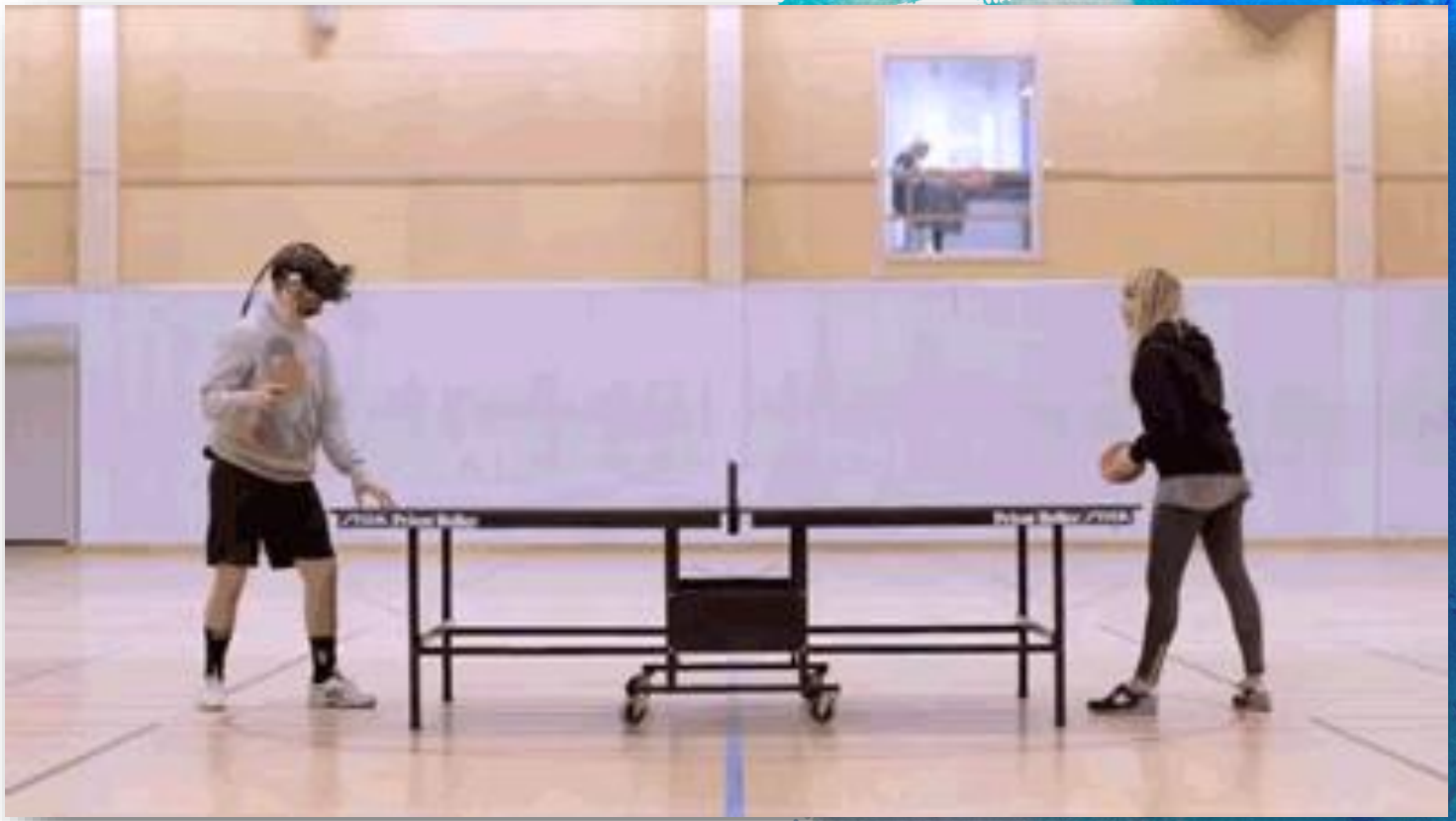




High-Level Concepts of Content Creation

The story, the core experience, conceptual integrity and gestalt principles

The core experience: is the essential moment-to-moment activity of users making meaningful choices resulting in meaningful feedback.



Affecting Behavior

By having easy access to a virtual compass users can easily redirect themselves after performing a virtual turn and return to the intended direction of travel.

Affecting Behavior

A character can be either a computer-controlled character(an agent) or an avatar.

Transitioning to VR Content Creation

- Focus on the user experience
- Minimize sickness-inducing effects
- Make aesthetics secondary
- Study human perception
- Give up on having all the action in one part of the scene
- Experiment excessively

Interaction

The Cycle of Interaction

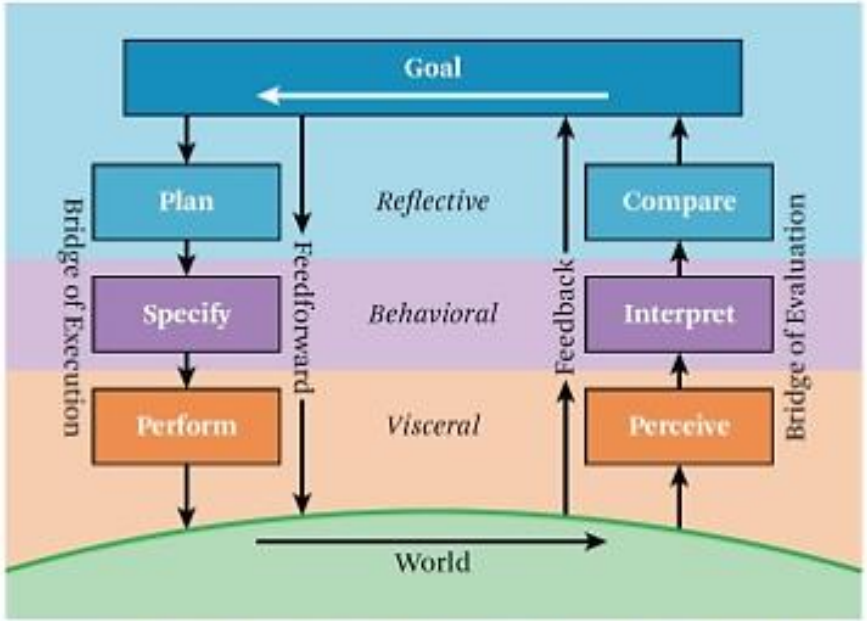
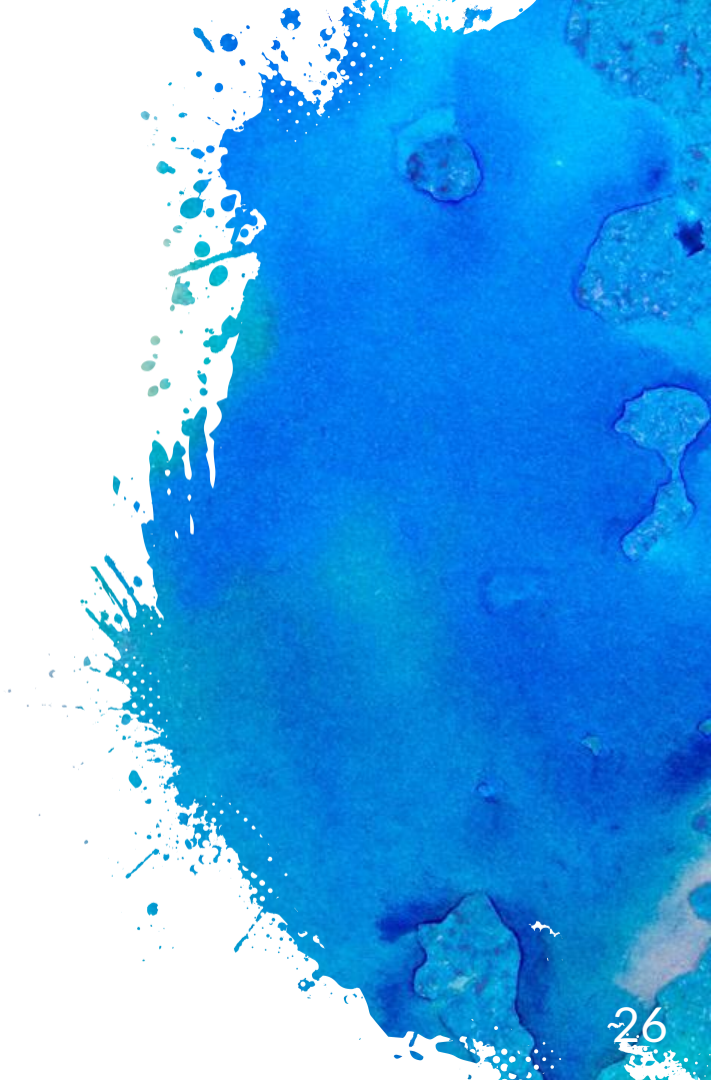


Image Courtesy of The VR Book (adapted from Norman [2013])

Sensory Feedback

These senses include vision (visual), hearing (aural), touch (haptic), and more

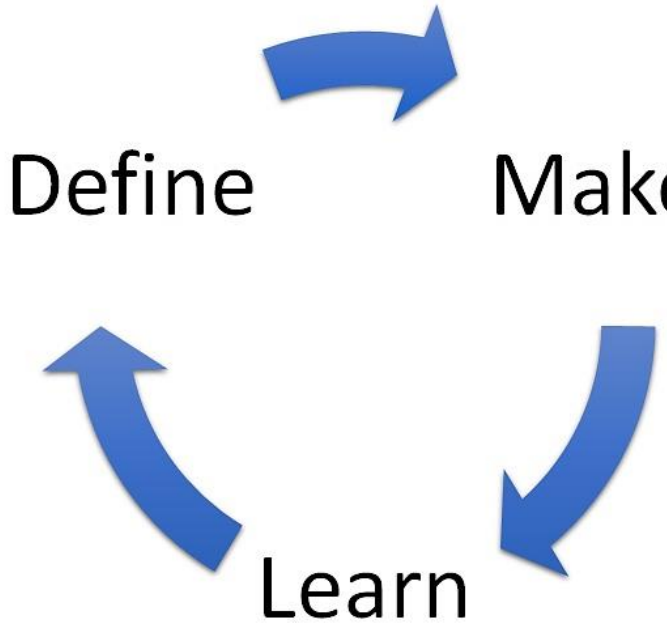


Input device are physical tools/hardware used to convey information to the application and to interact with virtual environment.

Oculus Touch

The Sixense STEM

Iterative Design



The ones who are crazy enough to think that they can change the world are the ones who do – Steve Jobs

The Future Starts Now

The best way to predict the future is to create it – Alan Kay

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

https://www.youtube.com/watch?v=wHOKFr5asl4


How Does Virtual Reality Work?

Key Components in VR

PC (Personal Computer)/Console/ Smartphone

Virtual reality content, which is the what users view inside of a virtual reality headset

Head-Mounted Display

A head-mounted display (also called HMD, Headset, or Goggles) is a type of device that contains a display mounted in front of a user's eyes.

Input Devices

They provide users with a more natural way to navigate and interact within a virtual reality environment.

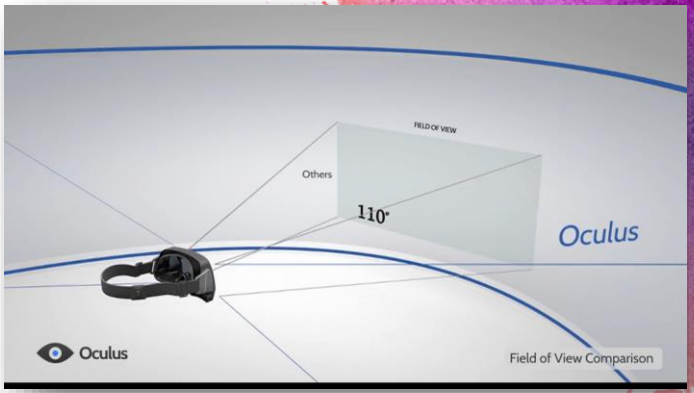
How Virtual Reality Headsets Work

- ***Sensors -*** Magnetometer, Accelerometers, Gyroscopes
- ***Lenses*** - Lenses lie between your eyes and pixels on the display screen(s)
- ***Display Screens*** - Display screens show the images that user view through the lenses
- ***Processing -*** Input Processor, Simulation Processor, Rendering Processor

Head tracking

A system called 6DoF (six degrees of freedom) plots your head in terms of your X, Y and Z axis to measure head movements forward and backwards, side to side and shoulder to shoulder

Lenses, field of view and frame rate for the resulting picture to be at all convincing



Processing

https://www.youtube.com/watch?v=hZ8Xj_I3aNU&t=1s


Thanks!
Any questions?

References

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