Introduction to Extended Reality

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Learning the Lingo

What is XR?

What is Virtual Reality?

Virtual reality is the computer-generated **simulation** of a three-dimensional image or environment that can be **interacted** with in a **seemingly real or physical way** by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.

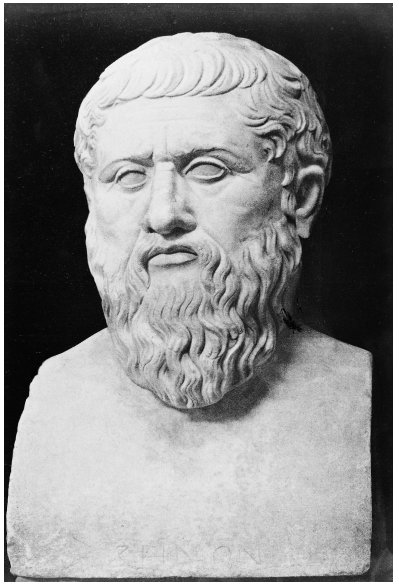
VIRTUAL REALITY

What is Augmented Reality?

Augmented reality is an **interactive experience** of a real-world environment where the objects that reside in the real world are **enhanced** by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.

LTE
6:02
AR
Pikachu
CP ???

Allegory of the Cave



Plato

The Science

Eye

Sensory System

Collect Data

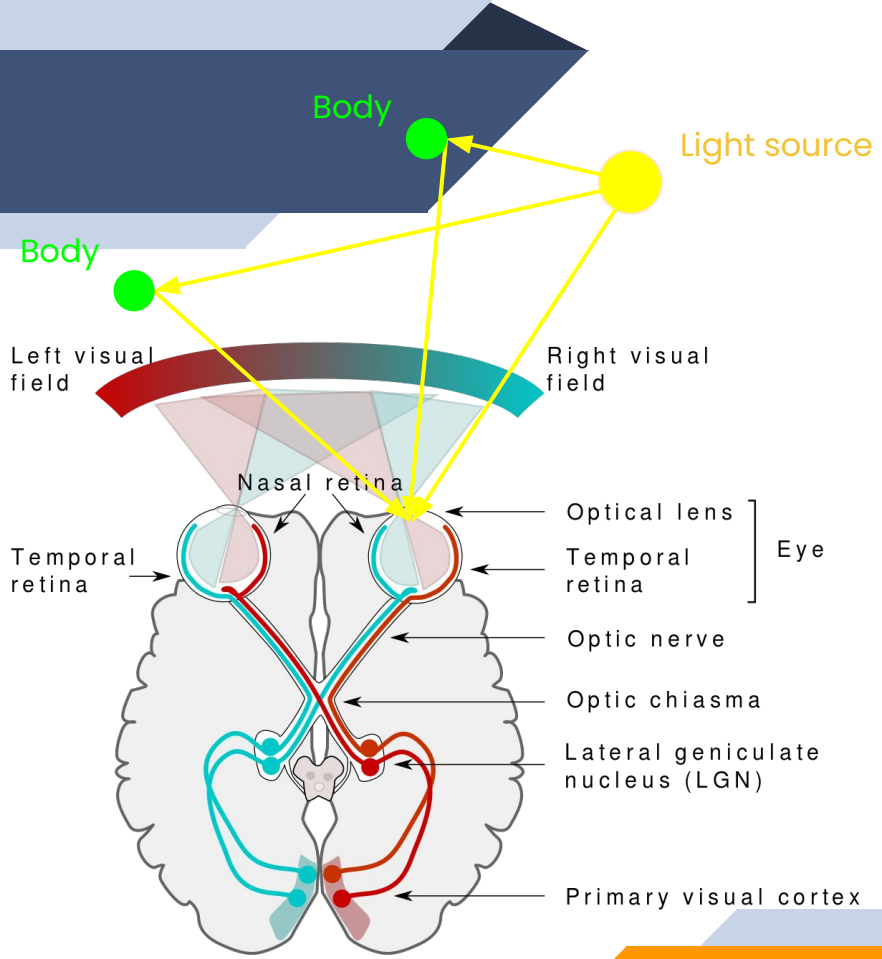
Light enters the eye through the lens and forms a 2D picture of the external world in the retina.

Visual Pathway

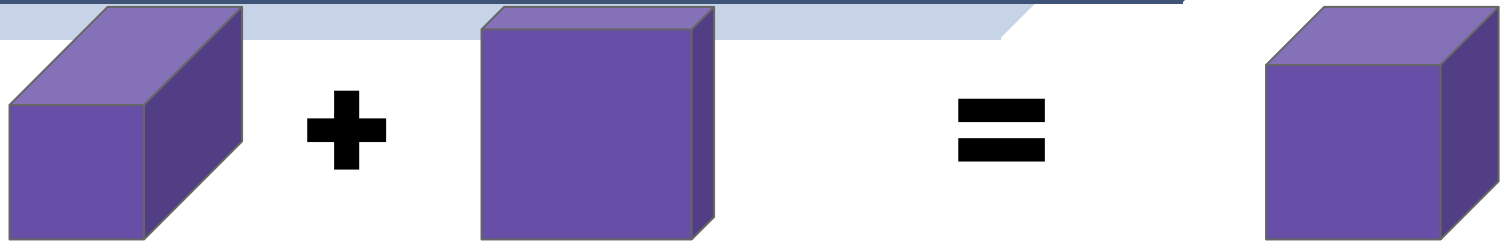
Perception System

Interpret Data

Retinal pictures, upon entering the optic nerve, are processed to infer depth, objects, and motion by various parts of the brain

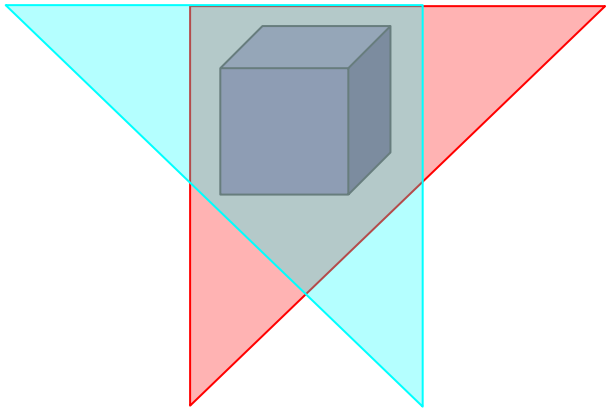


The Science



Right image

Left image



Stereoscopy

By comparing the two images formed at each eye's retina, the brain can infer depth.

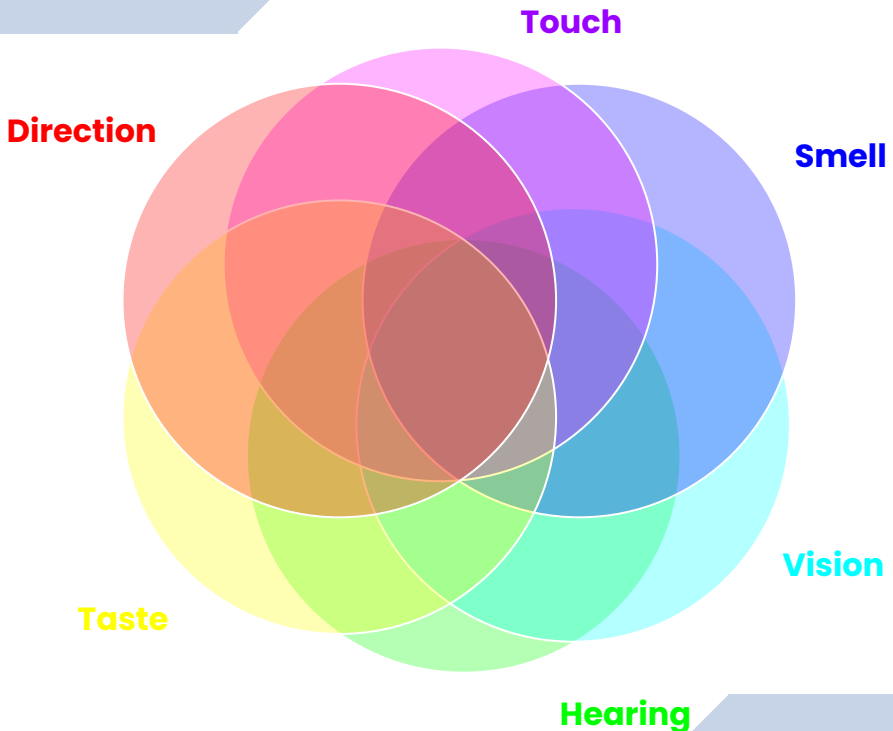
Human perception is more than just vision!

Complex System

A system made of subsystems, and whose behavior results from its subsystems' interactions. For example, hearing may change how one views an object, and vice versa

Psychophysics

The study of perception systems.



Historical Context

Morton Heilig's *Sensorama*, **1962**

Ivan Sutherland's *Sword of Damocles*, **1968**

Nintendo's *Virtual Boy*, **1995**

Modern Resurgence

Oculus Rift DK1, **2011**

Oculus Quest 2, **2020**

What's different this time?

Flat panel Displays
Batteries and Power
Mobile CPUs
Wireless networking
Sophisticated Cameras
Gyroscopes, Accelerometers

Different Terminology

VR AR MR XR

Virtual Reality

Replaces vision entirely with a virtual environment.

Valve Index

Different Terminology

VR **AR** MR XR

Augmented Reality

Augments regular vision with virtual overlays or objects.

Microsoft HoloLens

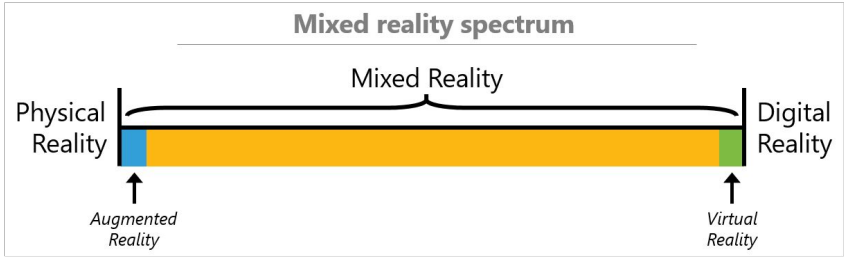
Different Terminology

VR AR **MR** XR

Mixed Reality

The spectrum of ratios between real life and virtual objects...or...

> Virtual overlays that seamlessly interact with the real world in synchronous time...or…
>
> > A Microsoft buzzword...



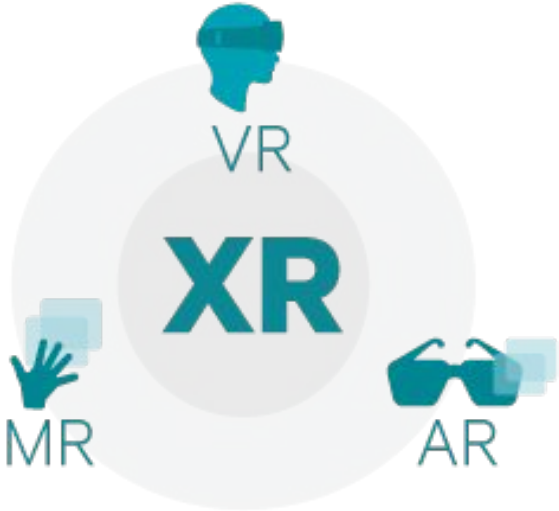
Different Terminology

VR AR MR **XR**

Extended/Cross Reality

Umbrella term that references all forms of digitally influenced “realities”.

Adopted by Unity in version 2017.2.



AR/VR Form Factors - Simulated Environments

Sports Simulator

Flight Simulator

VR Amusement/Arcade Rooms

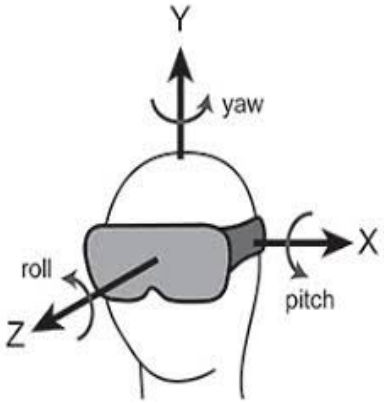
AR/VR Form Factors - VR Headsets

Mobile
(Samsung Gear VR)

PC Tethered
(Valve Index)

Standalone/All-in-One
(Oculus Quest 2)

Different kinds of input devices



Hover Select

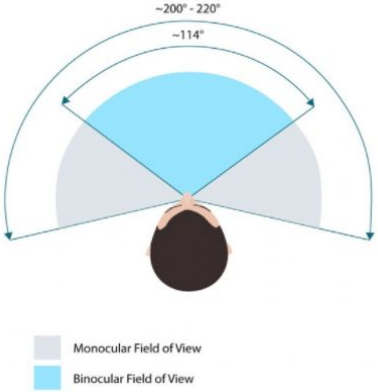
Remotes

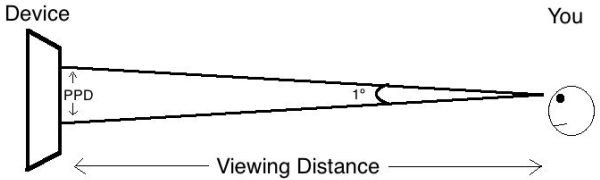
Tracked (3 DOF or 6 DOF)

Hand Tracking

Variables at Play

- Resolution (PPD)
- FOV
- FPS
- Comfort
- Durability
- Features
- ***Cost!***





About Extended Reality Decal (and us!)

Three Goals

1. To get you excited about VR!!
2. To teach you XR (VR specifically) design principles
3. To teach you practical Unity skills

Facilitators

Daniel He

James Hu

Erik Nelson

Alton Sturgis

Class Structure

	In Class	Outside Class
1st Half	Lectures	Homework
	Labs	
2nd Half	Final Project	

Logistics

Policies

- Homeworks are due the day before your section.
  - e.g. HW assigned this week would be due the night before next class.
  - Submit on Simmer.io, submit link to bCourses.
- Labs are completed in class.
  - Facilitator will check you off once you finish lab.
  - If you don't finish in time, please come to the other section or office hours to finish.
- Lowest HW score is dropped.
- Come talk to us if there are any problems regarding attendance/enrollment/etc!
  - Make sure you are enrolled in the EdStem and bCourses.
- **Use a mouse!**

Office Hours

- Will establish office hours later in the semester based on need.
- Do's
  - Ask for help/advice on class material
  - Ask us about XR
  - Ask about XR@B
- Assignments are straightforward, but many technical issues do pop up so don't wait until the last minute to start on assignments!

Grade Breakdown

- Labs (33%)
- Homework (33%)
- Final Project (33%)
  - Project Grade (23%)
  - Peer Evaluation (10%)
- Free Point! (1%)

Homework

- **HW1** has been officially assigned, due the **night before next class**

The homework can be found at **xr.berkeley.edu/decal/homework**

Unity Specs

Unity version: **2021.3.8f1**

Get this through Unity Hub

https://unity3d.com/get-unity/download