

CS 498

Sections VR3 & VR4

# Welcome to CS 498 - Virtual Reality

- Prof: Lawrence Angrave
  - Office Location: 2217 Siebel Center
  - Office Hours: Tues 11:30 - 12:30
  
- Course Staff: Yike Wang, Rui An, Katie Mimnaugh, Matthew Ong, Kai Fu, Mike Peretz, Shan Tulshi, Kewei Sui, Craig Santo, Gary Liu, Ke Lu, Nathaniel Myren, Sophia Lin, Edward Xue, Menglin Tian, Yinchun Xu, Victor Mouschovias

# Craig Santo

Junior in CS

3rd semester on staff

NCSA AVL intern

Unity Student Ambassador

# Edward Xue

Master in CS

3rd semester on staff

VR is awesome

# Menglin Tian

Master in CS

2nd semester on staff

It is fun to see and play with all the cool projects students work on at the end of the semester.

# Mike Peretz

Hi! I'm Mike! I'm a Senior in CS, and this is my 2nd semester on VR course staff. I've also CAd for CS225 for 5 semesters and CS242 for 2 semesters. My favourite thing in the world is Demi Lovato (my fiancé is a close second, oops). This is by far my favourite course, and I couldn't be more excited for this semester!



# Rui An

Senior in CS

Second semester on staff

NCSA Laboratory For Critical Technologies Research Programmer

# Nate Myren

Junior in CS

3rd semester teaching

Blame me if MP1 is bad

My advice: Start projects early- The lab fills up quick





# Shantanu Tulshibagwale (Shan)

I'm a junior in CS, and this is my third semester on staff!

Also blame me if MP1 is bad (can't let Nate take it all for himself)

My favorite thing about this course is just playing with the cool things people make with VR -- student or commercial projects. I can't wait to see what you all come up with!



# VR Lab - SC4107

20 workstations with Oculus Rift CV1s

6GB RAM

NVidia GeForce Titan Blacks

Dual 27 inch monitors

Windows. Unity3d.

Work in pairs on 4 assignments + final project



# Course Materials

- Webpage: <https://courses.engr.illinois.edu/cs498vr3/>
- Piazza
- Textbook: Virtual Reality, S.M. Lavalle, 2016 (free online)
- VR Lab: Siebel Center 4107

What this class is about:

VR, perception meets engineering and computer  
science

# Second Wave of VR, will there be a third?

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VIRTUAL REALITY

## VR Sales Numbers Are Wet Blanket on Adoption Hopes

Jeff John Roberts  
Feb 19, 2017

[f](#) [t](#) [e](#)

This time it's different, right? Unlike the virtual-reality fad that fizzled 15 years ago, boosters say today's version of VR tech—backed by the likes of Facebook (FB, -0.73%), Google (GOOGL, -0.68%), and Samsung—is going to be big.

Well, maybe not. Sales figures for 2016 are in, and they're not exciting: The VR industry shipped 6.5 million devices and pulled in \$1.8 billion in revenue, according to research firm Super Data. [That's below expectations](#), though analysts say it isn't terrible for an emerging technology.

What's more telling is who's buying. Though VR has promise for business, most customers now are gamers. They love it—VR game users reportedly engage in 40 sessions a month on average. But such hard-core fans aside, most people lack a compelling reason to shell out for the gear. Research firm Mordor says that

The SIEMENS hearing aid of the future is here  
Hear.com

Best & Worst Refinance Mortgage Companies  
Comparisons.org

The Past, the Present, and the Futu...  
VR isn't just for gaming anymore.

0:59 / 2:55

# What is the killer app??

(HINT: Don't use locomotion in your projects!)

## A BIT ABOUT YOU

Have you tried VR before?

Do you own a VR headset?

Do you like rollercoasters?

Do you get motion sickness?

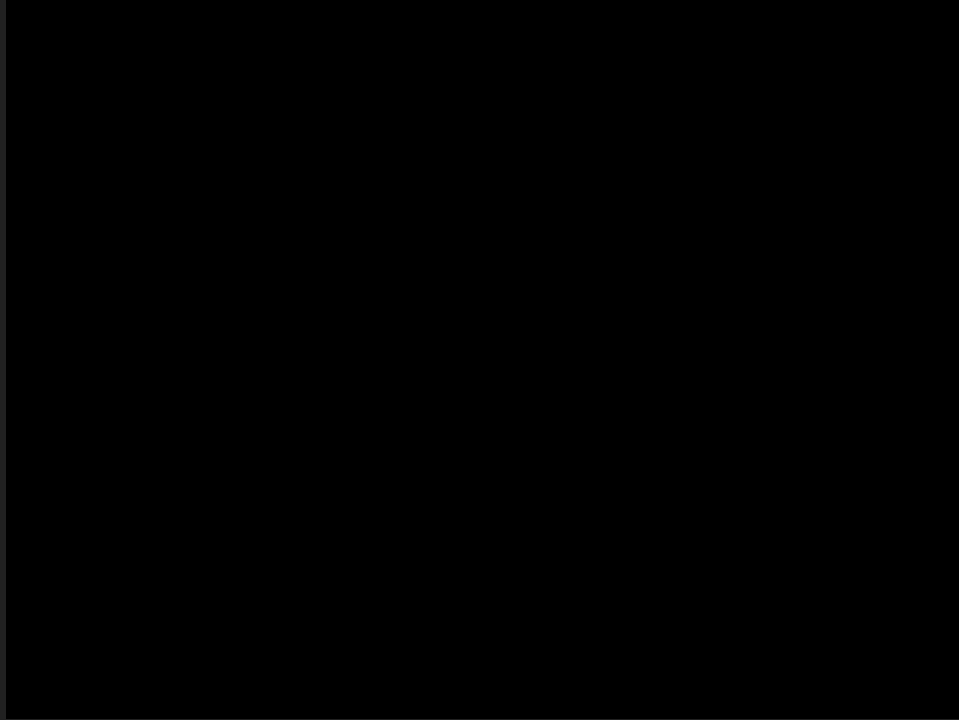
# A Bit About Oculus

- Early 2012, Palmer Luckey made a prototype headset (duct taped!!)
- Aug 2012, John Carmack improved it and showed at E3
- Aug 2012, game industry leaders showed strong support, Oculus was founded (Brendan Iribe, Michael Antonov, Nate Mitchell, and Jack McCauley)
- Sept 2012, Kickstarter very successful
- 2012 - 2014, over 60,000 headsets sold
- Mar 2014, Facebook acquires Oculus for \$2 billion





# A Bit About Oculus



<https://youtube.com/watch?v=pAC5SeNH8jw>

# What is this course about?

- Learn how to build \*good\* VR experience (comfortable + adequate for the task)
- Learn how VR works (engineering + psychology)
- Learn how to criticize VR
- Learn fundamentals to shape future of VR

Lecture, 4/5 MP's, 2 exams, project

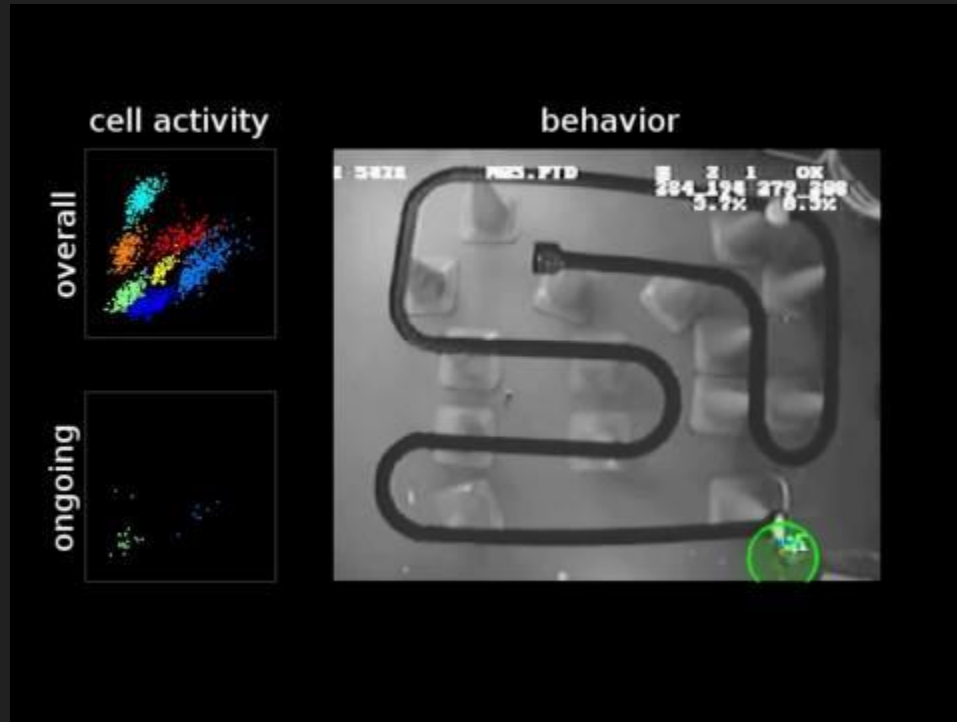
## TASK-DEPENDANT VR:

- Game, write code, maintain relationship, relax, watch film, travel to exciting virtual places

# Definition of VR

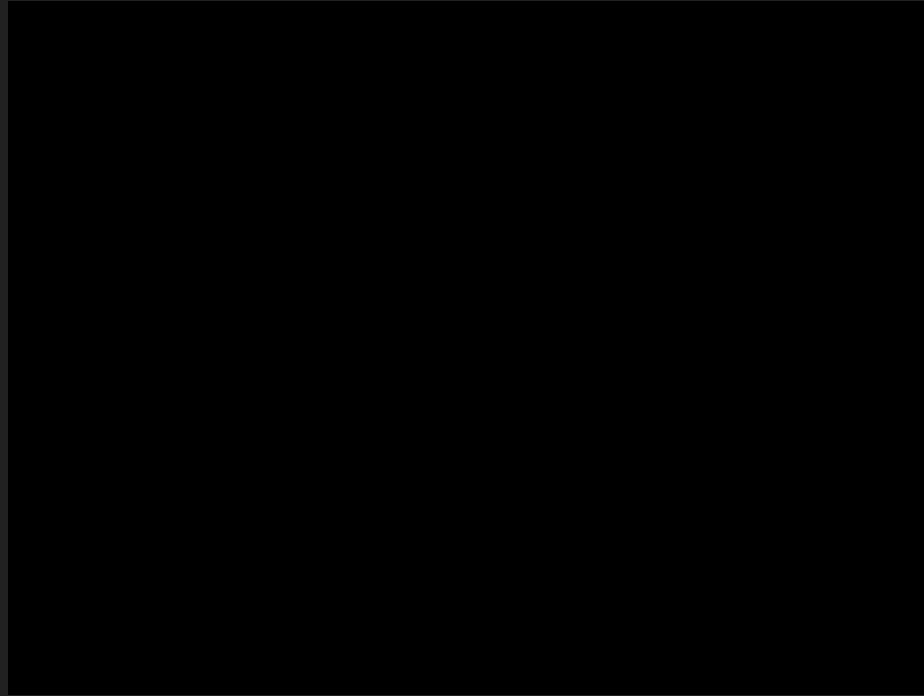
Inducing targeted behavior in an organism by using artificial sensory stimulation, while the organism has little or no awareness of the interference

# Awareness = place cells?



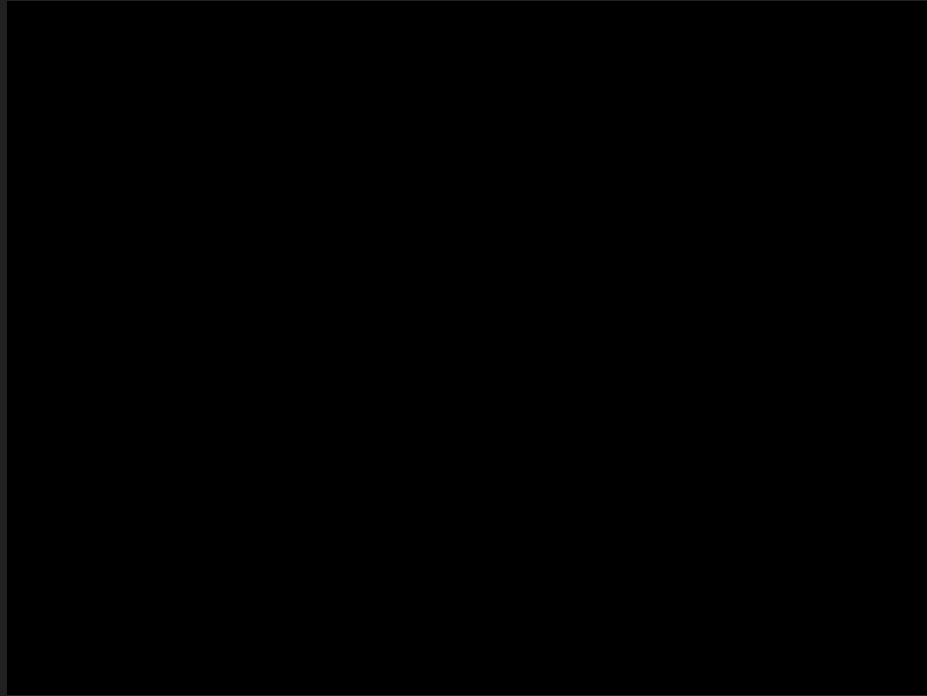
<https://www.youtube.com/watch?v=IfNVv0A8QvI>

# Examples of VR



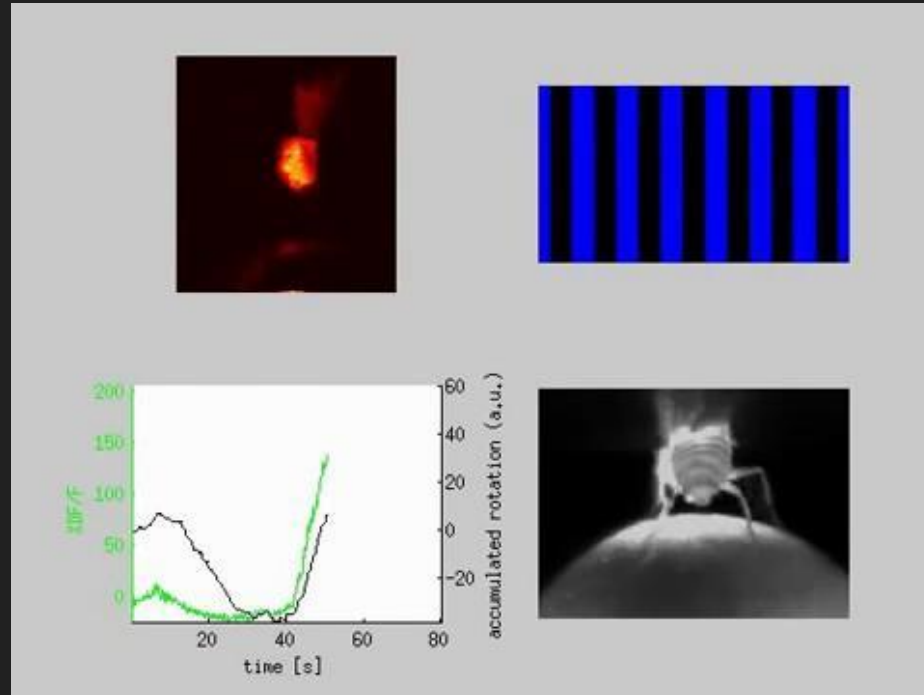
<https://www.youtube.com/watch?v=j1O8fZap3jM>

# Examples of VR



<https://www.youtube.com/watch?v=1DJOTEDBA2c>

# Examples of VR



<https://www.youtube.com/watch?v=1ezL8nGo--I>

# Definition of VR

Inducing targeted behavior in an organism by using artificial sensory stimulation, while the organism has little or no awareness of the interference

Who is the laboratory rat and who is the scientist?



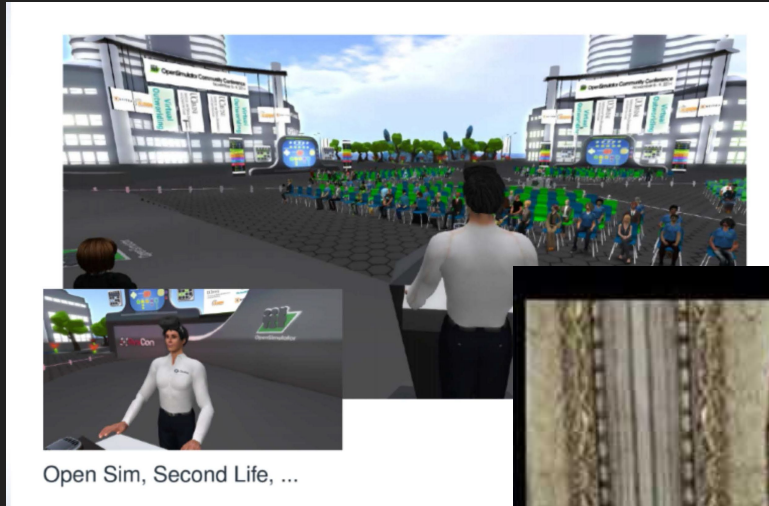
# VR or Not VR?

- Playing Second Life (first person video game)
- Watching a movie
- Video conferencing
- Listening to music
- Playing a third person video game
- Augmented Reality

# VR or Not VR?

- Talking on the phone
- Reading a book
- Looking at a painting
- Being under the influence of a hallucinogenic drug
- Wearing thermal clothes

# Definitely VR... Socializing in Virtual Spaces

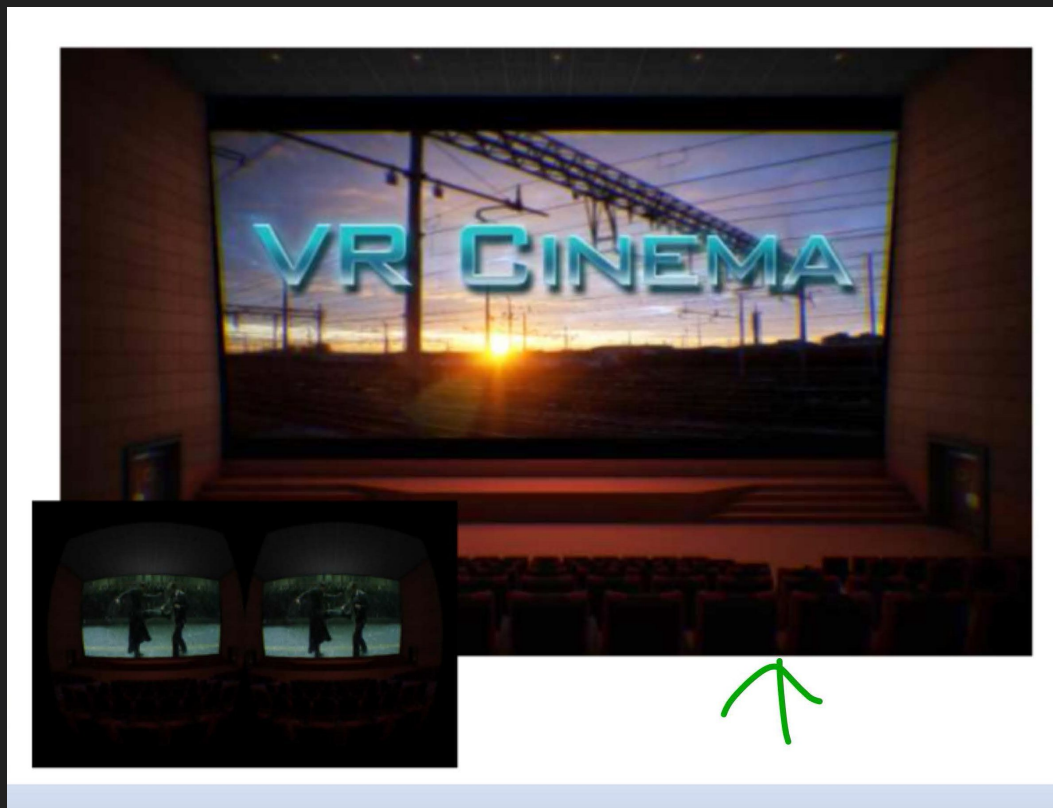


# Definitely VR... Architecture and Real Estate

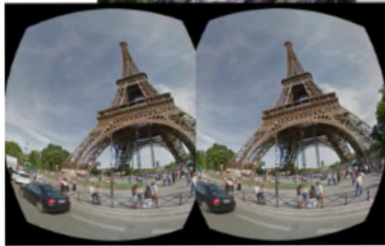
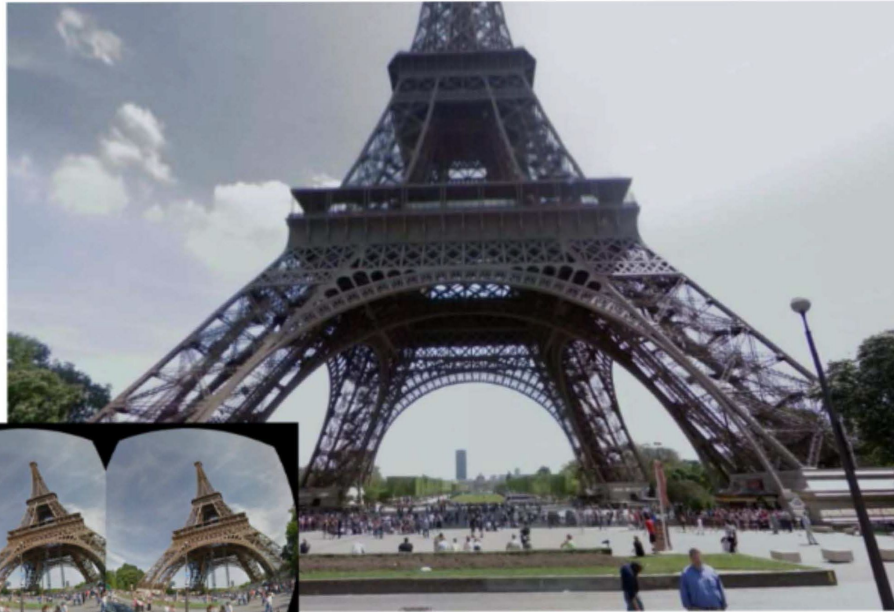


Do you wish your home were bigger?

# Definitely VR... Movies



# Definitely VR... Panoramas



Pick your favorite street views and have a look around.

# Definitely VR... VR + Robots



Connect omnidirectional cameras to mobile robots, humanoids, quadrotors

# Definitely VR... First-Person Shooter Games



Team Fortress 2, Valve Inc.



# Definitely VR... VR Game Jam



What could you do with an elephant trunk?

# Definitely VR... Thrill Seekers



Virtual amusement park rides!

# Definitely VR... Experiences



Ever wonder how Louis XVI must have felt?

# Definitely VR... Body Swapping



# Definitely VR... Flying Like in Your Dreams



Zurich University of the Arts

When did VR start?

# When did VR start? Paintings?



When did VR start?





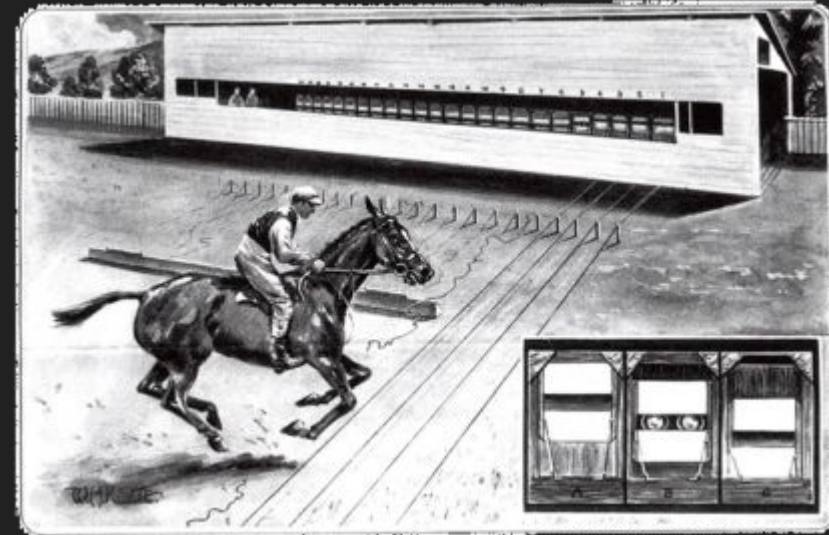
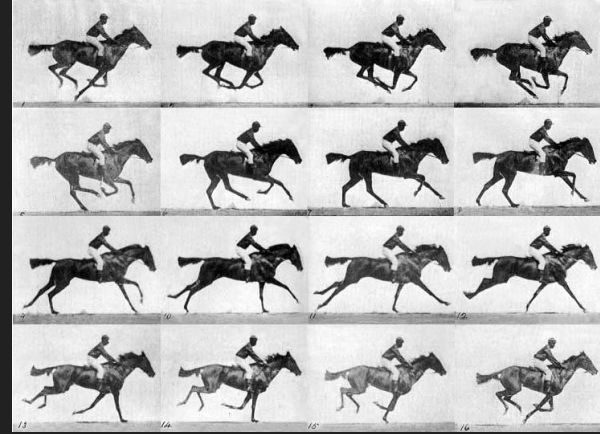
When did VR start?



When did VR start?

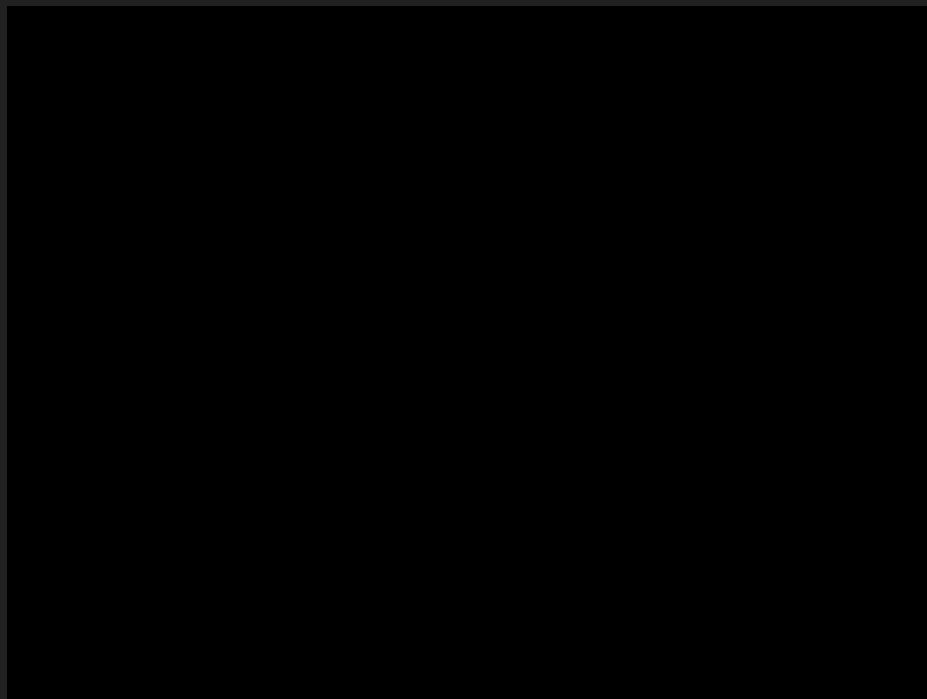


# When did VR start? Motion pictures?

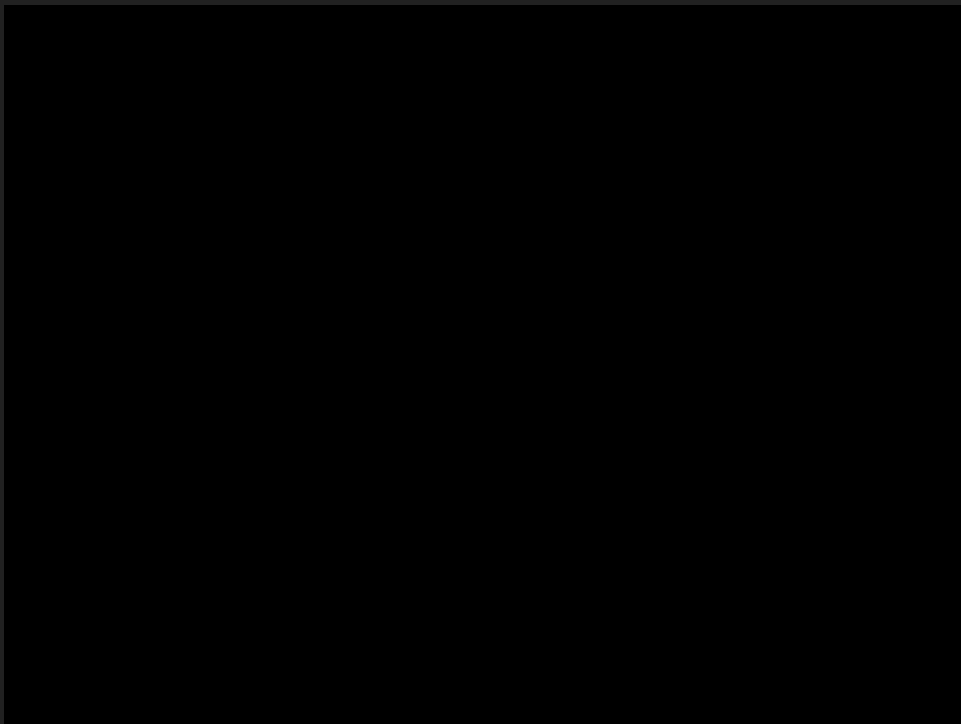


<https://www.youtube.com/watch?v=IEqccPhsqqA>

1878 Muybridge

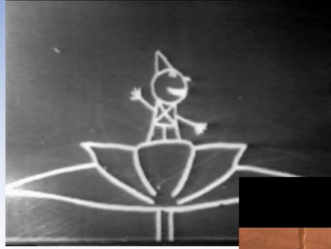


[https://www.youtube.com/watch?v=b9MoAQJFn\\_8](https://www.youtube.com/watch?v=b9MoAQJFn_8)



[https://youtube.com/watch?v=vKW-Gd\\_S\\_xc](https://youtube.com/watch?v=vKW-Gd_S_xc)

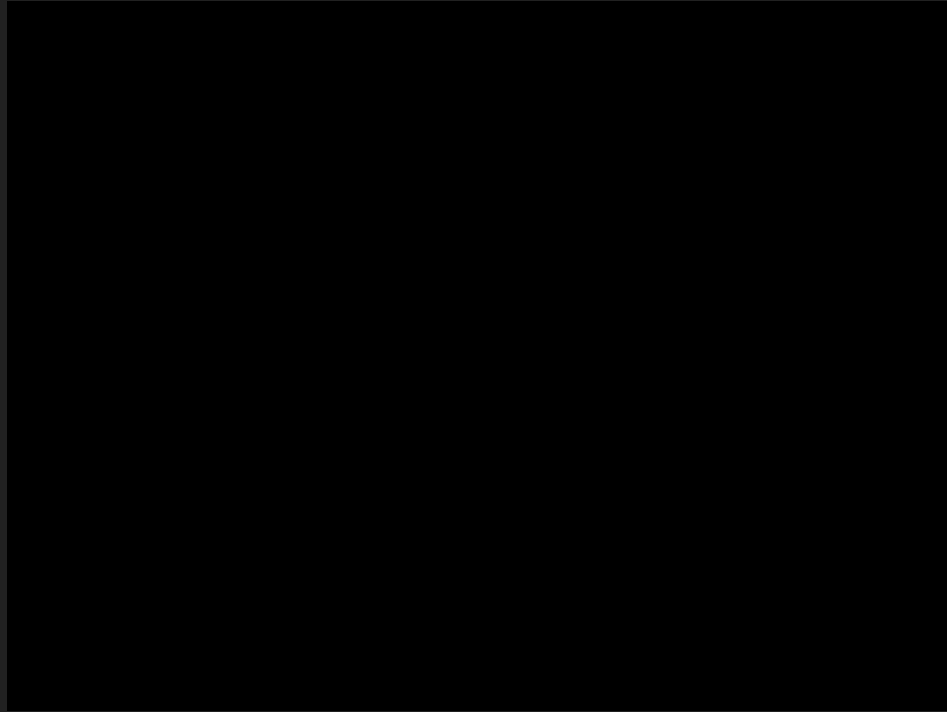
# Realism vs Simplicity in Cartoons



# Realism vs Lower Cost and Portability



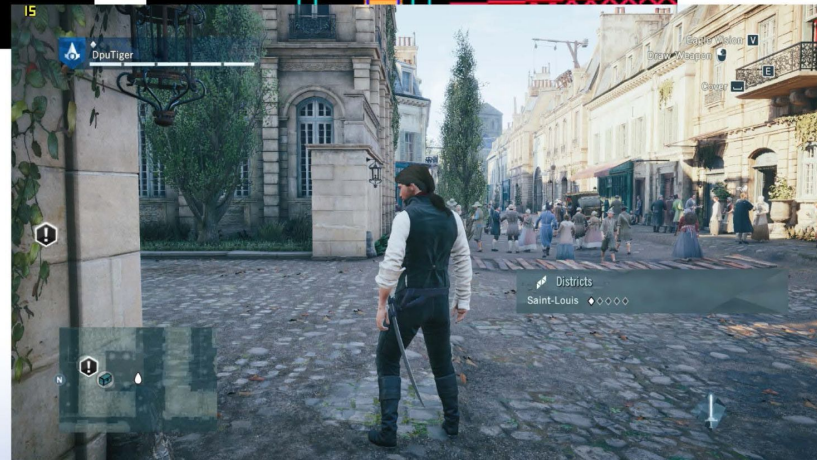
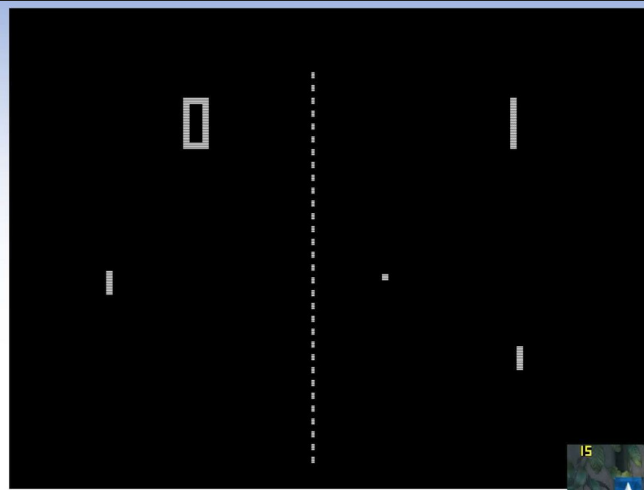
# How many FPS are enough?



<https://www.youtube.com/watch?v=-Qk7ZSXujRo>



# Evolution of Computer Games



# Realism vs Simplicity in Computer Games



# History of VR

Introducing . . .

## sensorama

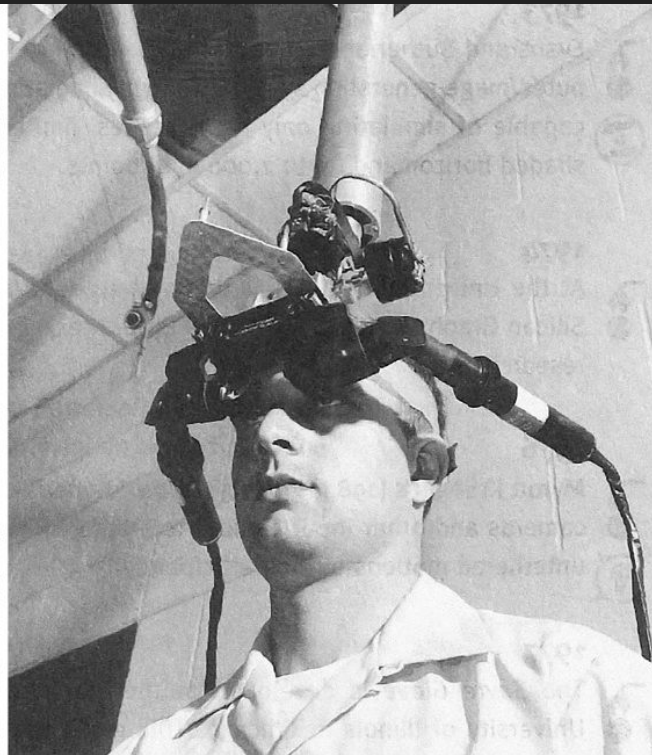
The Revolutionary Motion Picture System that takes you into another world with

- 3-D
- WIDE VISION
- MOTION
- COLOR
- STEREO-SOUND
- AROMAS
- WIND
- VIBRATIONS

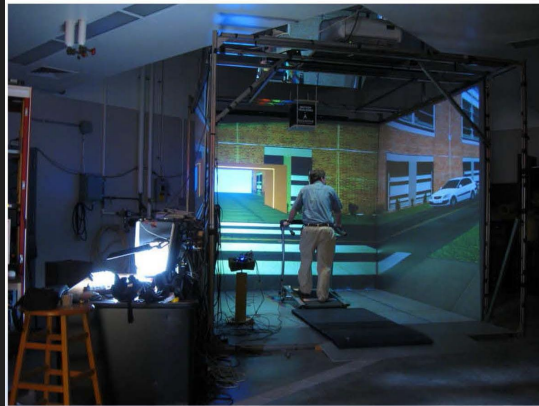


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SENSORAMA, INC., 855 GALLOWAY ST., PACIFIC PALISADES, CALIF. 90272  
TEL. (213) 459-2162



# Headsets vs Cave



# Birds-Eye View: Hardware

## Displays (Rendering):

- Visual:
- Audio:
- Touch:
- Smell? Taste? Vestibular?

## Tracking Hardware Components:

- IMU's:
- Magnetometers:
- Cameras

## Controllers:

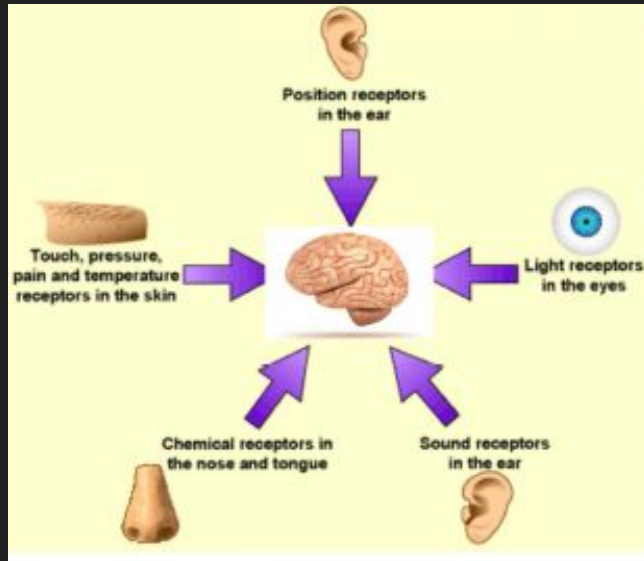
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## Lens:

## Computer:

- CPU:
- GPU:

# Hardware: Senses vs Sensors



A sensor is a transducer that transforms the physical world energy into a signal

# Review

Definition of VR?



# Definition of VR

Inducing targeted behavior in an organism by using artificial sensory stimulation, while the organism has little or no awareness of the interference

Review: Course Goals?

# What is this course about?

- Learn how to build \*good\* VR experience (good = ? )
- Learn how VR works (engineering + psychology)
- Learn how to criticize VR
- Learn fundamentals to shape future of VR

# Homework

- Chapter 1 of Steve LaValle's VR online book  
Definition of VR, modern experiences,  
historical perspective.
- Experiment on another student (not in this course):  
The Rubber Hand Illusion

