Video Games and Interfaces: Past, Present and Future

Class #2: Intro to Video Game User Interfaces

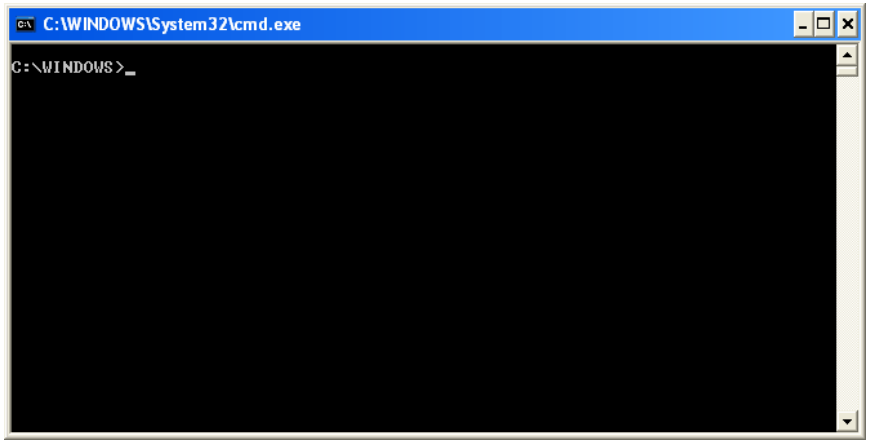
Today's lecture

- ***Goals of Today's Lecture:***
- What is a User Interface (UI)?
- What is the difference between 3D graphics and 2D graphics?
- History of Video Games and Interfaces
- Different types of Output:
  - 2D vs 3D vs Virtual Reality vs Augmented Reality
- What is a 3D UI?

What is a User Interface?

- Where the interaction between humans and machines occurs.
  - User interface refers to the parts of a computer and its software that you (the user) see, hear, touch, or talk to.
  - Input – allowing the users to manipulate a system.
  - Output – allowing the system to indicate the effects of the input.
- For example, if I use a mouse to point and click, or I speak instructions to the computer those are input. And the output is what I see displayed on the screen or what I hear coming out of the speakers.

User Interfaces



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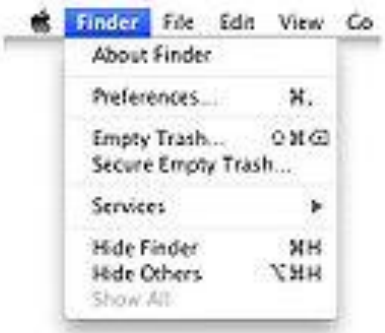
menu



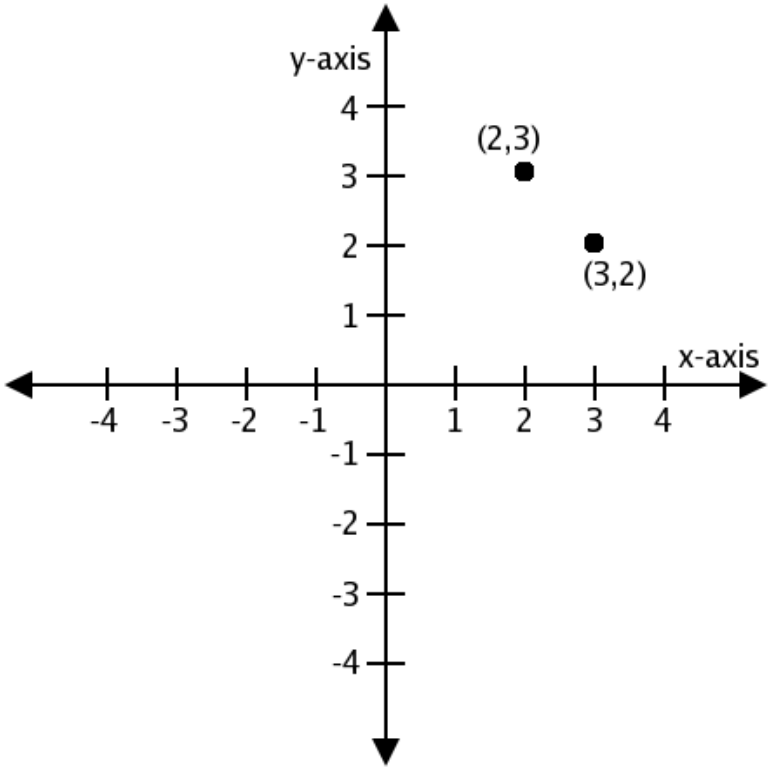
pointer

User Interfaces

User Interfaces

User Interfaces

2D vs 3D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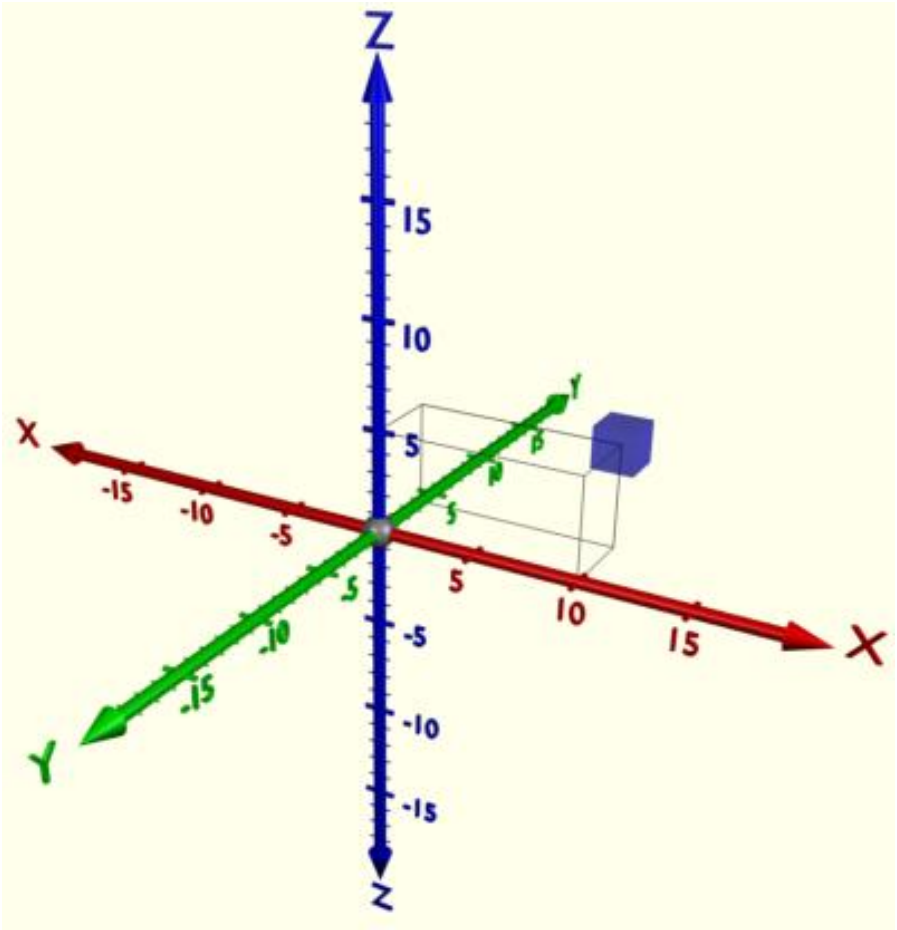
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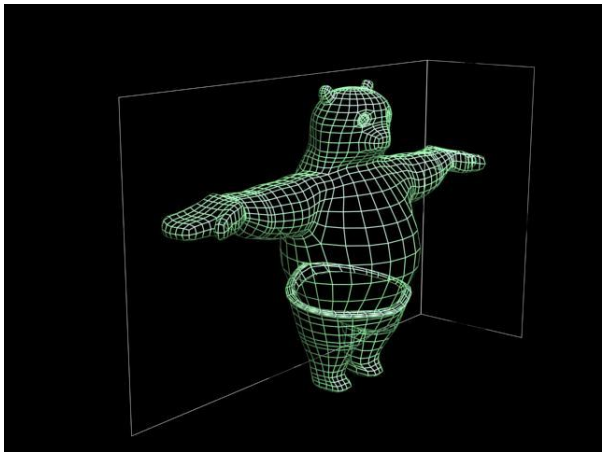
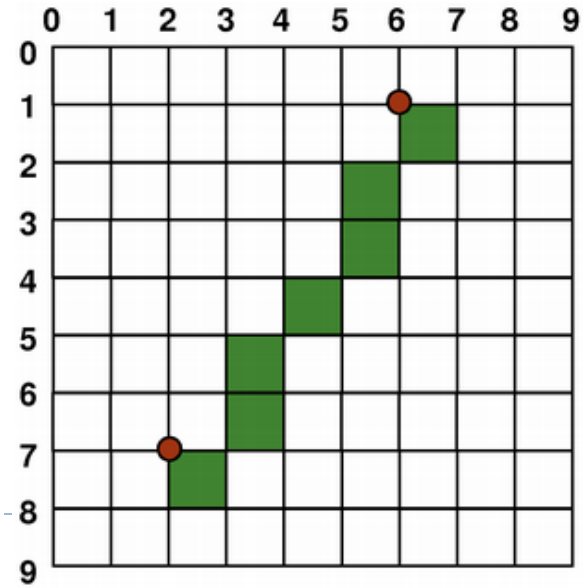
2D vs 3D Graphics

- 3D Graphics
  - Use a 3-dimensional representation of geometric data, that is rendered as a 2D image to the screen.
    - Same as how a movie is rendered as a 2D image is a recording of a 3D world.
    - 3D graphics often use 3D models which is the geometrical representation of any 3-dimensional object.



- 2D Graphics
  - Displaying digital images to the screen.
  - As an array of pixels.

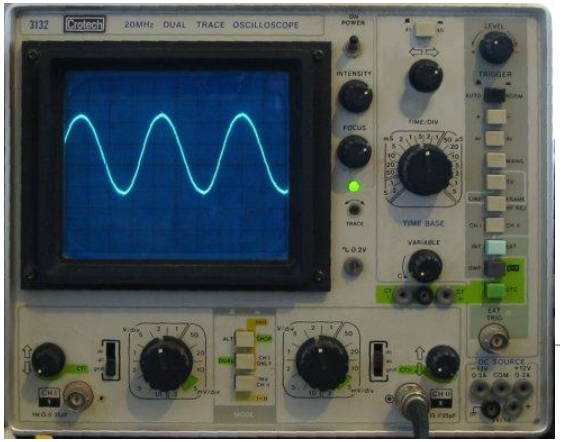


Why Video Games?

- Why do you want to learn about video games?
- Video Games
  - Multi-billion dollar industry: $18.5 billion in 2010 in US alone.
  - Major driving force in home entertainment.
- Driving force in technological innovation
  - Graphics algorithms, hardware, sound, AI, etc. can be applied to other fields.
  - Technological transfer to healthcare, biomedical research, defense, and education.

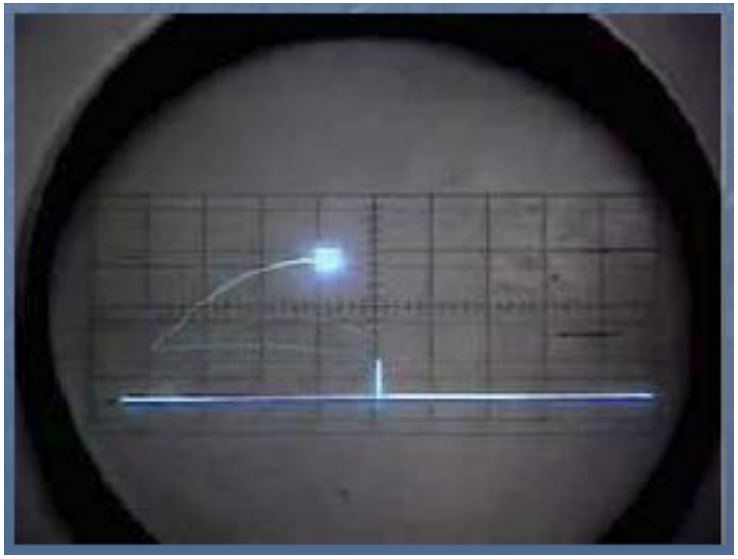
History of Game UIs

- Does anyone know when the first video game was invented?
- 1947: Cathode-ray tube amusement device.
  - Earliest proposal for an electronic gaming device.
  - The interface consisted of knobs and buttons.
  - Based on WWII radar displays, players use knobs to adjust the trajectory of light beams (missiles) in an attempt to hit targets.
  - Nobody knows if it was actually implemented, but the idea was patented.



Early Video Games

- Tennis for two: Original video game:
  - 1958
  - Display: oscilloscope – graph that shows a change in voltages.
  - Input: dial and a button
  - http://www.youtube.com/watch?v=6PG2mdU_i8k&feature=youtube_gdata_player



Early Video Games

- Spacewar! First computer game:
  - 1961: by Russel, Graetz, and Wiitanen at MIT.
  - Interface: mostly buttons, but also joysticks and light pen.
  - 2 armed spaceships attempt to shoot one another while maneuvering in the gravity well of a star.

Early Video Games

- 1972: Magnavox "Odyssey" is a first ever home game console.
  - Could play Ping-Pong with 2 people.
  - Buttons and dials, 1D.
- 1975: Atari creates Pong for home and arcades.
  - Game industry is born.

- http://www.youtube.com/watch?v=H2Elsnr_cv4&feature=related

Early Video Games

- 1977: Atari 2600 console
  - Cartridge based system, so you could change games.
  - 2D controllers – joystick and a trackball.
  - Introduce quality sound hardware, which is still popular today.

Early Video Games

- 1978: Magnavox Odyssey2
  - Includes full-sized keyboard.
  - Used for educational software and programming.
  - First home electronics device with speech synthesis.

Modern Consoles

- 1983: Nintendo Famicom
  - Modern controller layout: controls for both hands, directional buttons.
  - Increasingly complex controllers and interfaces: games are still 2D, but interaction is more complex and rich.
- 1994: Nintendo 64
  - First "true" 3D console
  - Adds joystick to controller, game pad gets more controls.

Modern Consoles

- 1996: Sony dual-shock controller
  - Adds second joystick and shoulder buttons.
  - Standard controller for PS, PS2, PS3.
- Observations
  - Increased complexity of game interface allows for more expression in games.
  - Difficult to master
  - Focuses more and more on "hard-core" games, since casual gamers often find games more difficult.

Arcade Games

- "Easy to learn, but difficult to master"
  - Has to be learned immediately.
  - Interface can't be too complex.
- Began in the mid 1970's
- Specialized interfaces
  - Often based on simulation activities:
    - Shooting, driving, snowboarding.
  - Many innovative and original interfaces…

Arcade Games – UI Innovation

Arcade Games UI Innovation

Manx TT

Dance Dance Revolution

Virtual Reality Arcade Games

- Arcades were first to introduce VR and 3DUI in games (1990's)
  - Head/body tracking
  - Stereoscopic vision
  - Immersive displays
  - 3D spatial interaction

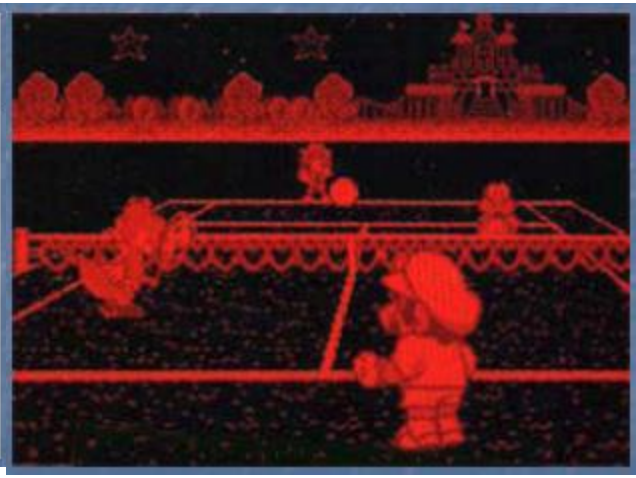
- In a virtual reality environment, a user experiences **immersion**, or the feeling of being inside and a part of that world.
  - The user is able to **interact** with his/her environment in meaningful ways.
  - The combination of a sense of immersion and interactivity is called **telepresence**.
- An effective VR experience causes you to become unaware of your real surroundings and focus on your existence inside the virtual environment.

Virtual Reality Arcade Games

- Disney Quest: Indoor interactive theme park (opened 1998)
- Several VR games
  - Pirates of the Caribbean: Battle for Buccaneer's Gold
    - Uses motion platform, shoot cannons, navigate with steering wheel.
    - Surround screen display, users wear stereo glasses.
  - Virtual Jungle Cruise
    - Users sit in raft, steer and paddle.
  - Aladdin's Magic Carpet Ride
    - Users wear Head Mounted Display (HMD), sit on motorcycle-like device to steer.

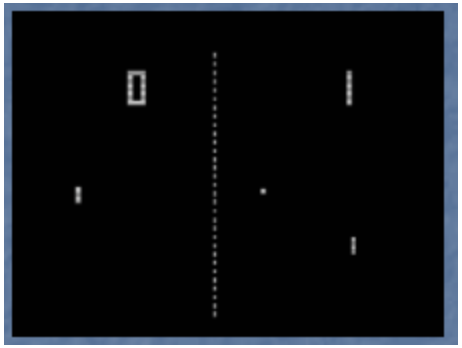
3D and VR on Game Consoles

- Several attempts to introduce 3D/VR for game consoles.
  - 1986: Sega Master System
    - 3D glasses, LCD shutters, few games.
  - 1995: Nintendo Virtual Boy
    - Virtual reality goggles, monochrome, stereo.
- Not successful
  - Low quality, didn't work well.
  - Not necessary since games were so simple.



Conclusions from History

- Games complexity increases
  - 1970: Pong
  - 1980: Donkey Kong
  - 2000: Halo
  - Interaction complexity increases.



Some Conclusions from History

- The complexity of controllers increased
  - Use same interface components as in the 60s
    - Buttons, Joysticks, Keyboard/mouse
  - Combined together / increased number.
  - More difficult to learn and master.
  - Less accessible to casual user.
- 3D spatial controllers / 3DUI
  - Very successful in arcades.
  - Failed in home devices.
  - Inaccurate/low quality.

3D User Interfaces - Today

3DUI – What?

- Goal of 3DUI in games
  - Designing input devices and interaction techniques to effectively control highly dynamic 3D content.
- 3 basic approaches:
  - **Mapping 2D input to interact with 3D world**
    - Keyboard and mouse, joysticks, game controllers.
    - Ex. Flight Simulator, Second Life, Halo 3
  - **Simulating real world tools or using physical props**
    - Simulation: steering wheels, light guns, musical instruments.
    - Physical props: dance pads.
  - **True spatial tracking of user gestures**
    - Camera, ex. Sony Eyetoy, Microsoft Kinect.
    - Acceleration/infrared tracking: Wii controllers.

3DUI in the Home Today

- Rapid growth of 3D spatial interfaces for games today
  - Cheaper and higher quality of sensors
  - Fast game hardware can perform complex tracking/recognition
  - Need for simpler and more intuitive interaction with games.
  - Games has become mainstream culture, more casual not only hard-core gamers.

3DUI in the Home Today

- 2003: Sony PS2 Eye Toy
  - Video camera interface for PS2
  - Casual/party games
  - Significant success in Europe/US
  - Based on several decades of research on visual tracking in robotics and computer vision.

3DUI in the Home Today

- Nintendo Wii - 2006
  - Latest game console from Nintendo
- Key innovation – Wiimote controller
  - Provides 3D UI in the home.
- Makes games accessible to casual users.
  - Great competitive edge over Xbox 360 / PS3

3DUI in the Home Today

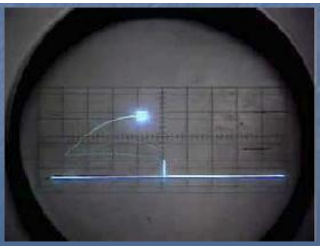
Spatial UIs in the Home Today

- Microsoft Kinect - 2010
  - RGB camera
  - Depth Sensor
  - Microphone
- http://www.usatoday.com/tech/gaming/2010-06-14-vidgame14_ST_N.htm

Nintendo 3ds with Augmented Reality

- http://www.youtube.com/watch?v=NicuHL0r5ak
- Released 2011

Timeline



Tennis for Two

Odyssey

Atari

Nintendo

Nintendo 64

Disney Quest

Nintendo Wii

Sony Move

Kinect

1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

- 53 years from the first video game in 1958 to 2011.
- 1994 – 2011, 17 years of 3D games.
- 2006 – 2011, 5 years of development in spatial tracking of user gestures.

3DUI in the Home Today

- Conclusions:
  - New wave in video games with 3D / spatial user interfaces.
  - Attracts casual gamers

User Interfaces in Video Games

- Types of User Interfaces
  - Keyboard and mouse – control a Graphical User Interface (GUI).
  - Console controller (XBOX, PlayStation)
  - Nintendo Wii – wiimote, balance board.
  - Arcade games, specialized UIs, Dance Dance Revolution.
  - Microsoft Kinect – webcam using gestures or spoken commands.