VIDEO GAMES

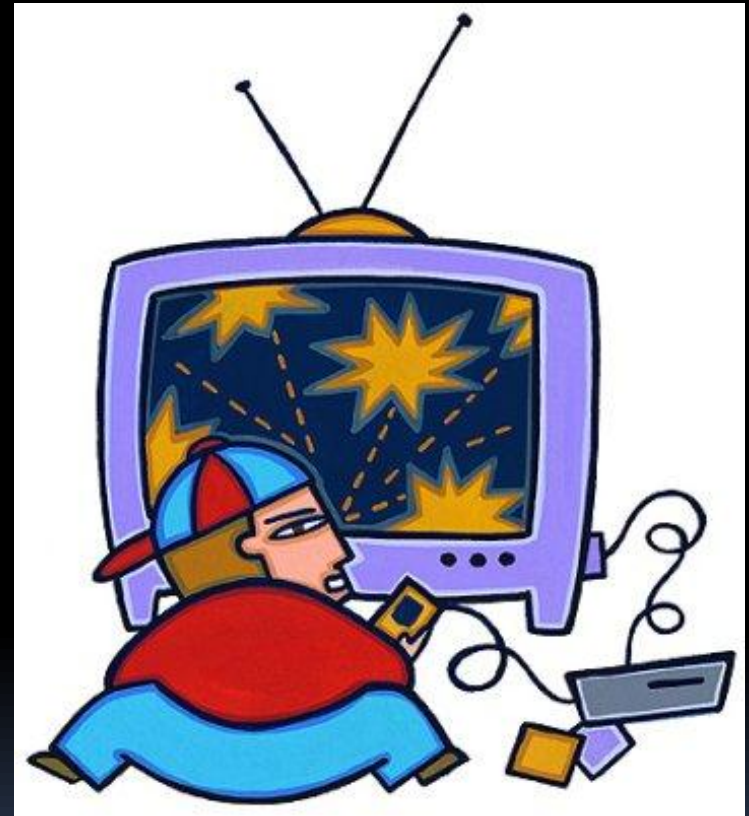## The Beauty and Joy of Computing/CS Principles

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Video Games : Overview

- **History**
  - Inventors & Games
- **How**
  - Design
  - 2D & 3D graphics
  - Motion Capture
  - Artificial Intelligence (AI)
- **Good, Bad, Ugly**
  - GWAP, RSI, Violence
- **Future**

The Beginning : Spacewar!

- **First to gain recognition**
    - Others had games before
    - "Conceived in 1961 by Martin Graetz, **Stephen Russell**, & Wayne Wiitanen"
    - Written for PDP-1 @ MIT
    - Inspired lots, widely ported
- **Can still play this!**
    - 1 Working PDP-1 … in CHM
    - Java version available

WEDGE SHIP

CENTRAL STAR

STARFIELD (HARD TO SEE AT SUCH A LOW RESOLUTION)

NEEDLE SHIP

www3.sympatico.ca/maury/games/space/spacewar.html
en.wikipedia.org/wiki/Spacewar!
www.computerhistory.org
spacewar.oversigma.com

The Founding Fathers

- ## Ralph Baer

- ## Nolan Bushnell

ODYSSEY

Atari 2600 / ATARI
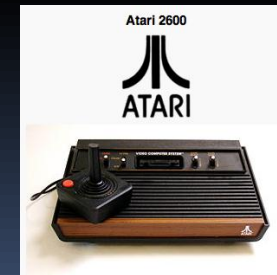
www.onnetworks.com/videos/play-value/the-founding-fathers
(also on iTunes in HD 720p)

UC Berkeley CS10 "The Beauty and Joy of Computing" : Video Games (8)

Shigeru Miyamoto

- The "Walt Disney" of computing gaming
  - Chief Game designer at Nintendo
  - 1st elected to Hall of Fame
- Designed (among others):
  - Donkey Kong
  - Super Mario Bros
  - The Legend of Zelda
  - Super Mario 64
  - Nintendo DS, Wii

www.onnetworks.com/videos/play-value/shigeru-miyamoto
www.time.com/time/asia/2006/heroes/bl_miyamoto.html
en.wikipedia.org/wiki/Shigeru_Miyamoto

History of Video Games : 1970s

- Golden age of video arcades
  - Pong, Space Invaders, Asteroids, Pac Man
- 1st gen consoles (1972–1976)
  - Magnavox Odyssey
- Mainframe computers
  - Hunt the Wumpus, Rogue
- Home computers
  - Type the program in!
  - Floppies, Tapes. Zork, others.
- 2nd gen consoles (1977–1984)
  - Atari 2600, Intellivision

en.wikipedia.org/wiki/History_of_vid
eo_games
www.thegameconsole.com

History of Video Games : 1980s

- **Genre innovation**
- **Gaming computers**
  - Apple II, Commodore 64, Atari 800
- **Early online gaming**
  - Mostly text only, MUDs
- **Handheld LCD games**
- **Video game crash of 1983**
  - Atari buried millions of ETs in dump
- **3rd gen consoles (1985–1989)**
  - Nintendo Ent. System (NES)
    - Super Mario Bros, Zelda, FF I
   - Gamepad introduced
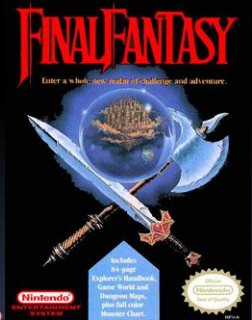
History of Video Games : 1990s

- Decline of arcades
- Handhelds come of age
  - GameBoy, Sega Game Gear
- Mobile phone gaming
- Fourth generation consoles (1990–1994)
  - Sega Genesis, Super NES
- Fifth generation consoles (1995–2000)
  - Playstation, Nintendo 64 (with Super Mario 64)
- Transition to 3D, CDs
  - Crash Bandicoot, Tomb Raider

History of Video Games : 2000s

- **Mobile games**
  - iPhone (games ½ apps)
- **Sixth generation consoles (since 2001)**
  - PS2, Xbox, GameCube
  - Return of alternate controllers (DDR, guitars)
- **Online gaming rises to prominence**
  - WoW, Ultima Online
- **Rise of casual PC games**
  - Bejeweled, The Sims
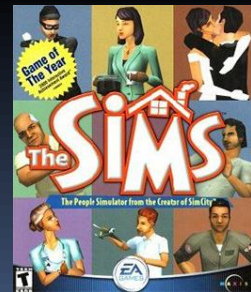
History of Video Games : 2005+

- **Seventh generation consoles (since 2005)**
  - Portables
    - Nintendo DS, PSP, iPhone
  - Consoles
    - PS3, Xbox 360, Wii
  - Increases in development budgets
 - Motion control revolutionizes play
    - Wii controller, iPhone

Example: Playstation 3 Hardware

- State-of-the-art system
  - But SW determines success!
  - (also, cool controllers helps)
- 9 3.2GHz Cores (1PPE, 8SPE)
  - Power Processing Elt (PPE)
    - Supervises activities, allocates work
  - Synergystic Processing Elt (SPE)
    - Where work gets done
    - During testing, one "locked out"
      - I.e., it didn't work; shut down
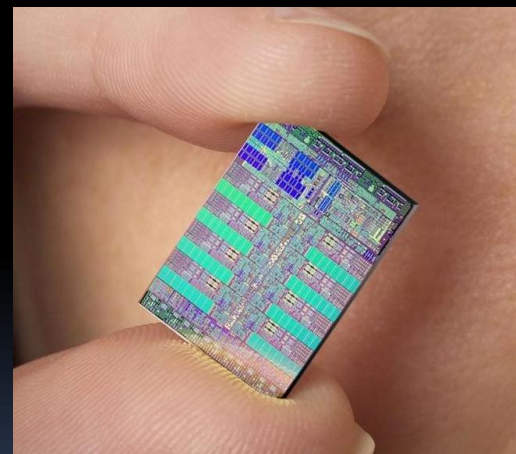
en.wikipedia.org/wiki/PlayStation_3
www.us.playstation.com

Design of a *Casual* Video Game

- ■ **Staff requirements**
  - ▫ Can be done by one person, ala days of old
  - ▫ Bigger teams also (< 10)
  - ▫ Lots of new developers

- ■ **Phones great platforms**
  - ▫ iPhone dominates field
  - ▫ Students are signing up!

- ■ **Time to completion**
  - ▫ Often only a few months!

www.apple.com/iphone/apps-for-everything/fun-and-games.html
blog.entertonement.com/2009/07/7-addicting-casual-games
en.wikipedia.org/wiki/Casual_game

Design of a *Core* Video Game

- **Staff requirements**
  - Cross-disciplinary
  - Producer, programmers, game, graphic & sound designers, musicians, testers, …
  - 100+ person teams
- **Similar to film**
  - Often, games->film, and film->games
  - Lucasfilm, etc. want to tie assets together
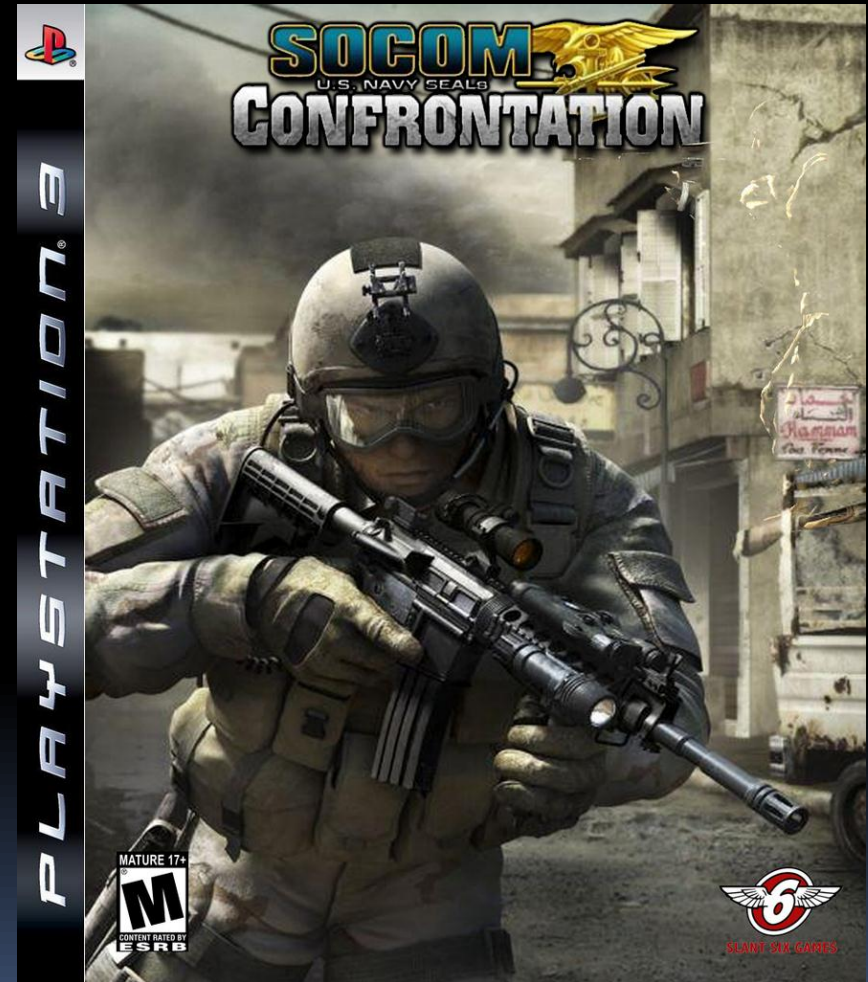
en.wikipedia.org/wiki/Video_games

How : 3D Computer Graphics

- Similar to making a 3D animated film…
  - *Model* characters, environment in 3D
  - Add *shading* + *lights* + *effects* + *behavior*
  - Let 3D *rendering* engine (on graphics card) do the work of figuring out 2D scene from 3D

- Limitations
  - Many things are too "expensive" to do in 30 frames per second
  - Research breakthroughs!

www.nytimes.com/2009/07/08/arts/television/08fight.html
en.wikipedia.org/wiki/Portal:Computer_graphics
www.siggraph.org

How : Motion Capture

- Actors in MoCap suits
- Motions recorded, put in "motion libraries"
  - E.g., running, throwing, passing, tackling
  - Can be edited/cleaned
  - Motion *synthesis* also
- Challenges
  - Motion "blending"
  - Non-"sliding" feet
  - UC Berkeley Research!
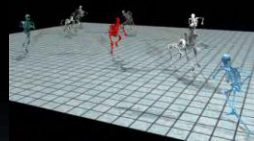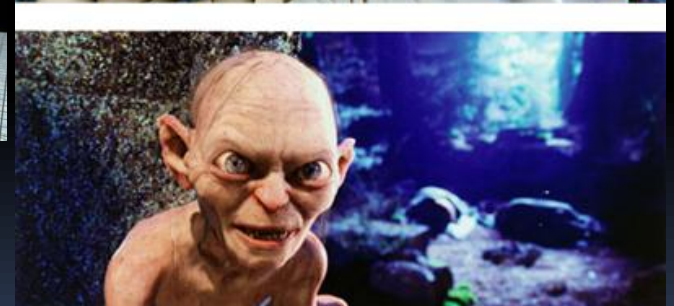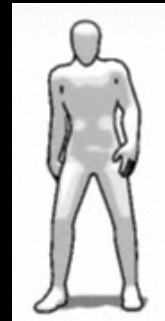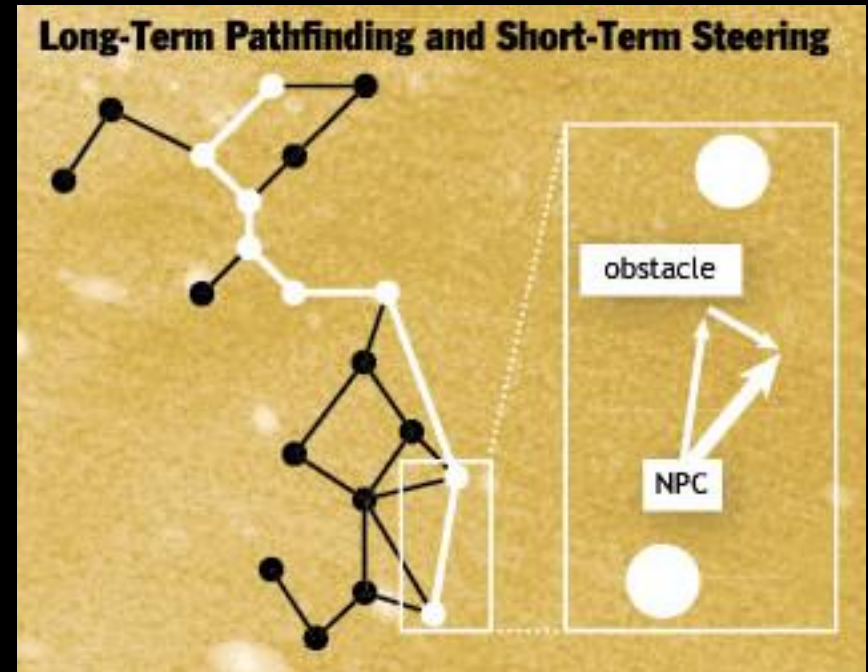

en.wikipedia.org/wiki/Motion_capture
www.phasespace.com

How : Artificial Intelligence

- **Range of intelligence**
  - Low: simple heuristics
  - High: Learns from player
- **Dynamic difficulty**
  - Must hold interest
  - "Simple to learn, difficult to master is the holy grail of game design."
  - Cheating AI (e.g.,racing)

Long-Term Pathfinding and Short-Term Steering

obstacle

NPC

www.businessweek.com/innovate/content/aug2008/id20080820_123140.htm
en.wikipedia.org/wiki/Dynamic_game_difficulty_balancing
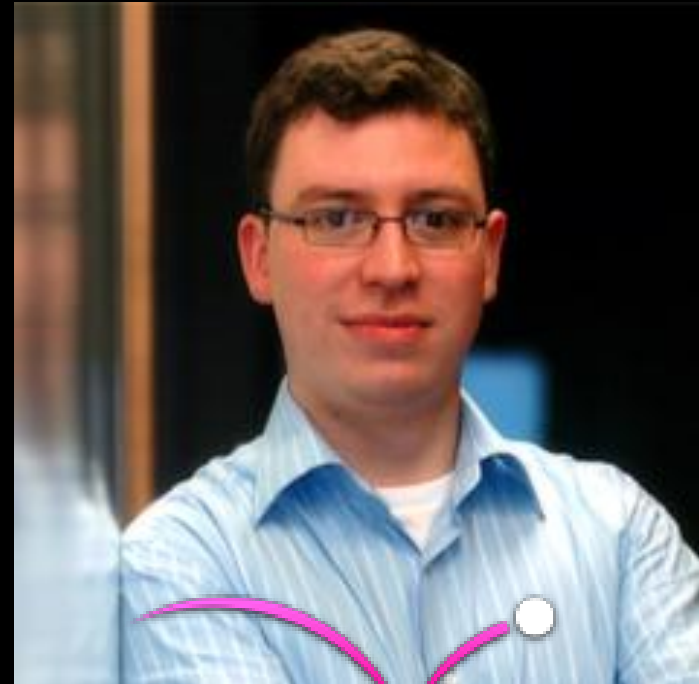en.wikipedia.org/wiki/Game_artificial_intelligence
queue.acm.org/detail.cfm?id=971593

Video Games : Good (Serious Games)

- **Simulations for training**
  - Flight simulations, combat, medical training
- **Games w/a Purpose**
  - A game to do useful stuff, hard for computers
  - Luis von Ahn … gwap
    - ESP : Label images fastest
    - Gender Guesser
    - Popvideo : label video
    - Matchin : Pick best images

en.wikipedia.org/wiki/Serious_games
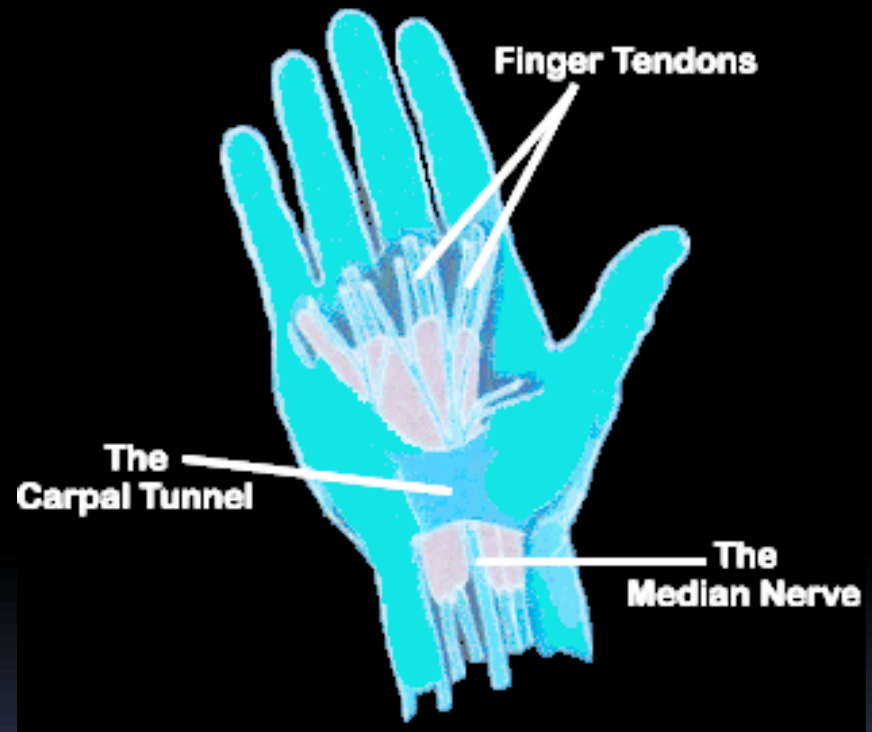en.wikipedia.org/wiki/Game_based_learning
gwap.com

Video Games : Bad (RSI, addiction)

- *Gamers Thumb*
  - Caused with too much use of gamepad
  - I suffered this in 1980s!
  - Solutions?
    - Break timers, rest
- Video game addiction
  - Impulse control disorder
 - Stanford: yes, addictive!
  - "Gamers Wife"
  - Online gamers anon

Finger Tendons

The Carpal Tunnel

The Median Nerve

`en.wikipedia.org/wiki/Video_game_addiction`
`en.wikipedia.org/wiki/Repetitive_strain_injury`

Video Games : Ugly (Violence)

- Violent video games
  - Increase aggression, decrease "helping"
  - Others found no link
- High-profile incidents
  - Columbine kids loved the Doom video game
- Ratings help
- Games "folk devil"
  - Billions $, kids at stake
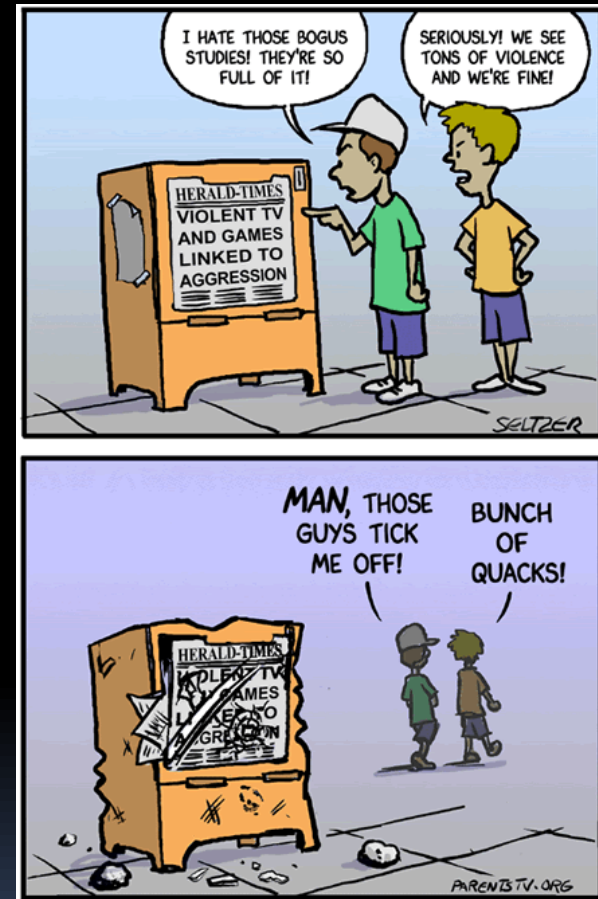
`en.wikipedia.org/wiki/Video_game_controversy`
`www.apa.org/science/psa/sb-anderson.html`

Future of Video Games

- **Media producers connecting assets**
  - Disney, Lucas big players
- **Controllers and sensors expand**
- **Games on Demand**
  - OnLive
- **Brain-Computer Interface (BCI)**
  - Invasive and Non-

www.pbs.org/kcts/videogamerevoluti
on/impact/future.html
en.wikipedia.org/wiki/Brain-
computer_interface