Lecture 1: Introduction

Prof. Aaron Lanterman
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Playstation 3 exclusive: Insomniac’s “Ratchet & Clank: Tools of Destruction”

http://www.gametrailers.com/player/23668.html
Xbox 360 exclusive: Bungie’s “Halo 3”

http://www.gametrailers.com/player/11237.html
Games are “serious business”

• Facts from www.esa.org:
  – $7.4 billion revenues in 2006
  – Average player is 33 years old and has been playing for 12 years
  – 36% percent of American parents play computer
  – 80% percent of gamer parents play with their kids

• Blizzard press release:
  World of Warcraft surpasses 9 million subscribers in July 2007
  – Monthly fee of $13 to $15
  – Do the math!!!

• Stephen Johnson, “Everything Bad is Good for You: How Today's Popular Culture Is Actually Making Us Smarter”
Our MPG class fills an industry need

- “CPU/GPU programming skill is the biggest hole they have. They can't find students who can do it well.” - Prof. Blair MacIntyre

- “The biggest challenge facing game companies right now is the problem of writing multithreaded code that fully supports the multiple-core architectures of the latest PCs and the next generation game consoles.” - Jeremy Reimer, “Valve goes multicore”

- “If a programming genius like John Carmack can be so befuddled by mysterious issues coming from multithreaded programming, what chance do mere mortals have?” - Jeremy Reimer, “Cross-platform game development and the next generation of consoles”

http://arstechnica.com/articles/paedia/cpu/valve-multicore.ars
http://arstechnica.com/articles/paedia/hardware/crossplatform.ars
The realities of real-time

• The architectures we will look at are driven by real-time constraints
  – 60 frames per second
  – $1/60 \approx 16.7$ milliseconds
  – Average performance is irrelevant; it’s the max that matters

• In contrast, most scientific applications can be handled “offline”
  – Computers historically designed to work well in “batch mode”

• Near the end of the course, we will discuss exploiting this kind of hardware for scientific applications
  – GPGPU movement
  – Sony’s folding@home
This is NOT a course on game design, or…

• See CS4455: Video Game Design
  – Founded by Amy Bruckman in 1998

• See CS4731: Game AI for the real deal on AI
  – But we may dabble in AI just a little bit

• Also won’t be talking about…
  – Handheld game devices
    • That may change in the future!
  – “Alternative” controllers
  – Networking issues (LAN parties, MMORPGs, etc.)
  – Prototyping, user testing
  – Societal impact of games
  – Gender and games
  – Business issues (organizational issues of large teams, etc.)

• May incidentally touch upon some of the above issues
This is only partially a graphics course

- No background in computer graphics required!
  - Make sure class is accessible to ECE majors
- We will review a minimal amount of necessary background
  - Geometric transformations, backface culling, clipping, rasterization, lighting, texture mapping, etc.
- Emphasis will be on real-time graphics
- We won’t be talking about things like…
  - Perception
  - Global illumination: ray tracing, radiosity, photon mapping
    - Although people are experimenting with putting such algorithms on GPUs!
  - Advanced animation techniques: inverse kinematics
This is WILL be a course on…

• Emphasis will be on games that simulate and depict “realistic” animated 3-D environments
  – Algorithms
  – Architectures
  – Programming paradigms

• Practical target platforms
  – Xbox 360
  – Playstation 3
  – Windows PCs with NVIDIA or ATI graphics cards
  – …and a taste of Playstation 2

• Theoretical target platforms
  – Mac OS
  – Linux

• What about the Wii?
Then vs. Now

- In the early days of computer games, the “designer” and the “programmer” were often one and the same.

- Nowadays there are usually separate positions of “producer,” “lead designer,” “lead artist,” “lead programmer,” etc.
Two recurring themes

• Theme 1: Hardware features influence game design
  – If the Atari 400 gives you 4 sprites, you’ll naturally find something to do with those 4 sprites
  – If a Playstation 3 can push a gazillion polygons, developers feel obligated to provide a gazillion polygons
    • Driving budgets through the roof
    • 100 person teams - 30 programmers, 70 artists
    • Trend not sustainable!
    • With all the emphasis on 3-D realism, could great games like Ms. Pac-Man or Balance of Power be made today?

• Theme 2: Sufficient cleverness can sometimes overcome hardware limitations
Taking a broad view of “video games”

• Commercial game industry is brutal
  – Some companies get hundreds of resumes per week per listing
    (www.gamasutra.com/features/20050711/mcshaffry_01.shtml)

• Think “outside the box” a bit
  – Computer engineering
    • Nothing is driving technological develop as fast as gaming
    • Gaming experience gives future computer engineers insight
    • Maybe you’ll work for NVIDIA or ATI?
    • Maybe you’ll work for Intel, AMD, or IBM?
    • Maybe you’ll help design the Playstation 4 or Xbox 720?
  – “Game” programming/design: think beyond the commercial industry
  – Scientific potential of GPGPU
  – Even if you never program any “games,” **multicore is the future**

• That all said - we’d be totally thrilled if you got a job at
  Insomniac, Bungie, Blizzard, Activision, LucasArts, etc.
Many opportunities for independent developers

• On-line distribution
  – Takes manufacturing costs out of the equation
  – “Brick & mortar” stores have limited shelf space - on-line services like Amazon, Netflix, etc. can exploit “the long tail”
  – Why are we still shipping boxes mostly full of air?

• Greg Costikyan’s Manifesto! Games

• Jeff Vogel of Spiderweb Software has been crafting “old-school” 2-D and isometric RPGs as his full-time job for over a decade
  – Exile, Nethergate, Avernum, Geneforge
  – [www.spiderwebsoftware.org](http://www.spiderwebsoftware.org)
  – Makes house payments, feeds kids
Consoles hostile territory for indie developers (1)

• To sell games on a console, you still must pass the gatekeepers at Sony, Microsoft, and Nintendo
• Code must be “digitally signed” to run
  – Piracy concerns
  – Consoles supposed to provide safe environment
    • Unlike PC users who are used to dealing with viruses, spyware, crashing programs
    • Manufacturers worried about “untrustworthy” code screwing up people’s consoles
    • Want to ensure a uniform, “quality” experience
    • Same reasons Apple is wary about turning people lose on the iPhone

• They have more lawyers than you
Consoles hostile territory for indie developers (2)

- Nintendo NES “pioneered” business model
  - Typical ell consoles at a loss
  - Charge royalty on units manufactured, not units sold

- For indie developers, online distribution (Xbox Live, Playstation Network, etc.) seems like the least risky option
“Serious Games”

- Games for “training” and “education”
  - First responders: “Hazmat: Hotzone”
  - Medicine: “Pulse!!”
  - Business: “Stone City” for Cold Creamery

- Ian Bogost (LCC) doesn’t like the term “serious games”

Screenshot from
www.gamasutra.com/features/20051102/carless_01b.shtml
www.businessweek.com/innovate/content/apr2006/id20060410_051875.htm
www.persuasivegames.com
“Persuasive Games” & “Games for Change”

• Expand the “Serious Games” notion to include broader categories like “advertising,” (advergame), “propaganda,” “subversion”

• The Howard Dean for Iowa game
• Disaffected! (not authorized by Kinkos)
• America’s Army - training, advertising or propaganda?
  – U.S. government spent $7 million, but free to play
  – made with Unreal Tournament engine

Info from Ian Bogost, “Persuasive Games”

Pics from Wikipedia & www.persuasivegames.com
Other real-time applications

- **Graphics**
  - MRI in the operating room

- **Processing**
  - Machine vision
    - Toshiba demos: real-time face tracking, markerless motion capture, hand gesture user interface
  
  - Data compression/decompression
    - New Toshiba HDTVs will use Cell processors
  
  - Radar signal processing
    - 7 SPE Cells -> PS3s; 8 SPE Cells->Mercury Computing blades

Images from sti.cc.gatech.edu/Slides/Masubuchi-070618.pdf and http://www.radiology.uiowa.edu/NEWS/Haller-PDF.pdf
Movie magic

- **Hollywood**
  - Final ray-traced renderings usually done off-line using “render farms”
  - Continually improving real-time graphics lets moviemakers more easily experiment via “pre-viz”
    - Both on CGI-intensive sequences and live-action sequences

- **“Machinima”**
  - Fans making films using game engines

thesims2.ea.com/sims2_userdata/16/303316/movie_myimmortal.wmv