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 = 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

http://arstechnica.com/articles/paedia/cpu/valve-multicore.ars
http://arstechnica.com/articles/paedia/hardware/crossplatform.ars
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
  - Nov. 2004: “EA Spouse” post (ea-spouse.livejournal.com)
  - 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 development 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.spiderwebssoftware.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”
“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

Pictures from Wikipedia & www.persuasivegames.com
Info from Ian Bogost, “Persuasive Games”

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

Pictures from:
  - sti.cc.gatech.edu/Slides/Masubuchi-070618.pdf
  - 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

Images from:
  - thesims2.ea.com/sims2_userdata/16/303316/movie_myimmortal.wmv