CS-184: Computer Graphics

Lecture #1: Introduction, Overview, and Image Basics

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University of California, Berkeley
Today

- Introduction and Course Overview
- Homeworks #0 and #1
- Digital Images
The Subject: Computer Graphics

- **Computer Graphics:**
  Using computers to generate and display images

- **Issues that arise:**
  - Modeling
  - Rendering
  - Animation
  - Perception
  - Lots of details...
Computer Graphics

- Applications (in other words, why we care)
  - Movies
  - Video Games
  - Simulation
  - Analysis
  - Design
  - Others...
Computer Graphics

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  - Others...

From Star Wars Episode I, Lucasfilm Ltd.
Computer Graphics

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From Finding Nemo, Pixar Animation Studios
Computer Graphics

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From Halo 2, by Bungie Entertainment
Computer Graphics

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From America’s Army
Computer Graphics

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Fluid simulation w/ NASA FAST
Course Topics

- Image representation and manipulation
- 2D and 3D drawing algorithms
- Object representations
- Rendering
- Animation
- Interaction techniques
People

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Contact Information

- **Class web site:**
  - [http://inst.eecs.berkeley.edu/~cs184](http://inst.eecs.berkeley.edu/~cs184)
  - Handouts assignments, etc. will be posted there
  - Lecture notes posted there *(hopefully)* before classes

- **News group:**
  - [ucb.class.cs184](http://inst.eecs.berkeley.edu/~cs184)
  - Not reading newsgroup... bad idea

- **Email addresses on previous page...**
Computing Resources

- Class accounts handed shortly
- Can also use CS Labs
  - Linux
  - Windows
  - Mac
**Text Book**

- *Fundamentals of Computer Graphics*
  
  by Peter Shirley

* Get the current version!

- Also handouts and other supplemental material will be provided

- See other books listed in course information handout
Grading

- **Assignments:** 30%
  - Mix of written and programing
  - Average 1 or 2 weeks to do them
- **Final Project:** 30%
- **Midterm:** 20%
- **Final:** 20%

- **Dates in course handout**
  - Check *now* for conflicts!
Prerequisites

- You must know how to program C or C++
  - Big final project, several programming assignments
  - No hand holding
- Data structures (CS60C)
- Math: linear algebra, calc, trig
Waitlist

- Relax for now... there is lots of space.
Class Participation

- Reasons to participate
  - More fun for me and you
  - You learn more
  - I won’t give stupid little annoying quizzes in class

- How to participate
  - Ask questions
  - Make comments

- Stupid questions/comments
  - That’s okay
Homeworks #0 and #1

- **Homework #0**
  - Setup CS184 account and let us know who you are
  - Do this ASAP (after you get the account sheet)

- **Homework #1**
  - Due (see handout)
  - Tests math prerequisites
Academic Honesty

- If you use an external resource cite it clearly!
- Don’t do things that would be considered dishonest... if in doubt ask.
- Cheating earns you:
  - An ‘F’ in the class and
  - Getting reported to the University
  - No exceptions.
Questions?
Images

- Something that represents a *pattern of light* that will be *perceived* by something
- Computer representations
  - Sampled (pixel based)
  - Object based
  - Functional
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PS Type 1 font

Vector- or stroke-based
Images

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Well, this *used* to be in an object based representation...
Images

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Mandelbrot Fractal Plot by Vincent Stahl
Images

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Function $\rightarrow$ Polygons $\rightarrow$ Pixels

Think about making edits...

“Spiral Crossed” by Sandor Kabai
Storing Images

- Object and Function representations basically arbitrary ...later...

- **Raster Images**
  - 2D array of memory
  - Pixels store different things
    - Intensity
    - RGB color
    - Depth
    - Others...
  - May be mapped to special HW
Storing Images

- Object and Function representations basically arbitrary ...later...

- Raster Images
  - 2D array of memory
  - Pixels store different things
    - Intensity (scalar value, e.g. float, int)
    - RGB color (vector value)
    - Depth
    - Others...
  - May be mapped to special HW
Real world and “object” representations are continuous.

Raster images have discrete pixel locations and discrete pixel values.

We will see problems from this soon...
High Dynamic Range Images
High Dynamic Range Images

- Dynamic range of the human eye >> range of standard monitors
- Eye adjusts as we look around
Perception

- The eye does not see intensity values...

This striking visual illusion suggests that what we see depends more on what we expect than on any "reality". Despite appearances, the shadowed "light" square (B), and the four "dark" squares completely outside the shadow (such as A), are the identical shade of gray. Not convinced? Hold the mouse button down to see a "paint swatch", and compare it to the various squares on the board.

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Perception

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Perception

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Storing Images

- Digital file formats
  - TIFF, JPEG, PNG, GIF, BMP, PPM, etc. ...
  - Compression (lossless and lossy)
  - Interlaced (e.g. NTSC television)
  - Tend to be complex... use libraries

- Mapping to memory