CS-184: Computer Graphics

Lecture #1: Introduction, Overview, and Image Basics

Prof. James O'Brien
University of California, Berkeley

V2009-F-01-1.0

Today

- Introduction and Course Overview
- Assignments #1 and #2
- 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...

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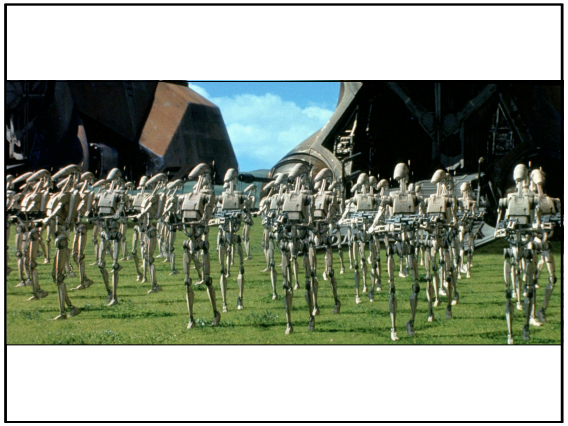

From *Star Wars Episode 1*, Lucasfilm Ltd.

Computer Graphics

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From *Finding Nemo*, Pixar Animation Studios

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From Halo 2, by Bungie Entertainment

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From *Star Wars: The Force Unleashed* by Lucas Arts

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From America's Army

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Image from CAE Inc.

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Carlo Sequin

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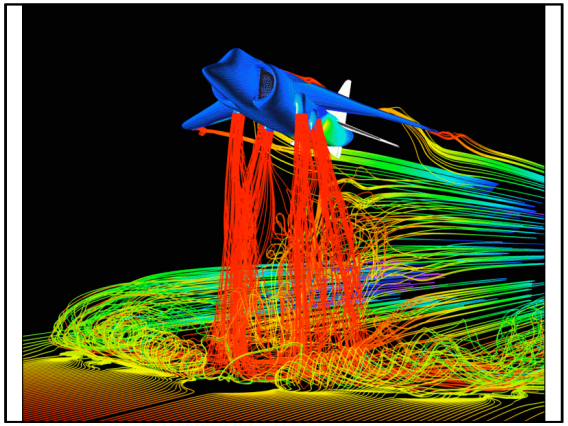

Fluid simulation w/ NASA FAST

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Course Topics

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

People

Prof. James O'Brien

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Office hours: 4:00 - 4:30 Mon / Wed *(priority to CS 184 students)*
2:00 - 3:00 Fri
Office location: 633 Soda Hall

T.A. Daniel Ritchie

Email: dcritchie@berkeley.edu
Office hours: 4:00 - 5:00 Wed
3:00 - 4:00 Thur
Office hours location: 751 Soda Hall

T.A. Leon Barrett

Email: leon@barrettnexus.com
Office hours: TBA
Office hours location: TBA

Send class related email to
cs184@imail.eecs.berkeley.edu

Contact Information

- Class web site:
  - 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
    - Server: news.csua.berkeley.edu
    - Username/password: usenet/gobears
  - 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: 40%
  - Mix of written and programing
  - Average 1 or 2 weeks to do them
- Final Project: 20%
  - Presentation: TBA prior to midterm
- Midterm: 20%
  - Wednesday, October 14, In class
- Final: 20%
  - Thursday, December 17 5:00-8:00pm
- Check *now* for conflicts!

Prerequisites

- You must know how to program C or C++
  - Big final project, several programing assignments
  - No hand holding
- Data structures (CS61B)
- 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

Assignments #1 and #2

- Assignment #1
  - Setup CS184 account and let us know who you are
  - Get very simple OpenGL program working
- Assignment #2
  - 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

Images

- Something that represents a *patten of light* that will be *perceived* by something
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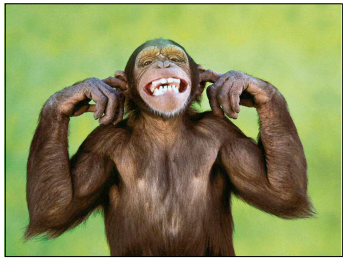

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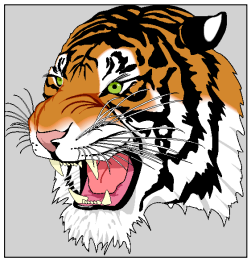

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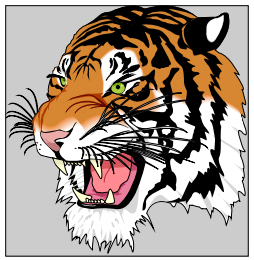

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PS Type 1 font →

← Vector- or stroke-based

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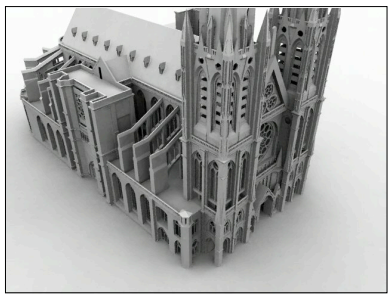
Well, this *used* to be in an object based representation...



Okan Arikan

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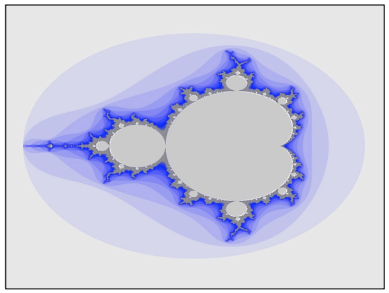

Mandelbrot Fractal Plot by Vincent Stahl

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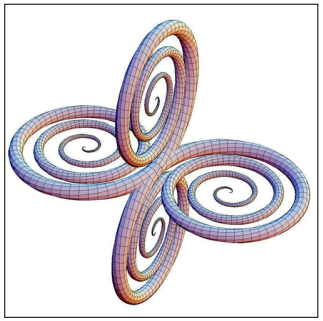
Function→Polygons→Pixels

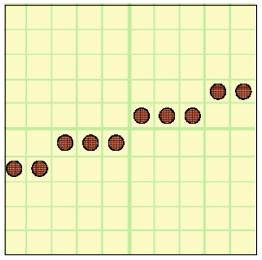
Think about making edits...



"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...
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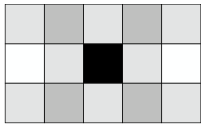
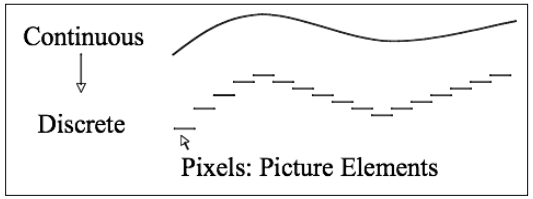


0.25	0.5	0.25	0.5	0.25
1	0.25	0	0.25	1
0.25	0.5	0.25	0.5	0.25

Stephen Chenney

Discretization

- Real world and "object" representations are continuous.
- Raster images have discrete pixel *locations* and discrete pixel *values*



Stephen Chenney

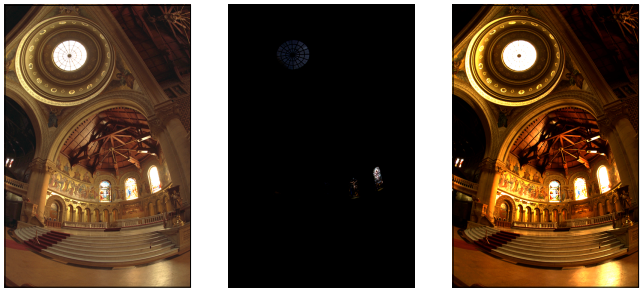
- We will see problems from this soon...

High Dynamic Range Images

Jack Tumblin

High Dynamic Range Images

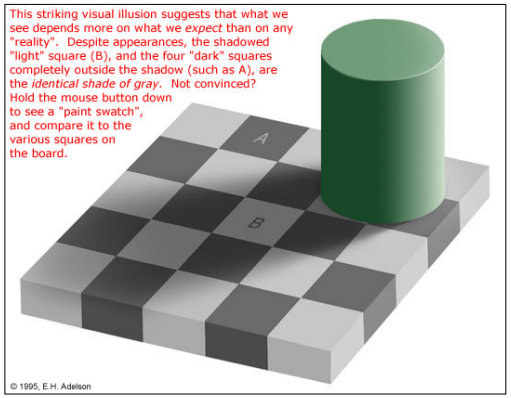
- Dynamic range of the human eye >> range of standard monitors
- Eye adjusts as we look around



Paul Debevec and Jitenrda Malik

Perception

- The eye does not see intensity values...



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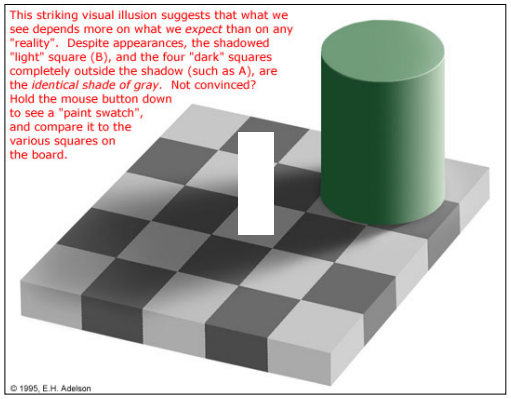

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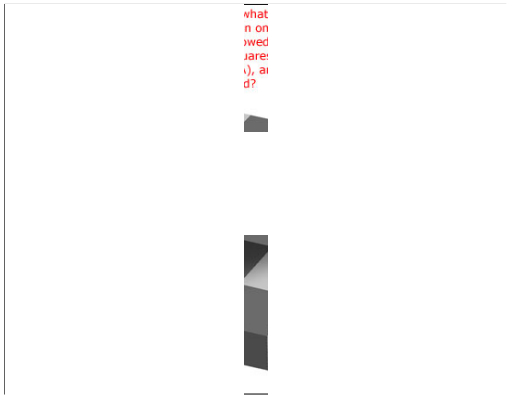

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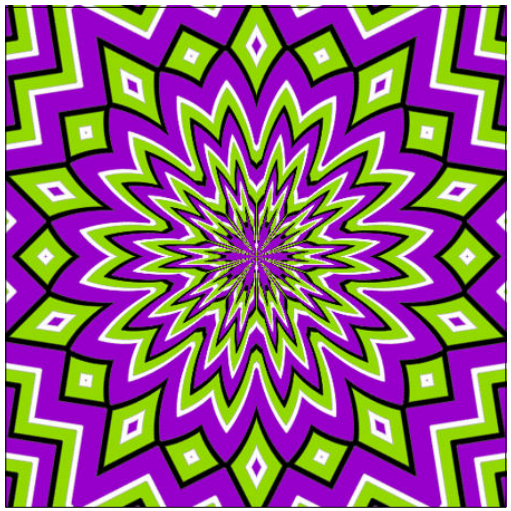

Storing Images

- 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