# CS559: Computer Graphics

Lecture 1 Introduction

Li Zhang

University of Wisconsin, Madison

# Today

- Introduction to Computer Graphics
- Course Overview

# What is Computer Graphics

- Using computers to generate and display images

- Core areas
  - Modeling
    - lighting, shape, reflectance ...
  - Rendering
    - math models -> images



The Digital Michelangelo Project
Stanford University

# What is Computer Graphics

- Using computers to generate and display images
- Core areas
  - Modeling
    - lighting, shape, reflectance …
  - Rendering
    - math models -> images
  - Animation
    - how things change

Park and Hodgins, SIGGRAPH 2006

# What is Computer Graphics

- Using computers to generate and display images
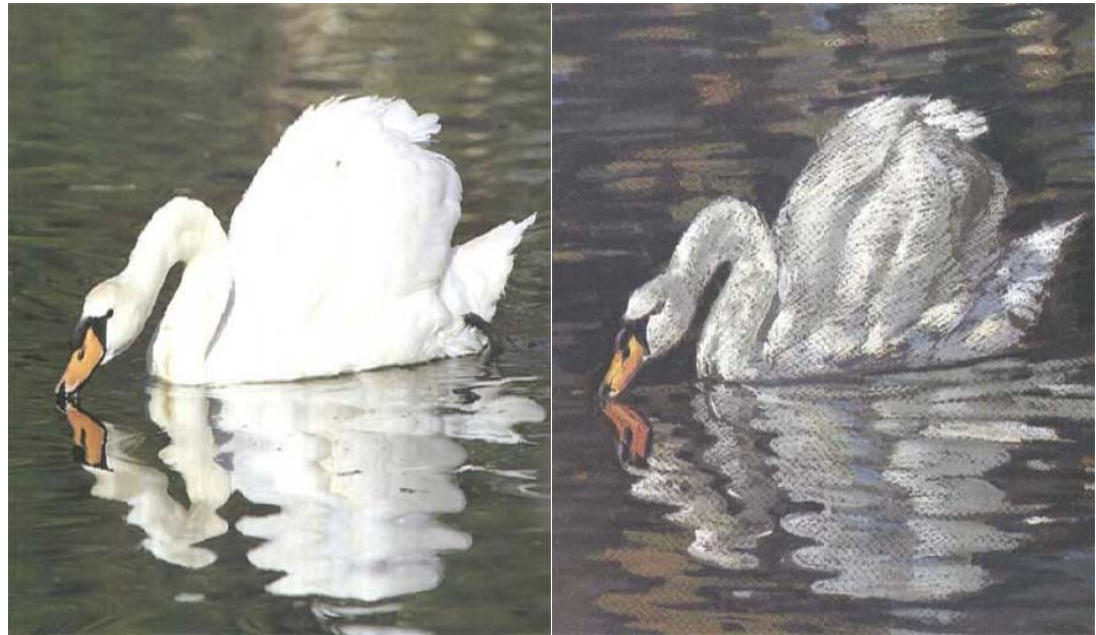- Related areas
  - Image processing



Image Analogies, Hertzmann et al, SIGGRAPH 2001

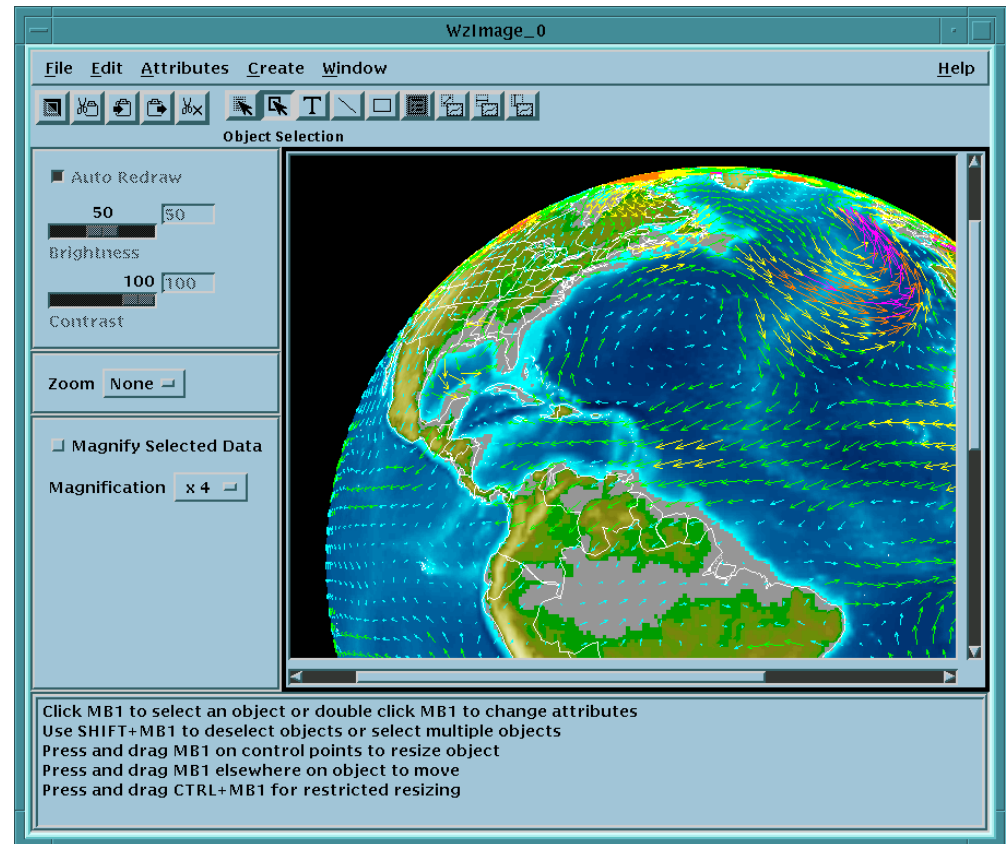# What is Computer Graphics

- Using computers to generate and display images
- Related areas
  - Image processing
  - 3D photography



Cyberware

# What is Computer Graphics

- Using computers to generate and display images
- Related areas
  - Image processing
  - 3D photography
  - Visualization

PV-Wave, Visual Numerics

# What is Computer Graphics

- Using computers to generate and display images
- Related areas
  - Image processing
  - 3D photography
  - Visualization
  - Virtual reality



U.S. Navy personnel using a VR parachute trainer
http://en.wikipedia.org/wiki/Virtual_reality

# What is Computer Graphics

- Using computers to generate and display images
- Related areas
  - Image processing
  - 3D photography
  - Visualization
  - Virtual reality
  - User interaction



Freeform from Sensible Technologies
J. Hodgins, Computer Graphics, Fall 2007

# Why do we care?
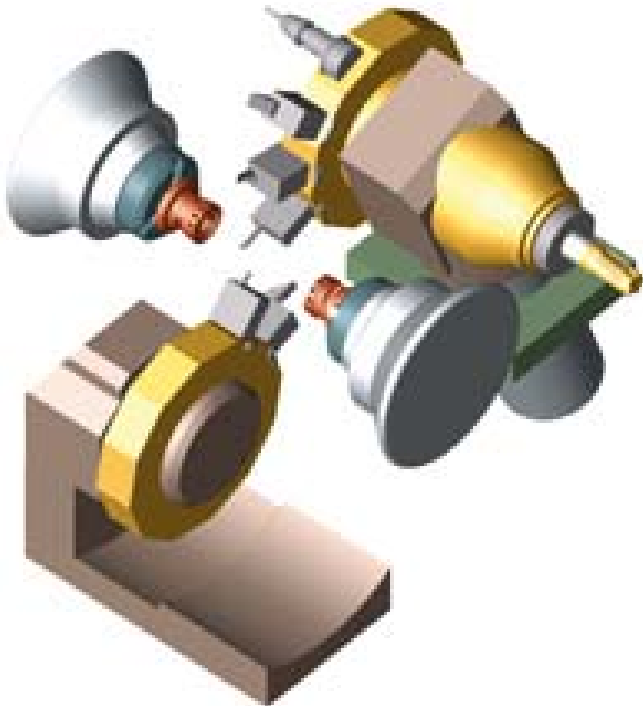
- Cool pictures – fantasy world



Graphique3d.republika.pl

Pirates of the Caribbean

# Why do we care?

- Applications
  - Industry Design



Missler Software



Icadsolutions.com

# Why do we care?

- Applications
  - Industry Design
  - Architecture





Jingyi Yu, Graphics, U Delaware

# Why do we care?

- Applications
  - Industry Design
  - Architecture
  - Movies



Star War, Episode I, Lucas Film



Finding Nemo, Waltt Disney

# Why do we care?

- Applications
  - Industry Design
  - Architecture
  - Movies
  - Games



America's army, released by US Goverment

US Game Sales:
- $4.82 billion in December
- $~18 billion for all of 2007
market research firm NPD, Jan 17



PSP, SONY

# Why do we care?

- Applications
  - Industry Design
  - Architecture
  - Movies
  - Games
  - Training



Image from Defense News, 31 Jan 07

# Why do we care?

- Applications
  - Industry Design
  - Architecture
  - Movies
  - Games
  - Training
  - Virtual World
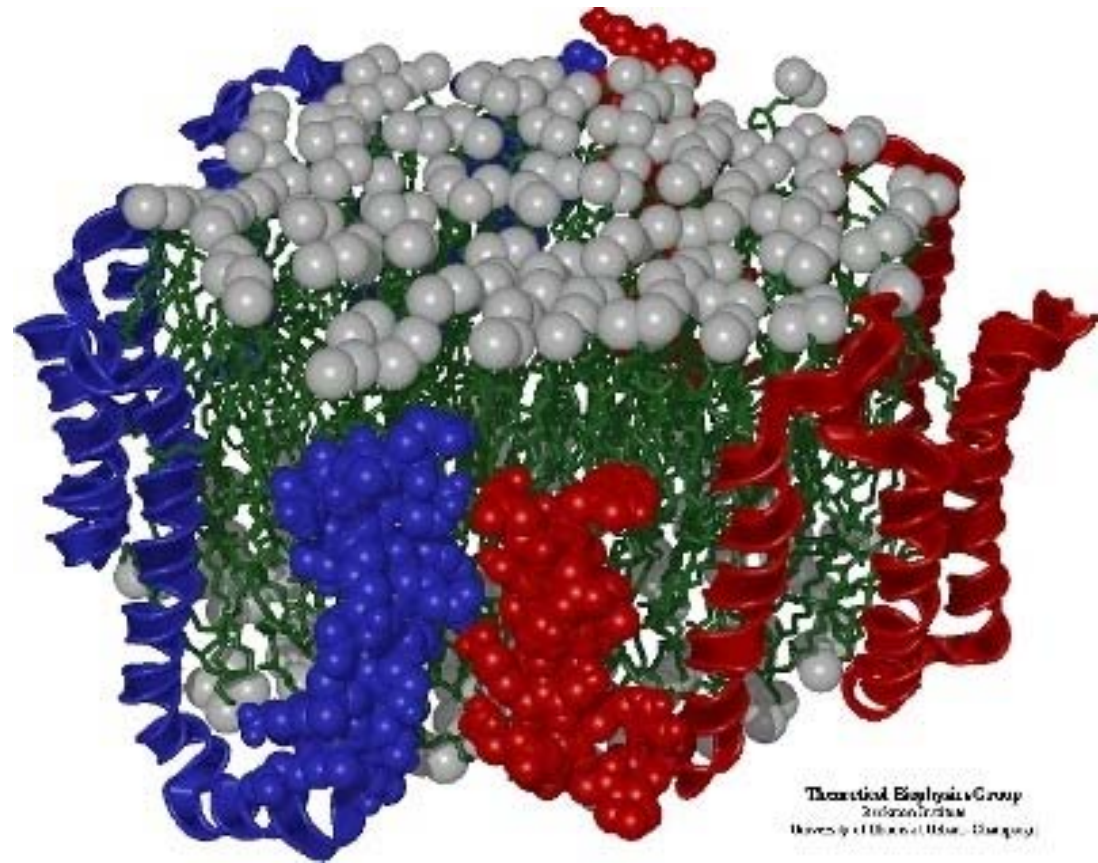


Second Life

# Why do we care?

- Applications
  - Industry Design
  - Architecture
  - Movies
  - Games
  - Training
  - Virtual World
  - Medical Imaging



Jingyi Yu, Graphics, U Delaware

# Why do we care?

- Applications
  - Industry Design
  - Architecture
  - Movies
  - Games
  - Training
  - Virtual World
  - Medical Imaging
  - Visualization

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# A broader view

- Computer Graphics is
  - The technology for communicating and interacting with information *in a visual way*

- Visual information is
  - Intuitive
  - Parallel
  - Correlated

# What's covered in this class

- **Not!**
  - Paint and Imaging packages (Photoshop)
  - CAD packages (AutoCAD)
  - Rendering packages (Maya)
  - Modeling packages (3D Max)
  - Graphics Modeling and Languages (RenderMan)

- We will cover…
  - Graphics programming languages (OpenGL)
  - Graphics algorithms
  - Graphics data structures
  - Graphical User Interface (GLUT)
  - Applied geometry and modeling
  - Shape and motion capture

# What's covered in this class

- Image related topics
  - Light, eye, and cameras,
  - Digital images, sampling and re-sampling
  - Color concepts, image adjustment, compositing
  - Filtering, Warping, Panorama


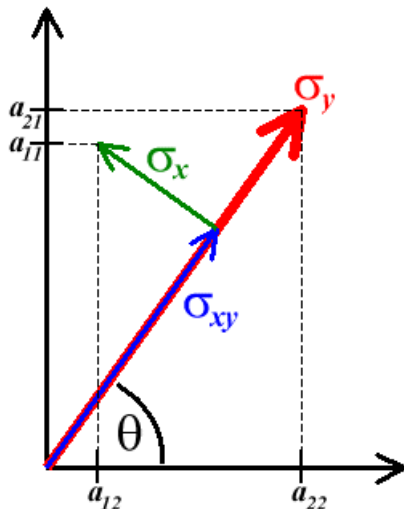
Jingyi Yu, Graphics, U Delaware

# What's covered in this class

- Project 1: A picture processing system
  - Implement basic image processing operations like filtering, re-sampling, warping,
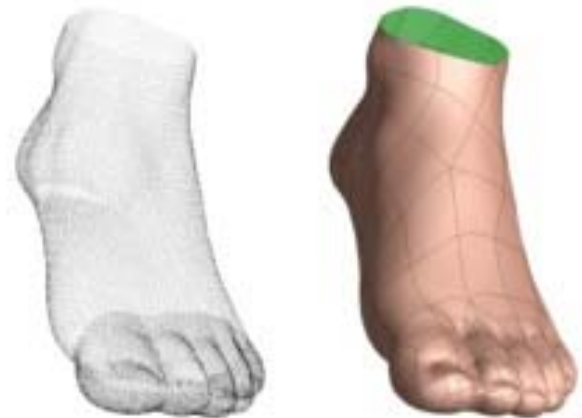  - Image compositing, impressionist painting



Image Analogies, Hertzmann et al, SIGGRAPH 2001
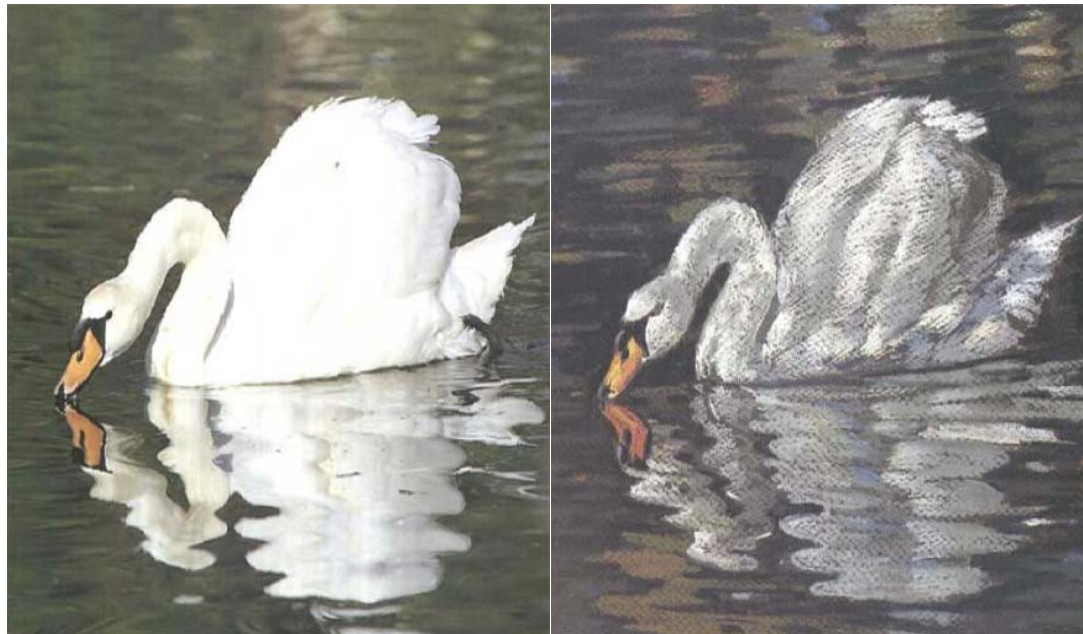
# What's covered in this class

- Geometric Modeling
  - coordinate systems, transformation
  - 2D/3D primitives, projection,
  - OpenGL, graphics pipeline, 3D UI issues
  - Shape concepts, parametric forms, splines
  - Meshes, subdivision surfaces

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Eck and Hoppe, SIGGRAPH 96

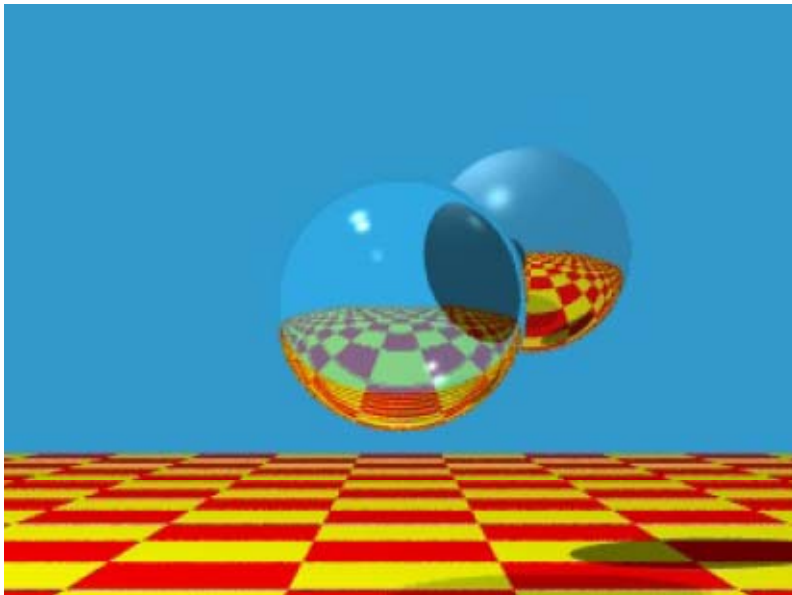# What is this class about?

- Project 2: Roller coaster train
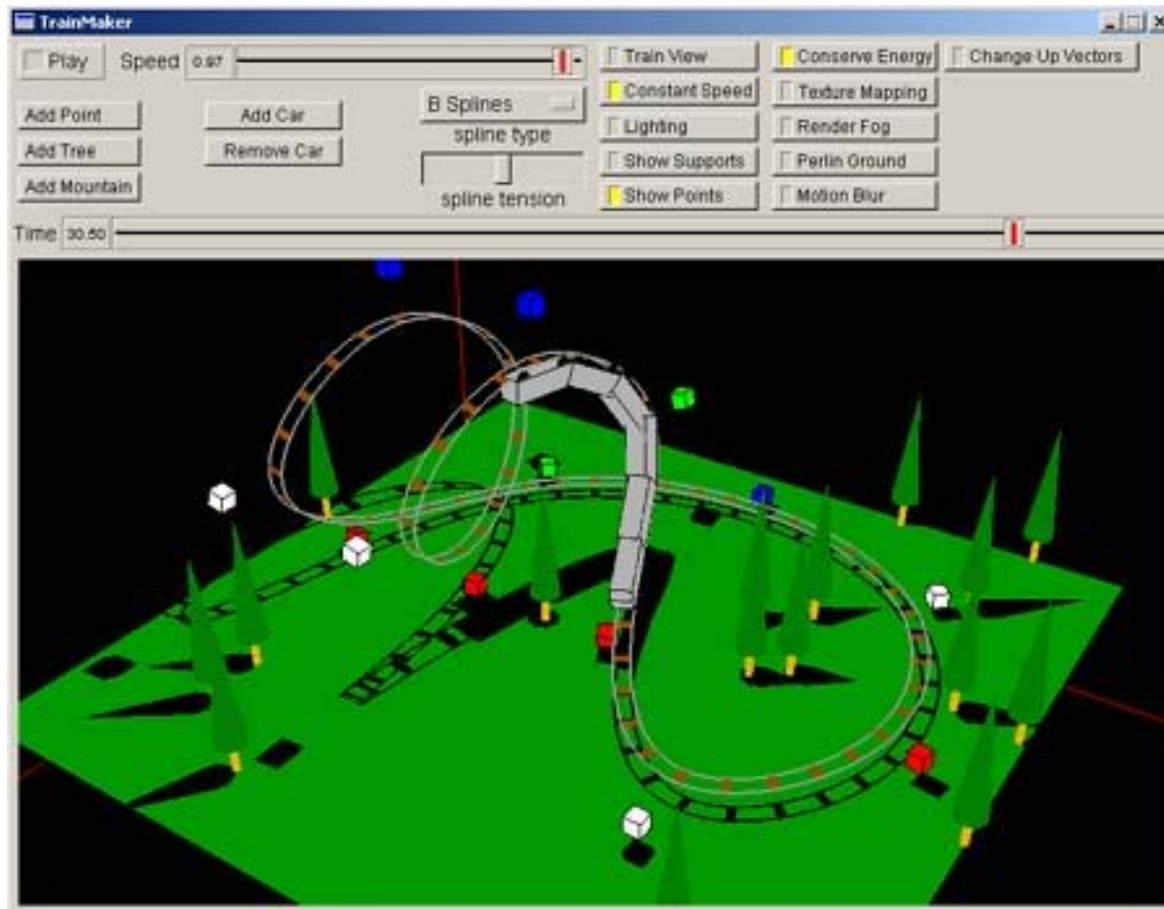


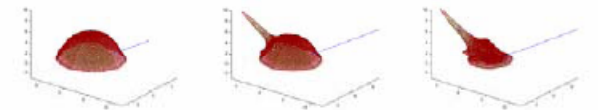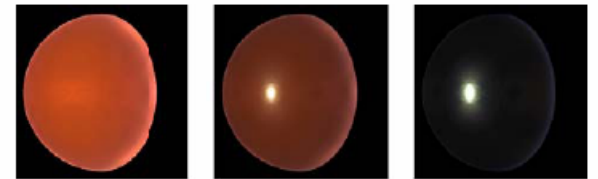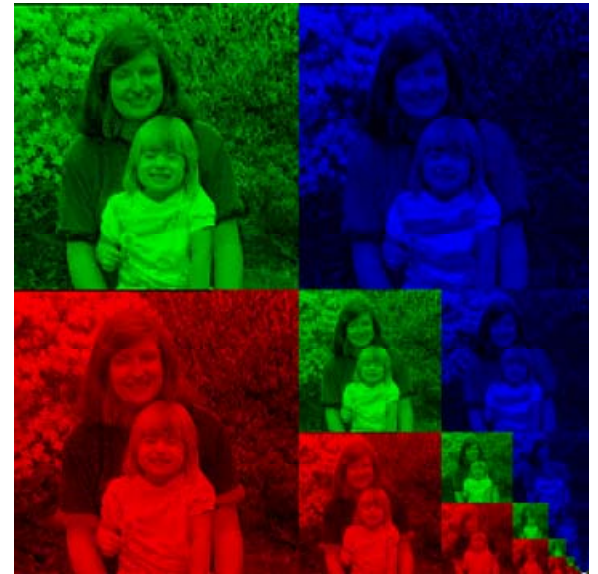Rob Iverson's A+ assignment from 1999

# What's covered in this class

- Basic Rendering techniques
  - Visibility, scan-conversion,
  - Lighting, Texture mapping,
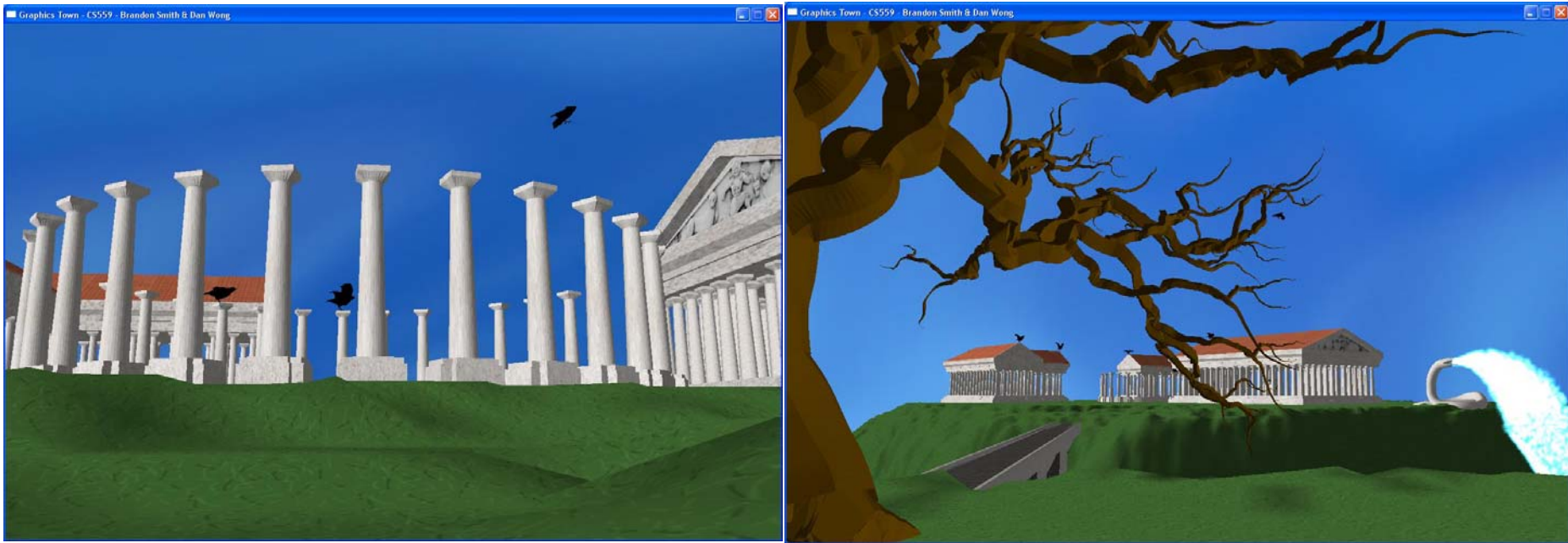  - Ray tracing, global illumination,

Jingyi Yu, Graphics, U Delaware

# What's covered in this class

- Project 3: A graphics town



Brandon Smith

# What's covered in this class

- Project 3: A graphics town



Jacob Felder

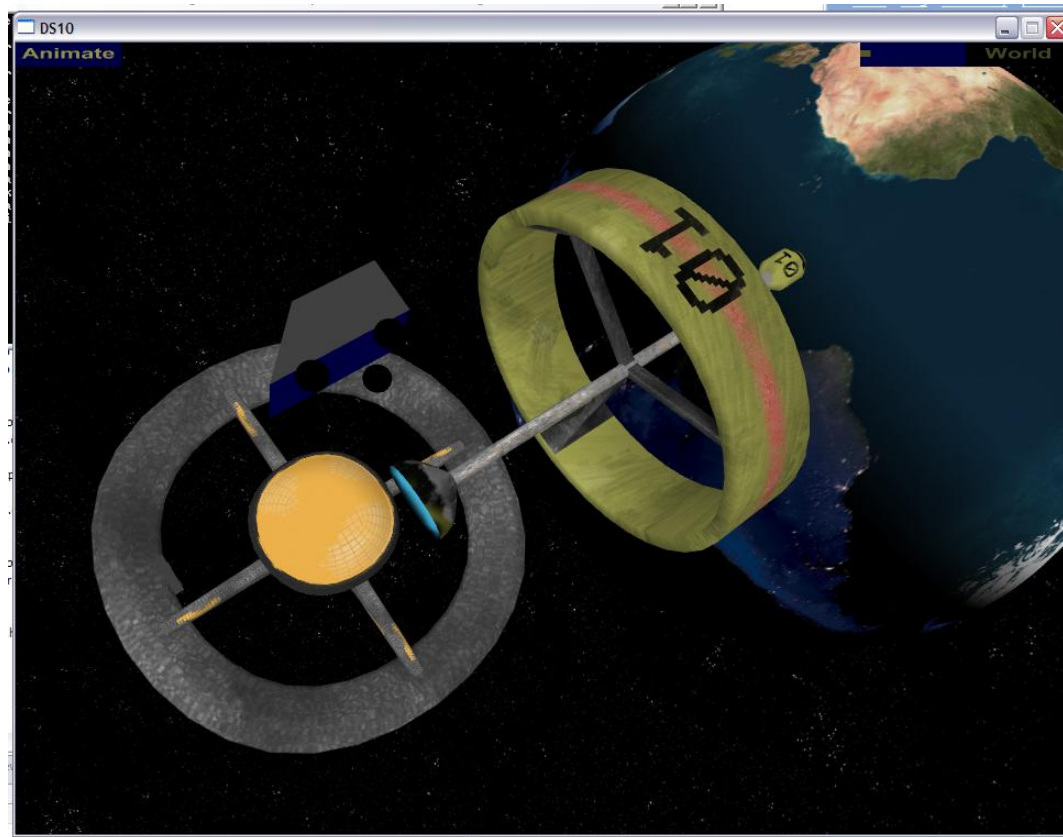# What's covered in this class

- Project 3: A graphics town



Daniel Geil

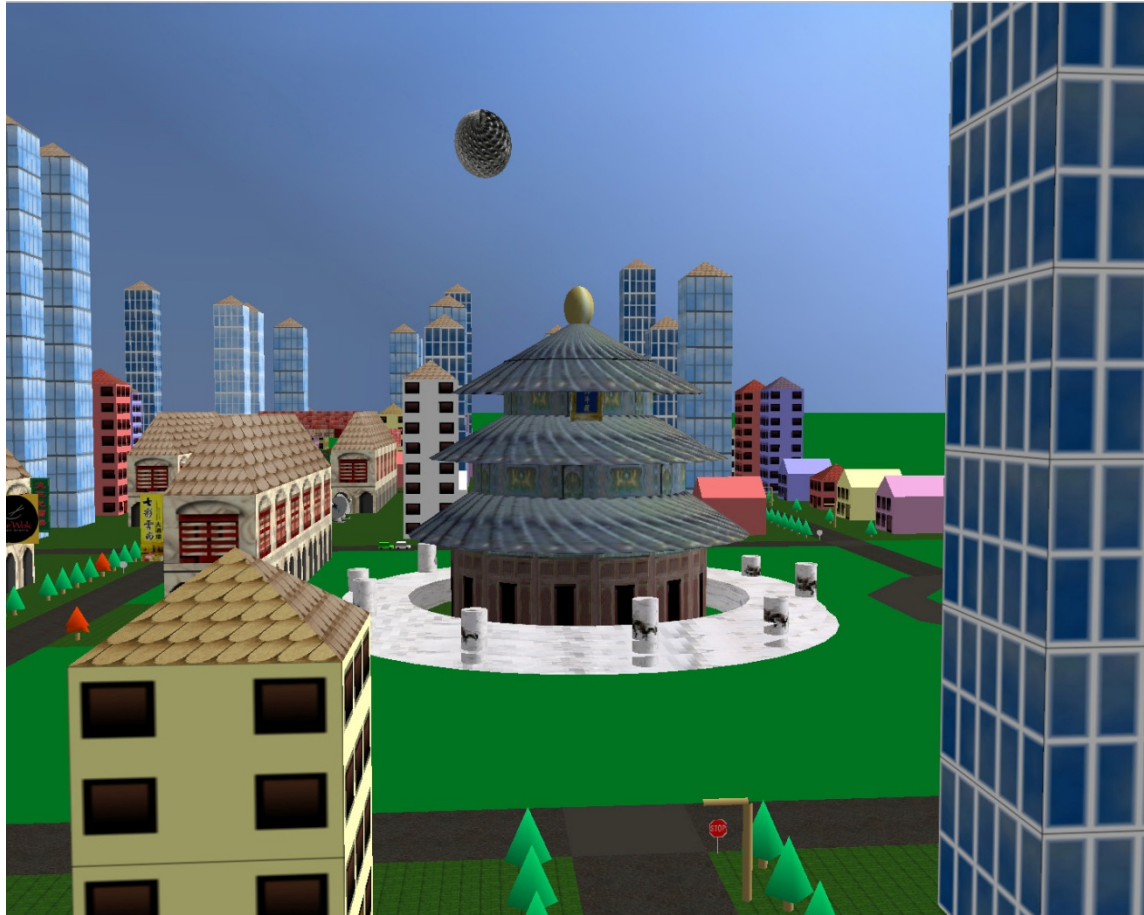# What's covered in this class

- Project 3: A graphics town



Marc Lenz

# What's covered in this class

- Project 3: A graphics town



Xiang Ji and Yuxiang Yang

# Staff

- Instructor: Li Zhang
  - lizhang@cs.wisc.edu
  - Office hours: Monday Wednesday 2:15-3:00pm
  - Office location: 6387 Comp S&ST
- TA: Chi Man Liu
  - cx@cs.wisc.edu
  - Office hours: Tu 11-noon, Th 3-4
  - Office location: 1301 Comp S&ST

# Course info

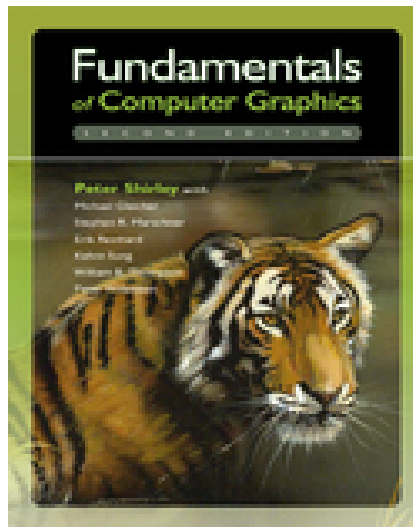- Mailing list: compsci559-1-s08@lists.wisc.edu
- Course web: www.cs.wisc.edu/~cs559-1
- Computers: storm lab -- 1366 Comp S&ST
- Language: C++
- Compiler: MS Visual Studio 2005

# Books

- Peter Shirley. *Fundamentals of Computer Graphics, 2ed*
  - note: the new 2nd edition is considerably different than the first - it is green (not orange).
  - check the errata page for the first printing.

# Books

- [Mason Woo, et al. *The OpenGL Programmer's Guide.*](#) ("red book") 6$^{th}$ edition
  - An older edition (available online) would be OK. It's an important reference.
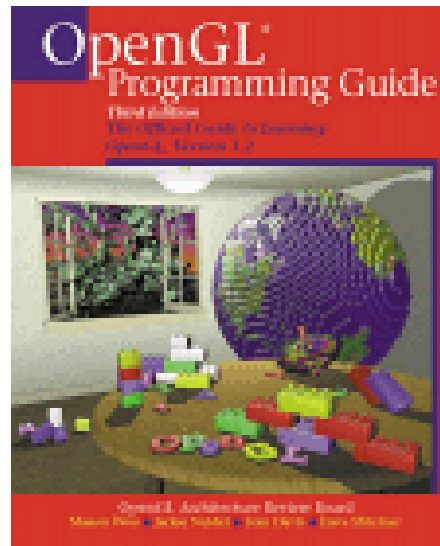
# Prerequisites

- CS367 (Data Structures)
- Math 320, 340 or CS416 (some familiarity with linear algebra)
- C/C++
  - You can learn it as you do project, but you need to work very hard.

# Exams

- Midterm
  - Monday, March 24th from 7:15-9:00pm
- Final
  - Saturday, May 17th from 7:45-9:45pm

# Grading

- Projects: 25% * 3
- Midterm: 10%
- Final: 15%
- Late policy
  - 80% 1st day, 60% 2nd day, … 0% 5th day,
    - Prorated hourly
  - Can be late ONCE without penalty in the semester,
    - But can't be later than demo date
  - Penalty Recovery

# Class Survey

- https://learnuw.wisc.edu/
- Questions like your major/home department, familiarity with C++ etc.

- <span style="color:red">YOU NEED TO FINISH THIS BEFORE WE GRADE YOUR FUTUER PROJECTS</span>

# Questions?