Computer Graphics

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Princeton University

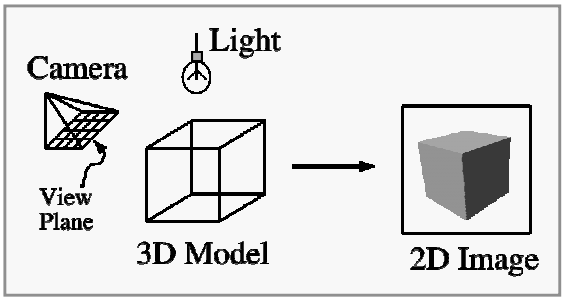
C0S 426, Fall 1999

Overview

- Introduction
  - What is computer graphics?
- Applications
  - What is it good for?
- Syllabus
  - What will I learn in this course?
- Coursework
  - How much work will there be?
- Examples

Introduction

- What is computer graphics?
  - Imaging = *representing 2D images*
  - Modeling = *representing 3D objects*
  - Rendering = *constructing 2D images from 3D models*
  - Animation = *simulating changes over time*



Applications

- Entertainment
- Computer-aided design
- Scientific visualization
- Training
- Education
- E-commerce
- Computer art

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- » **Syllabus**
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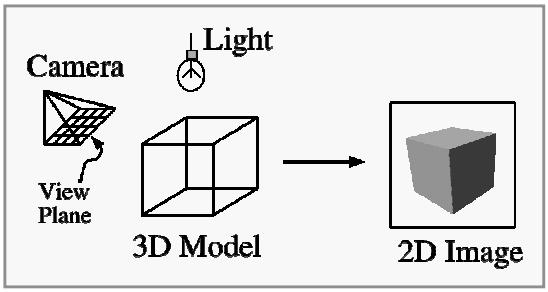
Syllabus

I. Image processing

II. Rendering

III. Modeling

IV. Animation



Part I: Image Processing

- Raster Graphics
  - Display devices
  - Color & perception
- Image Sampling
  - Pixels
  - Sampling
  - Reconstruction
  - Quantization
  - Dithering
- Image Processing
  - Filtering
  - Warping

Part II: Rendering

- 2D Rendering
  - Line and polygon primitives
  - Scan conversion, clipping
- 3D Rendering
  - Modeling transformations
  - Viewing transformations
  - Hidden surface removal
  - Illumination, shading, and textures
  - Hierarchical scene graphics
  - Global illumination
    - » Ray tracing
    - » Radiosity

Part III: Modeling

- Representations of geometry
  - Curves: splines
  - Surfaces: meshes, splines, subdivision
  - Solids: voxels, CSG, BSP
- Procedural modeling
  - Sweeps
  - Fractals
  - Grammars

Part IV: Animation

- Keyframing
  - Kinematics
  - Articulated figures
- Motion capture
  - Capture
  - Warping
- Dynamics
  - Physically-based simulations
  - Particle systems
- Behaviors
  - Planning, learning, etc.

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Quotes from Student Course Guide

- “Yes, if you haven't heard about it, it's called Death Graphics. You won't believe how much work you do for the course.”
- “This class is really a different experience from all other CS courses. If you have the guts, and you have the skills, and of course an interest in graphics, go for it. If you want to find out what a 'challenging’ semester means, go for it. Also, count this course as 2 courses when you are planning your schedule for the next semester.”

Coursework

- "Midterm" Exam (25%)
  - Open book exam in class (on 12/10)
- Programming Assignments (10% each)
  - Assignment #1: Image Processing (due 10/3)
  - Assignment #2: 3D Rendering (due 10/17)
  - Assignment #3: Ray Tracing (due 11/7)
  - Assignment #4: Procedural Modeling (due 11/21)
  - Assignment #5: Animation (due 12/5)
- Final Project (20%)
  - Do something cool! (due Jan 00)
- Class Participation (5%)

Programming Assignments

- When?
  - Every two weeks
- Where?
  - MECA Labs

Programming Assignment Grading:

6 = C:	Lame effort
8 = B:	Solid effort, but not done
10 = A:	Did everything on basic feature list
11 = A+:	Did some extra credt (hard)
12 = A++:	Did more extra credit (very hard)

- How?
  - WinNT (E417) or Unix (E423)
  - C and C++, OpenGL, GLUT
- Grading?
  - Basic feature lists
  - Extra credit lists
  - Art contest

Collaboration Policy

- Overview:
  - You must write your own code (no credit for other code)
  - You must reference your sources of any ideas/code
- It's OK to …
  - Talk with other students about ideas, approaches, etc.
  - Get ideas from information in books, web sites, etc.
  - Get "support" code from example programs
    - » But, you must reference your sources
- It's NOT OK to …
  - Share code with another student
  - Use ideas or code acquired from another sources without attribution

Survival Guide

- Midterm
  - Pay attention in class
  - Do most of the readings
- Programming Assignments
  - Drop the class if you can't program
  - Get started on every assignment early
  - Plan on using multiple programming sessions
  - Review progress/plan with TA during each assignment
  - Take the time to understand what you are doing
- Final Project
  - Choose something you like

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» **Examples**

Conclusion

- Course web page:
  - *http://www.cs.princeton.edu/courses/cs426/index.html*
- Precepts:
  - Wednesday at 8PM?
- Web signup:
  - *http://www.cs.princeton.edu/courses/cs426/enroll.html*
  - By next Wednesday (9/22)

Related Courses at Princeton

- Fall 1999:
  - Image processing (ELE 488)
  - Human-computer interfaces (COS 436)
  - Visual and audio design for large-scale computer displays (COS 495)
- Spring 2000:
  - Computational geometry (COS 451)
  - Geometric modeling for computer graphics (COS598)