Lecture 1: 9 September 1999

Welcome to 6.837 Fall 1999 !

Staff introductions

Please sign sheet, **with athena id**

Class page at:

`http://graphics.lcs.mit.edu/classes/6.837/F99/`

Course overview, projects, etc.

Administrative stuff

Assignment 1 (due next Friday)

(Thx to Prof. McMillan for add'l material)

Course Overview

What is computer graphics? Why do it?

Easy answers: "Making pictures. Because it's fun."

Better: "Application of computational processes to sensor or simulation data to simulate or predict appearance, and improve understanding or utility. Because it's fun."

Simulations require input! **Modeling, Computer vision.**

Common simulation: **Rendering (Optics, Physics). (Haptics!)**

Also: motion, time-evolution: **Kinematics, Mechanics.**

Grounded in **Geometry**, **Coordinates**, **Computation**.

Also: interaction; theoretical concerns; systems issues.

6.837 is Not About:

Paint packages (Adobe Photoshop)

CAD packages (AutoCAD)

Rendering packages (Lightscape)

Modeling packages (3D Studio MAX)

Animation packages (Digimation)

Graphics APIs (OpenGL)

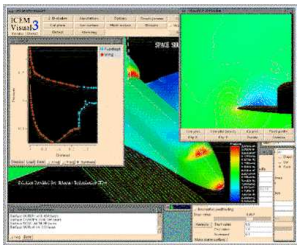
Modeling/Shading Languages (RenderMan)

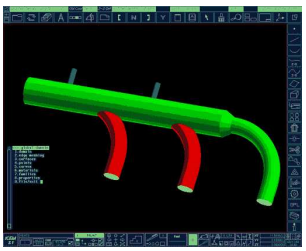
Games / Game Development (...)

But you may use some or all of these ...

Computer-Aided Design

Engineering Analysis





Issues:

Drives high-end hardware dev't

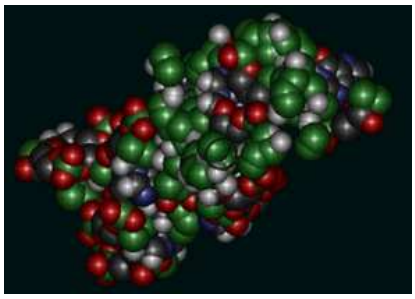
Integrate CPU, display processing

Shorten product design cycle

Steerable simulations

Scientific Visualization

Molecular Simulations

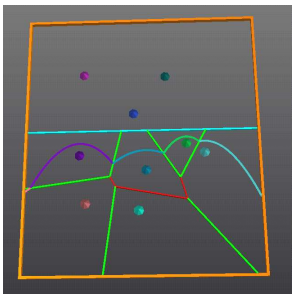


Issues:

- Connections to sensor data
- Scalable geometry representations
- Visual complexity, functional abstraction

Education

Mathematical Visualization



Issues:

- Numerical / topological guarantees
- Dimensional limitations, representations

Graphics Examples

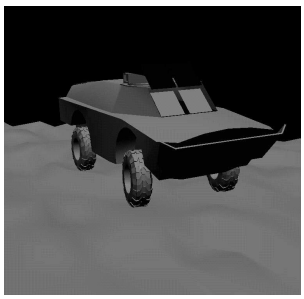
Entertainment/Games

Issues:

- Drives low-end hardware dev't
- Interactivity/quality tradeoffs

Military Uses

Planning, training, rehearsal, etc.



Issues:

- Scaling capabilities (terrain, actors)
- Live/canned/simulated actors
- Acquisition of environment models

Computer-Assisted Medicine

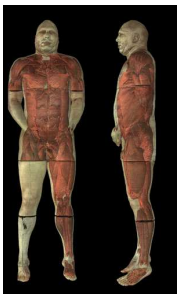
Image-Guided Surgery

Issues:

- Tracking and registration
- Depth presentation / occlusion
- Display latency
- Time-varying data

Medical Visualization

Visible Human



Issues:

- Data representations, scaling
- Precision, correctness issues
- Data presentation, interpretation
- Data acquisition, modeling !

What will you get?

Not an application-level course
(though we use applications...), but:
Basic knowledge to design and build a
variety of graphics systems/applications

Specifically:

Applied geometry and modeling
Graphics data structures
Rendering algorithms
Graphical interface design
Color and human vision
Applied numerical computing
Significant design opportunities

Course Overview

2D Preliminaries (framebuffer model, etc.)
Coordinate Systems and Transformations
Classical Rendering Pipeline
Curve, Surface, Volume Modeling
Ray Tracing and Global Illumination
Texture Mapping and Realism
Hardware, Algorithmic Acceleration
Careers in Graphics
Guest Lectures, Graphics Shows
Advanced Topics

Administrative Stuff:

- Course overview
- Prerequisites, Review sessions
- Assignments and grading policy
- Asst 1: Web reg.; SGI clusters; page creation

Prerequisites

18.06 (Linear Algebra):
  Vectors (dot, cross products, etc.)
  Matrices and matrix operators
  Solving linear systems of equations
  Bases: spanning, orthogonal, orthonormal
6.046J (Algorithms):
  Algorithm complexity, "big O" notation
  Upper bound (can't be harder than...)
  Lower bound (at least as hard as...)
  Sorting, convex hulls, tree traversal, etc.
Some C Programming Experience
  Assignments assume basic C proficiency
  You will pick up Java, C++, OpenInventor...
Substitutions:
  Analogous courses; relevant experience; osmosis
  An enthusiastic attitude; tolerance for pain
  Evening review sessions with the TAs

Assignments and Grading Policy

Programming assignments (six, 60%)
  Due Fridays at 5pm, weeks 2-7
  Asst 1: Web registration, page creation, etc.
  Asst 2: 2D Segment rasterization & clipping
  Asst 3: 3D Object Modeling (Inventor, C, C++)
  Asst 4: 3D Scene Composition (Inventor, C, C++)
  Asst 5: 3D Polygon Scan Conversion (Inventor, C++)
  Asst 6: Ray Casting/Tracing (Inventor, C++)
Late policy
  Assignments time-stamped by `turnin` (or equivalent)
  No late assignments accepted, period,
    except with a letter from a Dean.

Final Project Examples (F97)

Meteor Animation, Blowing Curtain, Interactive Parallel Radiosity, Acoustic Simulation (Concert Halls), Trick or Treat–Gothic Animation, Luxo Jr. Animation Sequel, Dome of the Rock, 3D Modeler for Kids, Precomputing Ray Tracer, Monk Animation (Douglas Adams), Foosball Players Come to Life (Animation), MIT Model & Animation, Relativistic Ray-Tracing, Human in Free-Fall, The Job (Movie), 3D Drilling for Tumors in MRI Scans Using PHANToM, Dali Animation, Flag modeling & animation, 3D Morphing, Fluid Simulation Haptics, Evolution of Movement, Tron Gone Wrong

Final Project

Final project (40%)
- Examples, brainstorming week 7
- Team formation, written proposals week 8
- Progress meetings with TAs, weeks 8-12
- Written report week 13
- Team presentations week 14 (No class)

6.837 Fall 1999 Assignment 1

Find an SGI cluster and free machine
- `http://www.mit.edu/cview`

Register for course on-line at
- `http://graphics.lcs.mit.edu/classes/6.837/F99/`
- Online signup, survey, picture
  - Due by 5pm next Friday, 17 September
  - **Required** for course registration

Create your own readable page at the URL (for `uid`):
```
% attach imagery4
% cd /mit/imagery4/6.837/F99/students/uid/WWW
% (edit) homepage.html
```
(We will validate & create the `.../uid/WWW` dirs based on today's signup sheets)

Your page should contain:
- Your name, and a picture (if you wish)
- Placeholders for pointers to each assignment
- A link back to the class page
- A link to any graphics sites of interest
- A link to your MIT page (if you wish)
- Anything else course-related

This will produce your page at URL:
- `http://imagery.mit.edu/imagery4/6.837/F99/students/uid/WWW/homepage.html`
- Check it from your own browser !

Pick up general info sheet on your way out ...
- see you on Tuesday.