CS 428: Fall 2009

Introduction to Computer Graphics

Introduction and Overview

First things first…

- **Seven** slots left in CS 428
- Write me an email by 11:59pm today
  - Name
  - Why you want to take this course in **max** three sentences
  - Grades for the CS 428 prerequisites
    - Calculus, Linear algebra, Java
- **Keep it short!**
- Will inform you on accept/reject by Thursday

People

- **Instructor: Prof. Andrew Nealen**
  - CBIM (Bowser road, near student center) Room 21
  - Office hours: Monday 1-3pm,
  - Best to contact me by email, or office hours
- **TA: Peter Borosan**
  - CBIM lab and Hill 250, 252 for office hours
  - Office hours: TBA
  - pborosan@

Web

- **Website (external access)**
  - **`http://tinyurl.com/cs428-fall09`**
- **Everything else: Sakai**
  - You should be able to see the “CS 428 Fall 09” tab after logging in to **`https://sakai.rutgers.edu/portal`** with your RutgersID
  - Mailing list: **`cs428-fall09@sakai.rutgers.edu`**

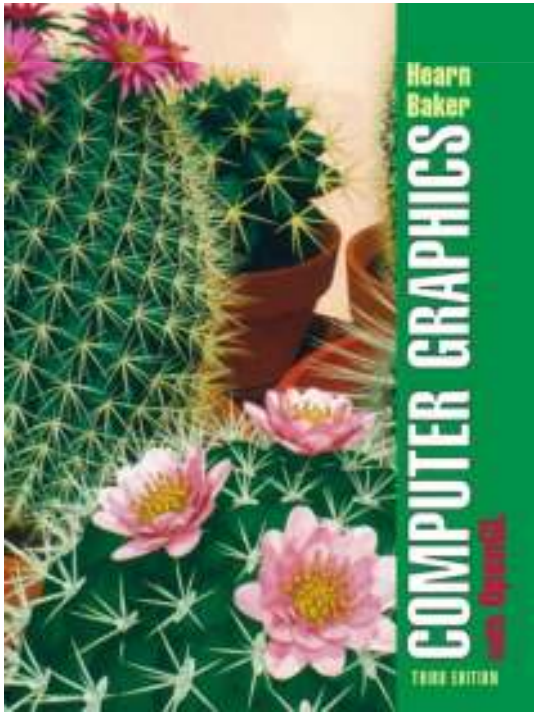
What's required?

- Programming (Java, JOGL)
- Math
  - linear algebra, some numerical computation
- Time commitment
  - This course is **very** work/code intense
  - You need to be aware of this!

Textbook

*Computer Graphics with OpenGL, **3rd** edition*

Donald Hearn and M. Pauline Baker,
Prentice Hall, 2004



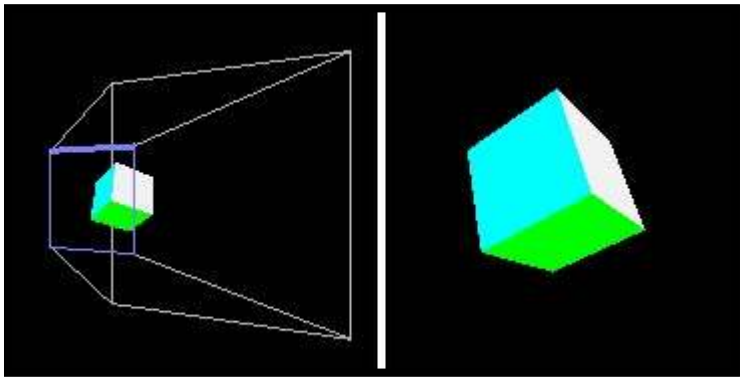
Academic Integrity

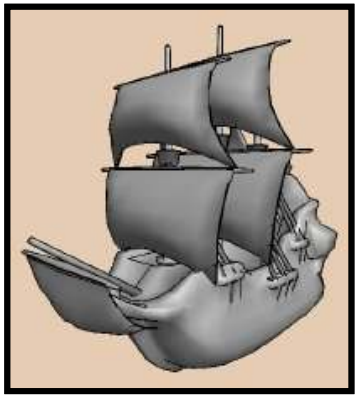
- Read the web page!
- But basically:
  - You need to do your own thinking, writing, and programming
  - You *should* discuss the course material with other people in the class, but you cannot give away how to do the homeworks or projects

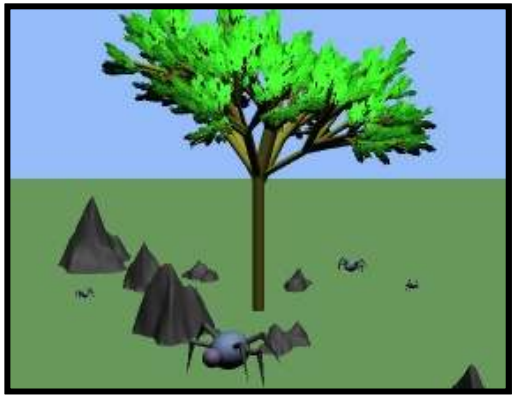
Computer accounts

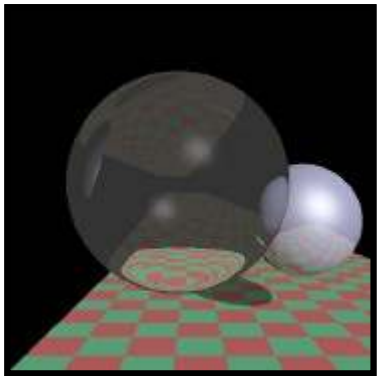
- We'll mainly be using Hill 248, 250 and 252
- Available on the course website
  - How to set up an account
  - How to get JOGL up and running
  - More…
- Access to the lab with your Rutgers ID

Programming projects









Grading

- Projects 60%
- Midterm 20%
- Final 20%

Late policy:

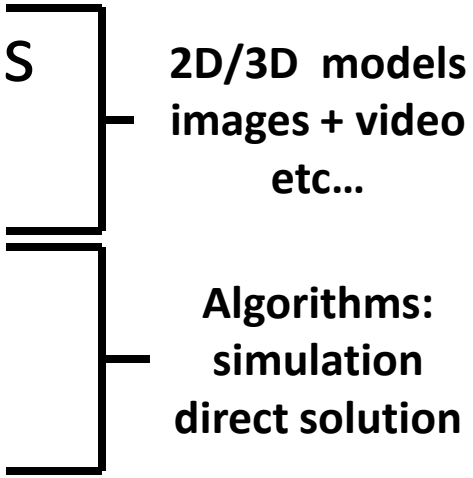
- tell me about problems in advance
- 50% credit for one day late (and no extra credit)

What this course is about

- Representations, computational models, and algorithms in computer graphics
- Using OpenGL on modern (programmable) graphics hardware

Representation + comp. models

- Shapes + materials + appearances
- Motions + behaviors
- **Representations:** specifications
- **Comp. models:** realizations
- Structure of problems
  - Spatial/temporal coherence. Sparsity.
- Optimization
  - Approximation. Pre-computation.



Topic overview

- Image formation and OpenGL
- Transformations and viewing
- Polygons and polygon meshes
  - Programmable pipelines
- Modeling and animation
- Rendering

Topic overview

- **Image formation and OpenGL**
  - **Modeling the image formation process**
  - **OpenGL primitives, OpenGL state machine**
- Transformations and viewing
- Polygons and polygon meshes
  - Programmable pipelines
- Modeling and animation
- Rendering

Topic overview

- Image formation and OpenGL
- **Transformations and viewing**
  - **Linear algebra review, Homogeneous coordinates**
  - **Geometric + projective transformations**
  - **Viewing, Viewports, Clipping**
- Polygons and polygon meshes
  - Programmable pipelines
- Modeling and animation
- Rendering

Topic overview

- Image formation and OpenGL
- Transformations and viewing
- **Polygons and polygon meshes**
  - **3D model/mesh representations**
  - **Piecewise linear shape approximations**
  - **Illumination and polygon shading**
- Modeling and animation
- Rendering

Topic overview

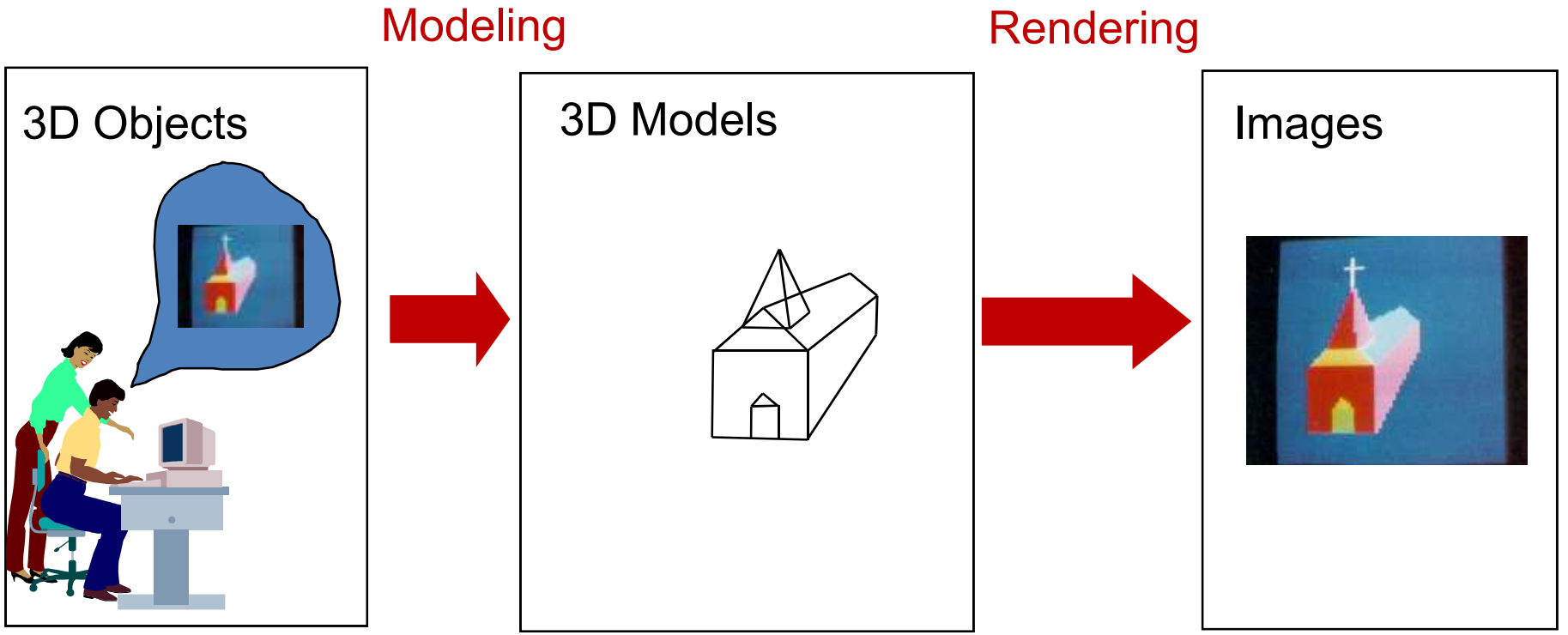
- Image formation and OpenGL
- Transformations and viewing
- Polygons and polygon meshes
  - Programmable pipelines
- **Modeling and animation**
  - **Procedural modeling and animation**
- Rendering

Topic overview

- Image formation and OpenGL
- Transformations and viewing
- Polygons and polygon meshes
  - Programmable pipelines
- Modeling and animation
- **Rendering**
  - **OpenGL rasterization: hidden surface removal, interpolation, texturing (some sampling theory)**
  - **Raytracing and radiosity**

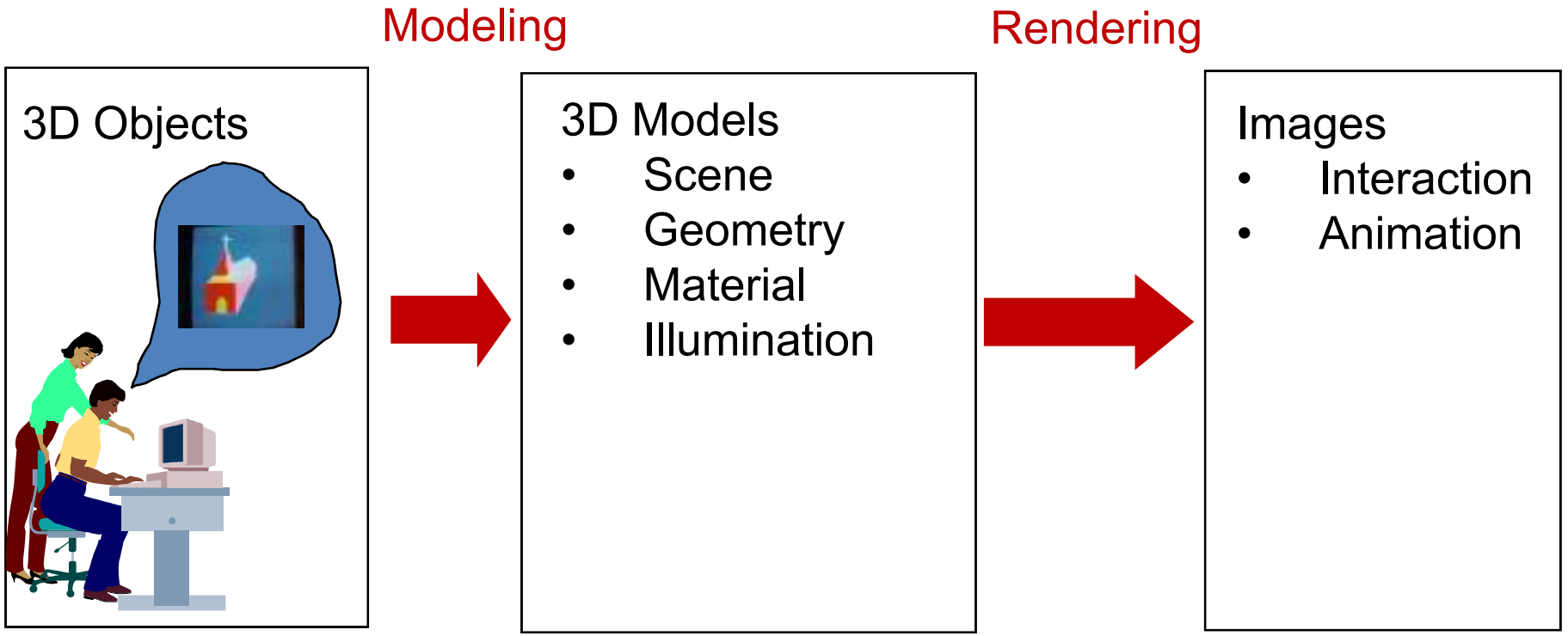
3D graphics programming

High-level view

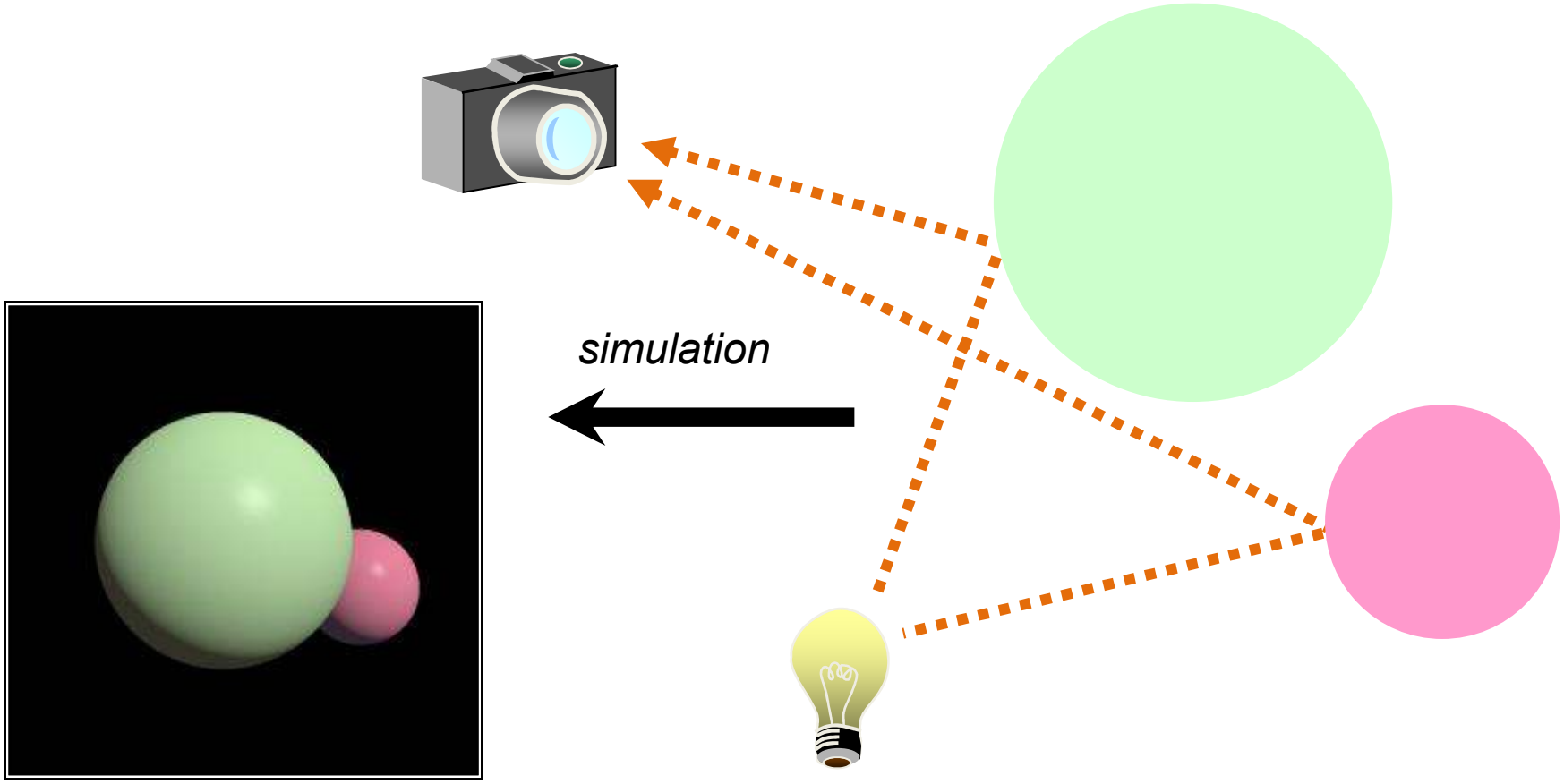


3D graphics programming

High-level view

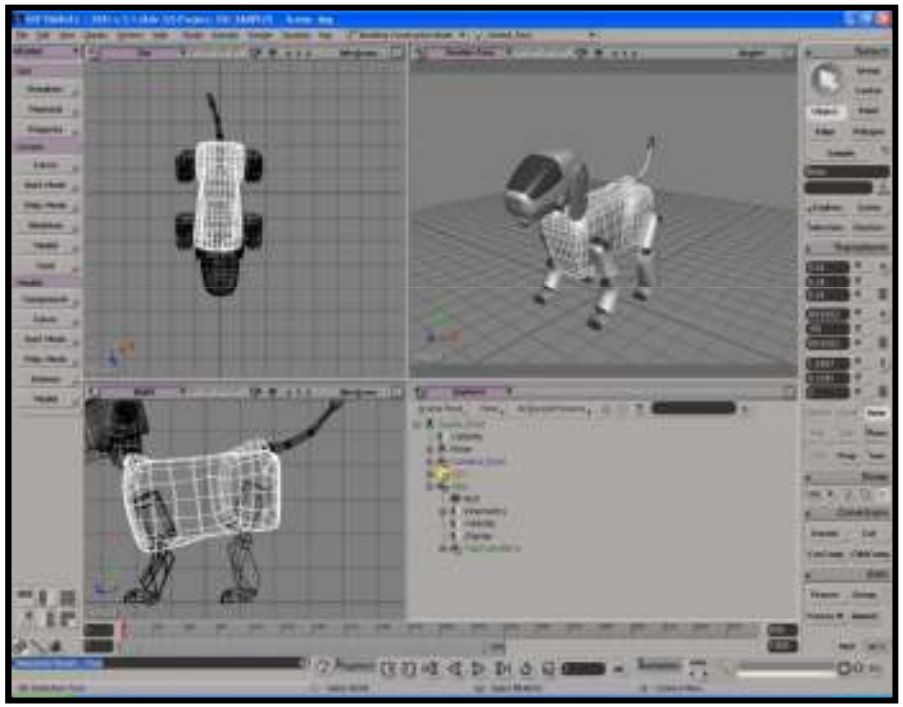


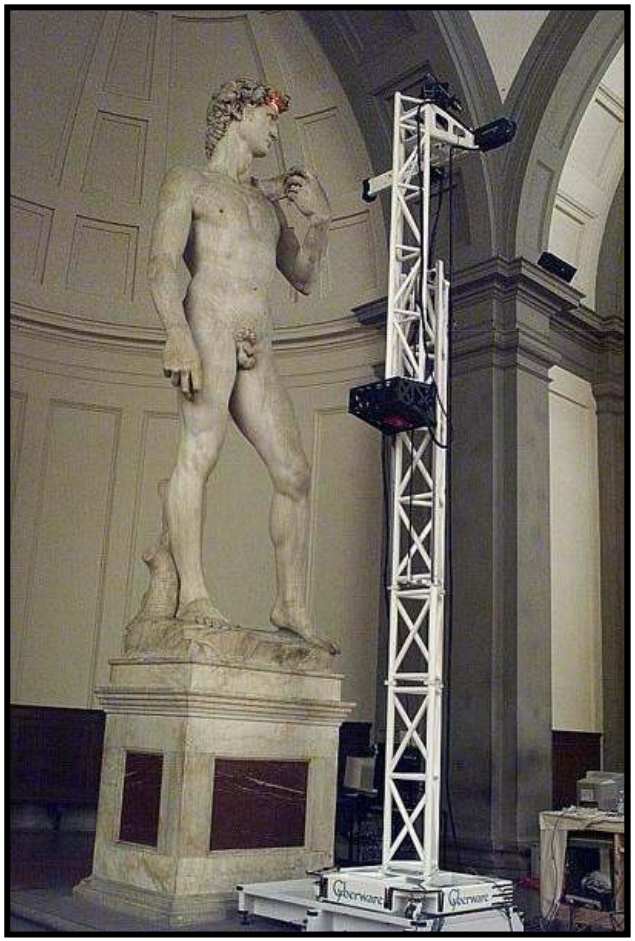
Making images in CG



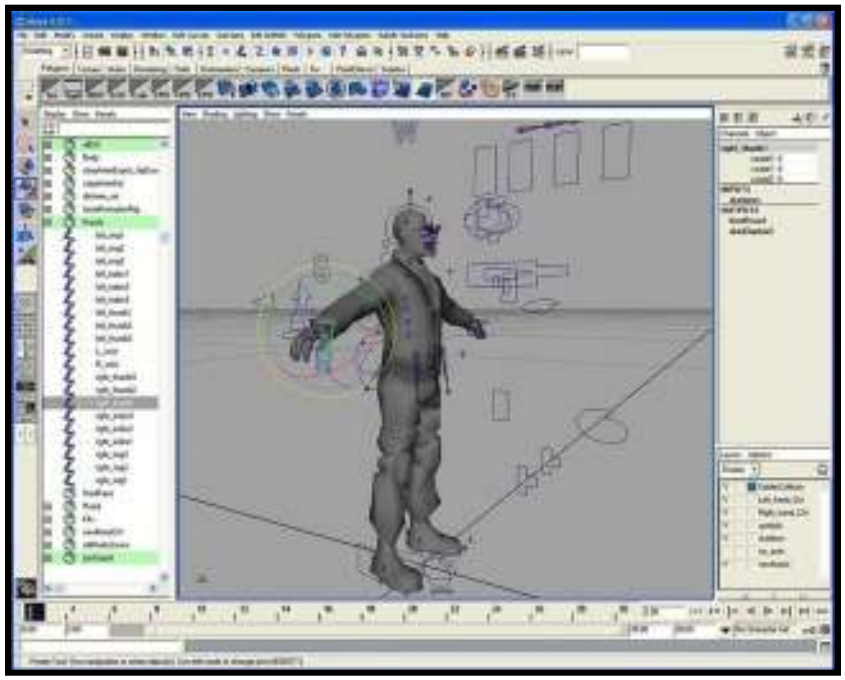
Appearance

Shape



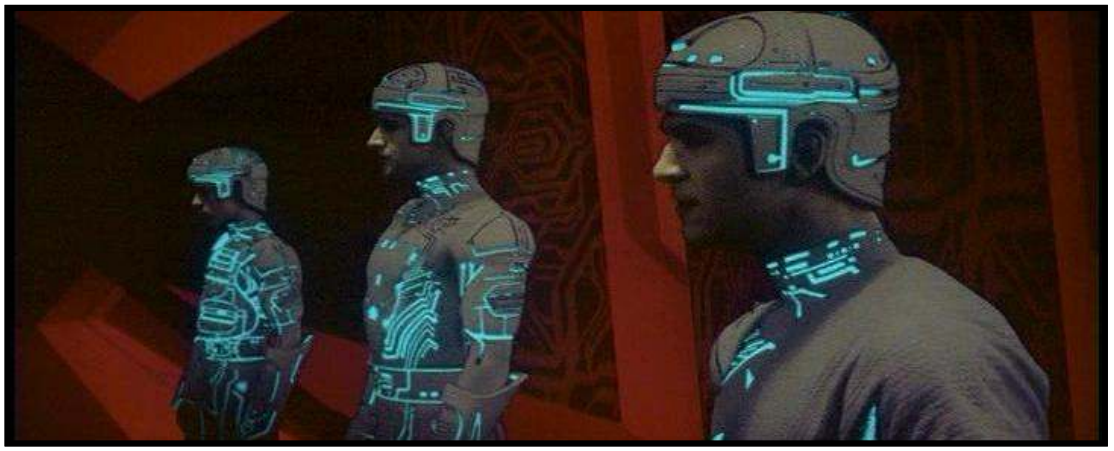


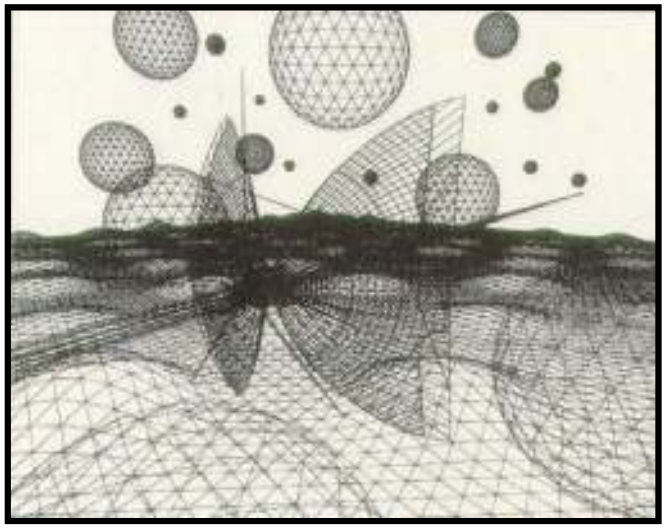
Motion

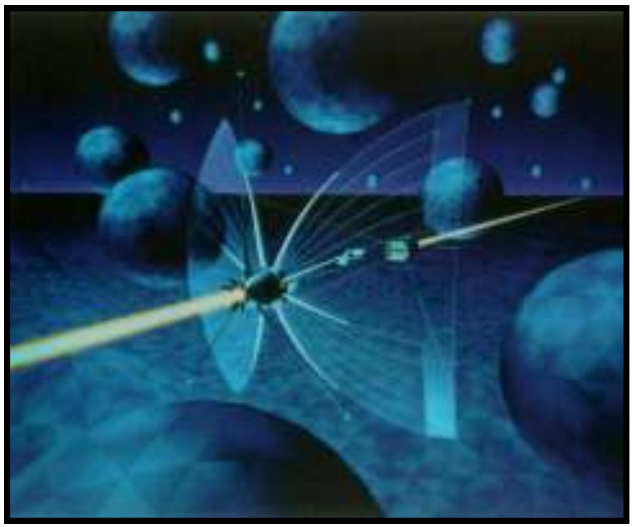


Movies

Tron (1982)







Movies

Luxo Jr. (1986)

Movies

The Matrix Revolutions (2003)

Movies

King Kong (2005)

Movies

Ratatouille (2007)

Movies

Wall-E (2008)

Video games

Team Fortress 2 (2007)

Video games

Resident Evil 5 (2009)

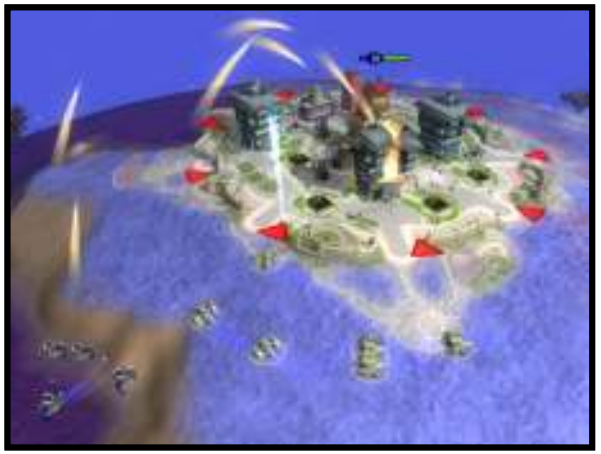
Video games

Spore (2008)

cell

creature

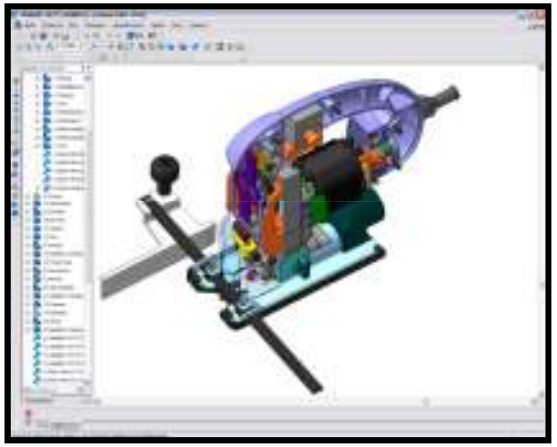
tribal



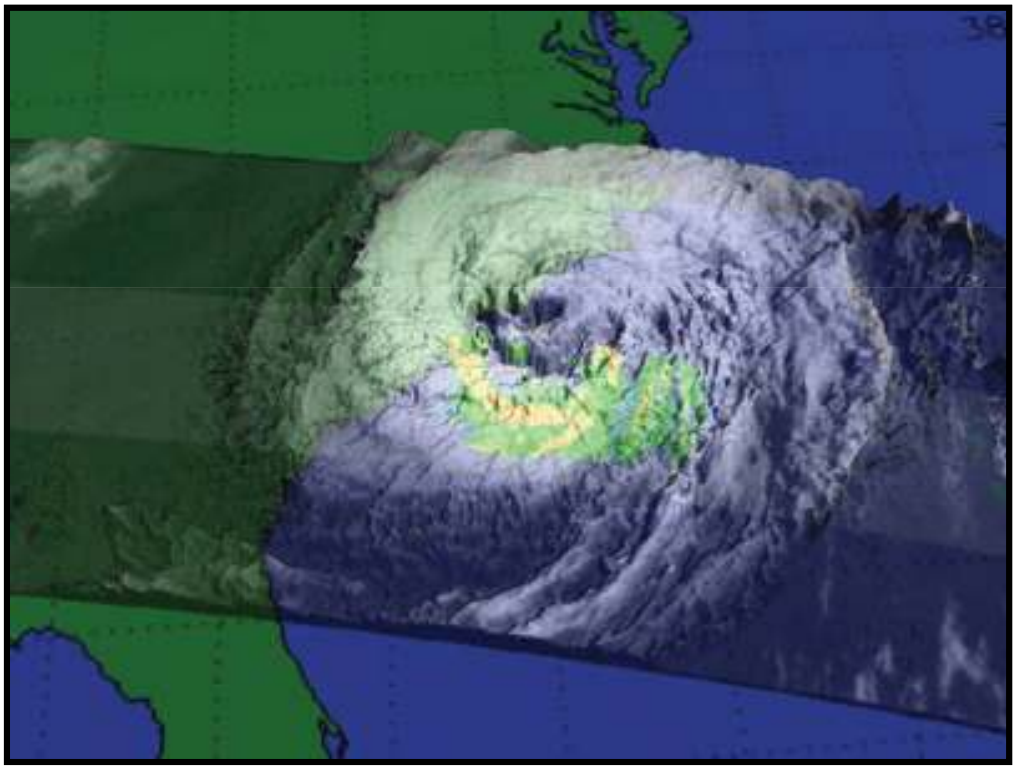
civilization

space

Computational Design



Scientific/Medical Visualization



Training and Education

Art