CSC 4356
Interactive Computer Graphics

Jinwei Ye

http://www.csc.lsu.edu/~jye/CSC4356/

Tue & Thu: 10:30 - 11:50am
218 Tureaud Hall

Lecture 1: Welcome to Graphics!

- Introduction to Computer Graphics
  - What is computer graphics?
  - What are the applications?
- Course Overview
  - What is this course about?
  - Course topics
- Course Logistics
  - Office hours, grading, policy…
  - Everything you care about!

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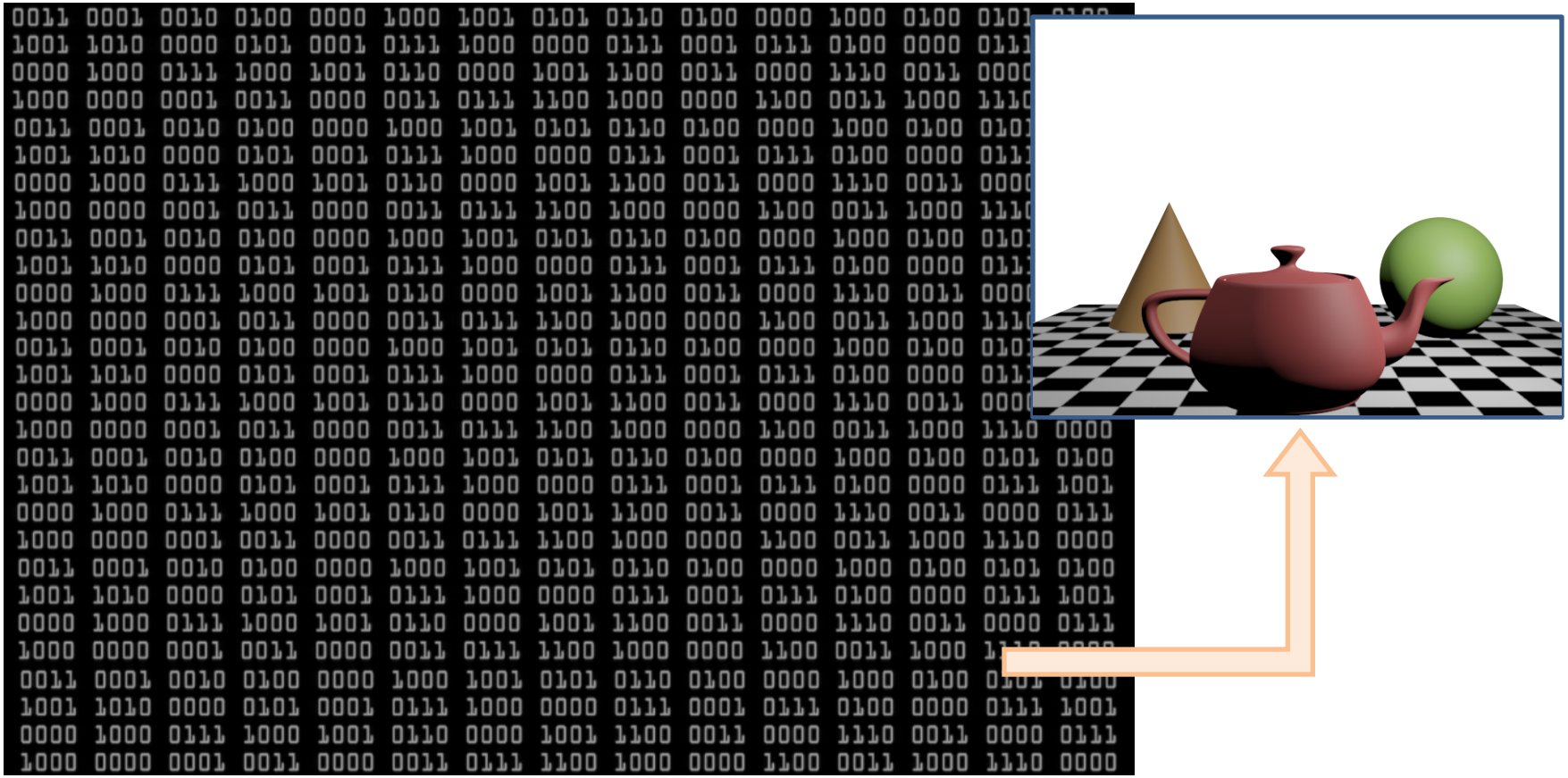
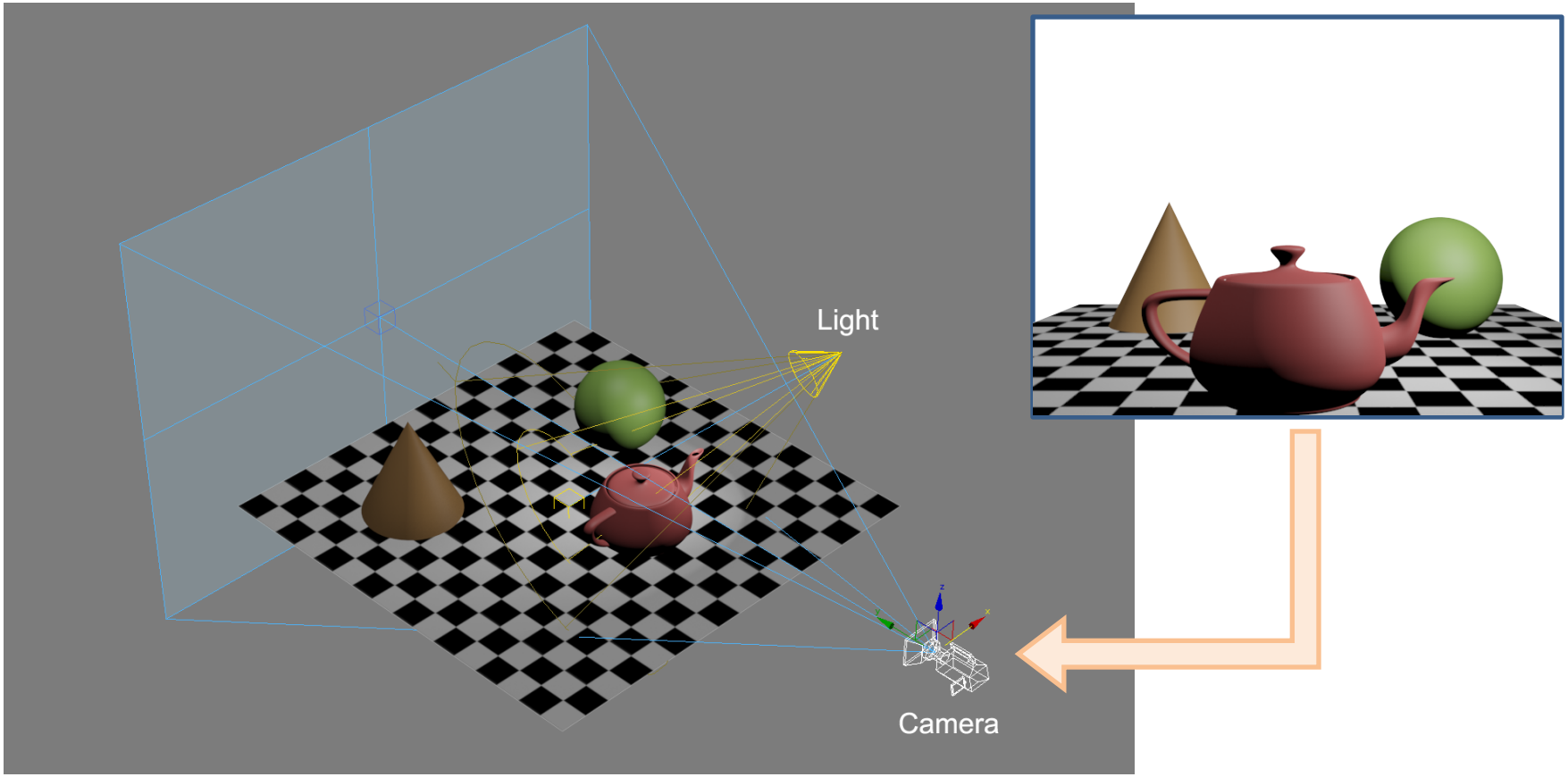
What is Computer Graphics?

- Rendering 3D scenes into 2D images



The Inverse is Computer Vision

- Interpret 3D scenes from 2D images



Why Learn Computer Graphics?

- Computer graphics is *everywhere*!
  - Entertainment
  - Design
  - Simulation
  - Scientific Visualization
  - Medical Imaging
  - …

Games

Movies

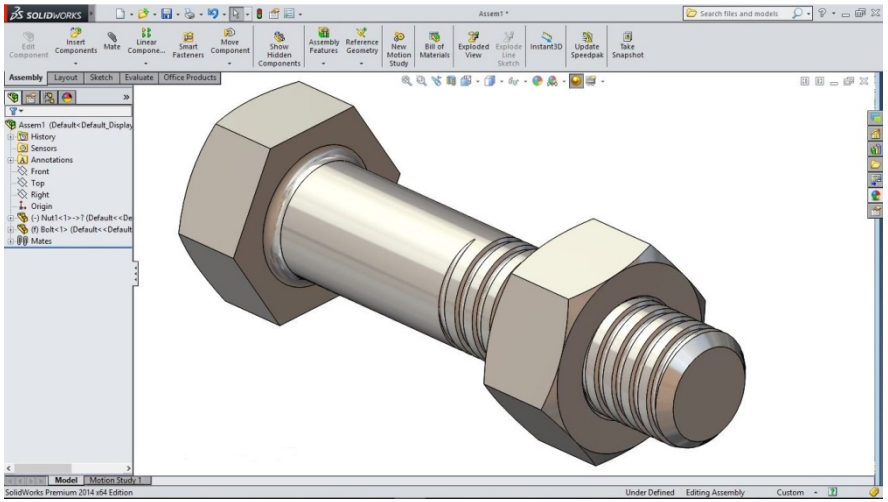

Harry Potter

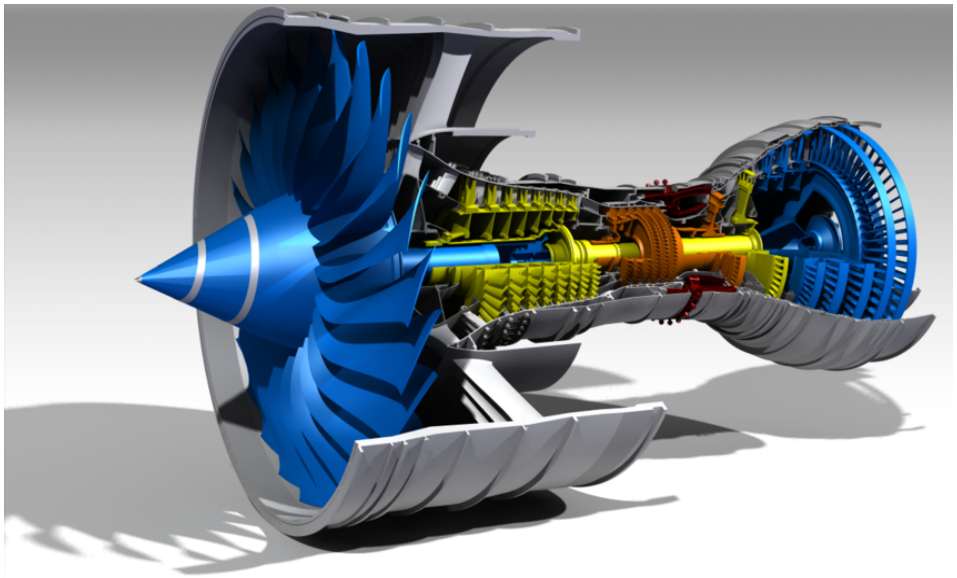

Disney
BEAUTY AND THE BEAST

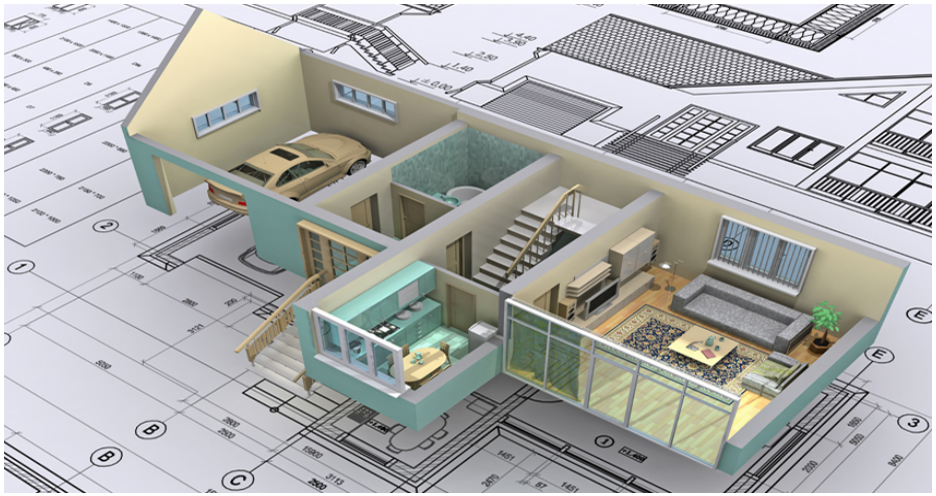

Walt Disney
ZOOTOPIA

Movies: Motion Capture

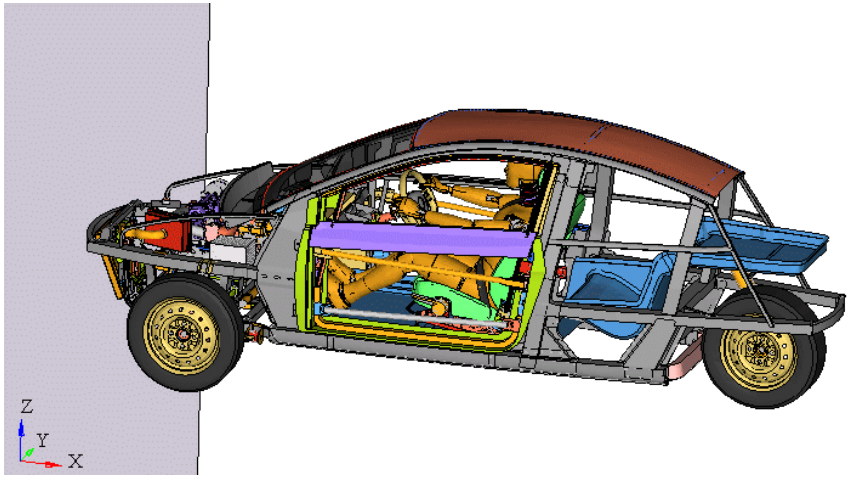
Computer-Aided Design (CAD)

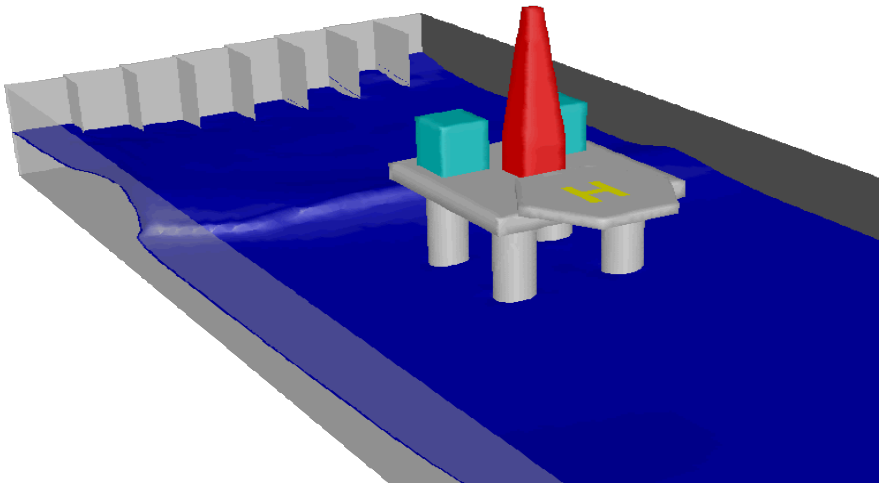


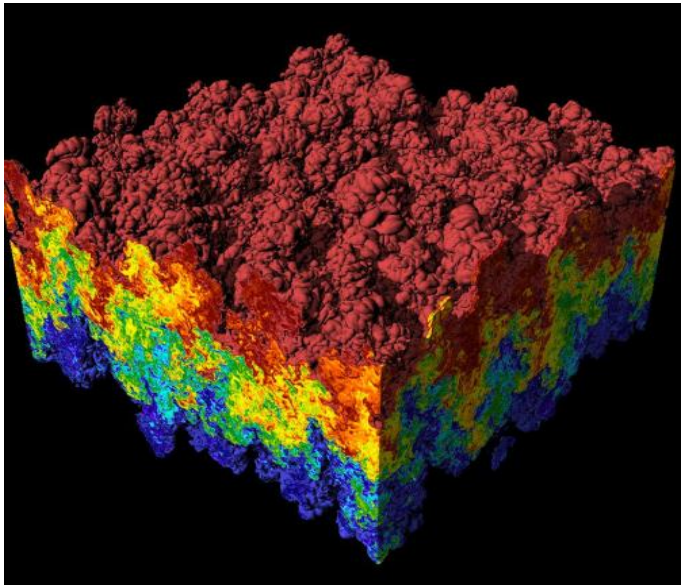


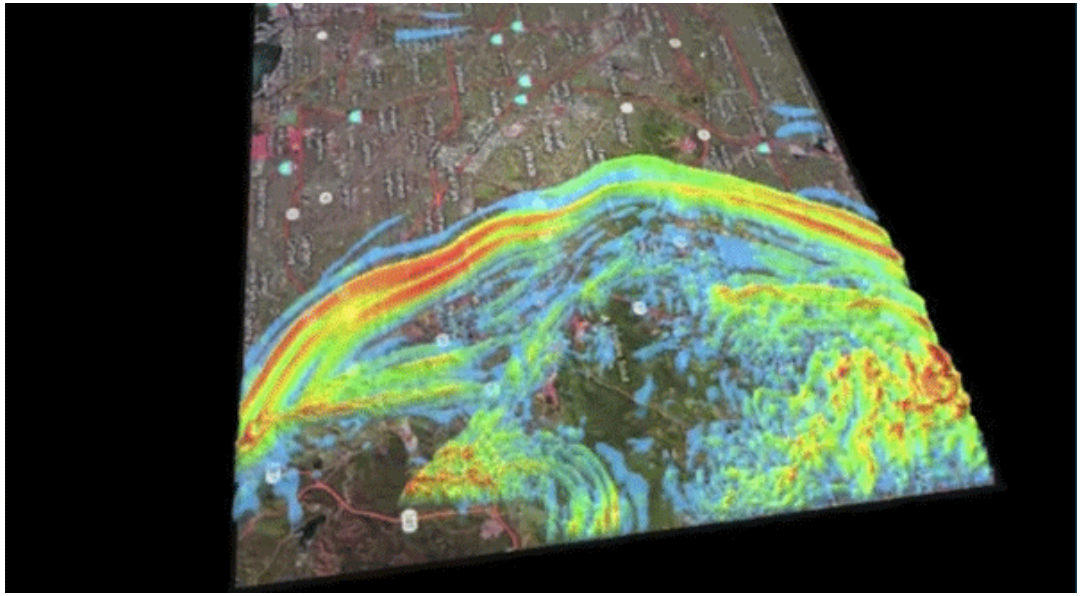


Simulation & Visualization

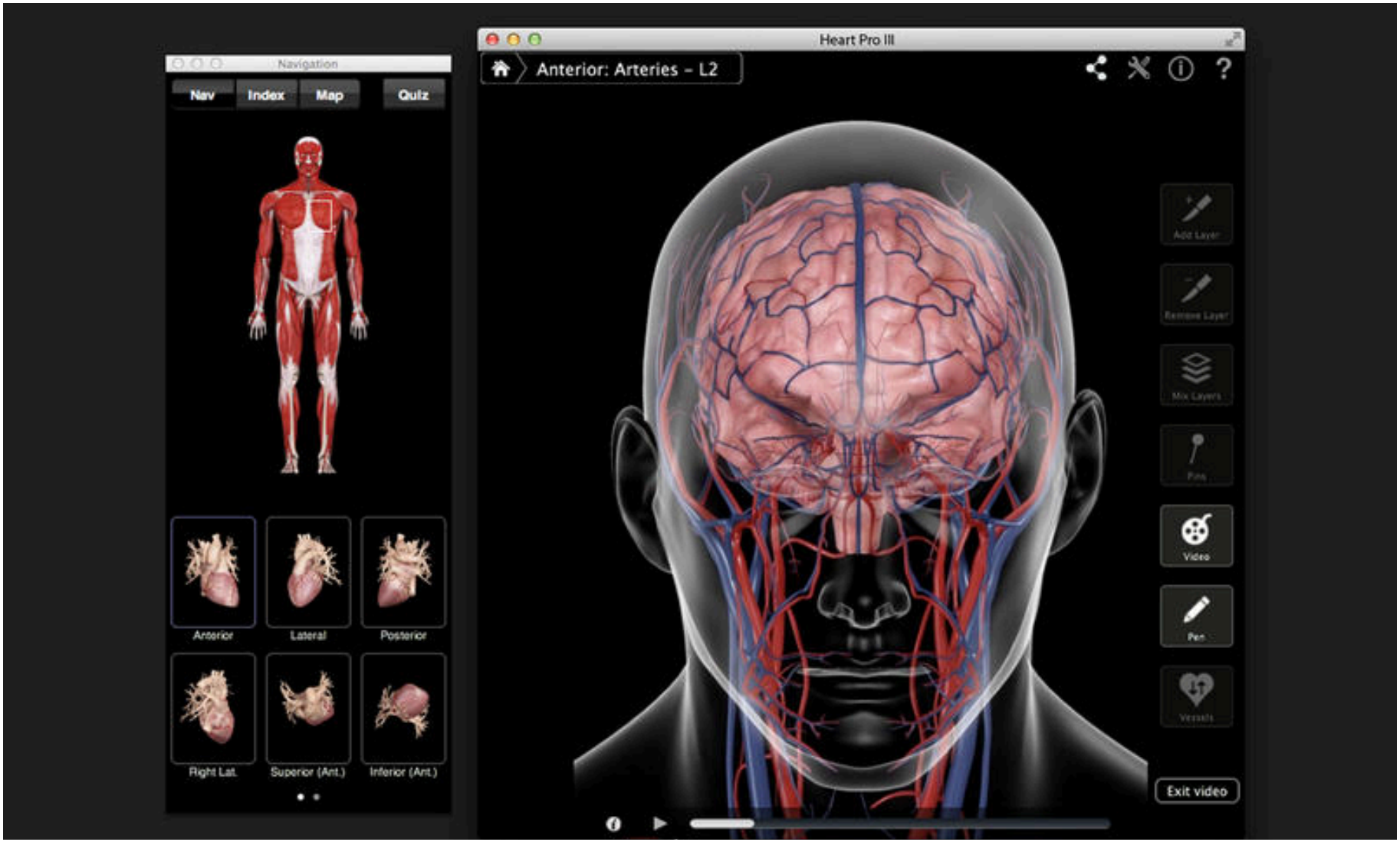






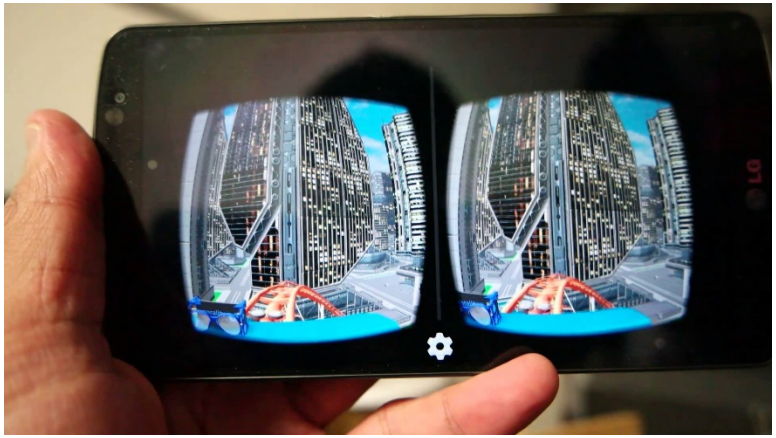


Medical Imaging



Virtual Reality (VR)

Virtual Reality (VR)



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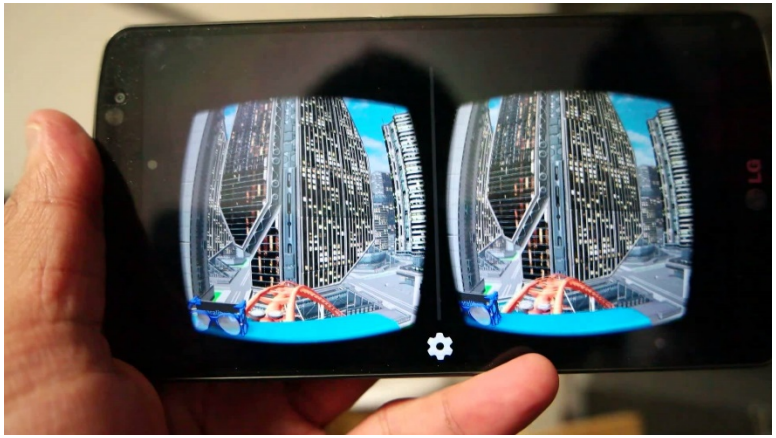

Virtual Reality (VR)

Virtual Reality (VR)

Augmented Reality (AR)

Microsoft Hololens

Augmented Reality (AR)

ARKit - Apple Developer

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What is the course about?

- NOT about:
  - Paint and imaging packages (Photoshop)
  - CAD packages (AutoCAD)
  - Rendering packages (Maya)
  - Modeling packages (3D Max, RenderMan)
- We will cover …
  - Graphics algorithms
  - Graphics data structure
  - Graphics programming language (OpenGL)
  - Graphical user interface (GLUT)
  - Applied geometry and modeling

What you can expect?

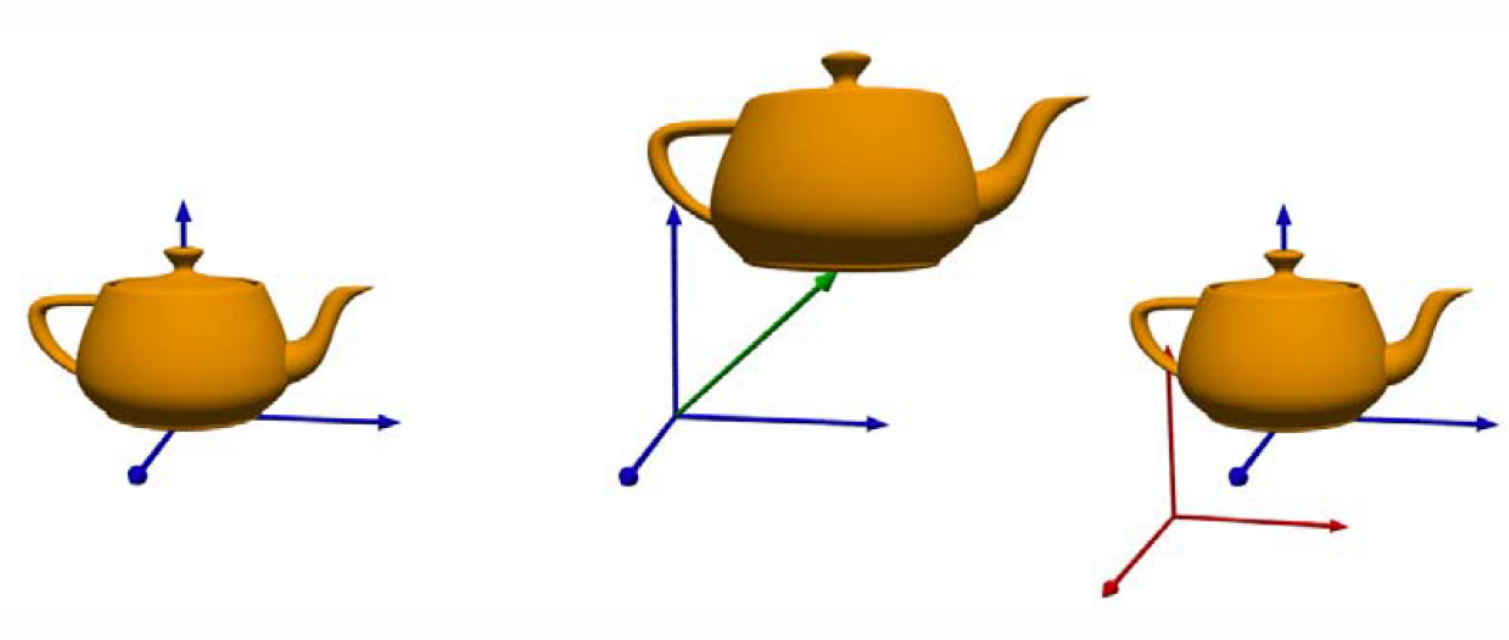
- After taking this course, you can
  - write complex 3D rendering programs
  - understand the underlying math and algorithms for modern graphics systems
- The course is heavy on math and programming ☹
- But lots of fun and rewarding! ☺

Topics

- Model transformation
- Viewing and projection
- Hidden surface removal
- Rasterization
- Lighting and shading
- Global illumination
- Texture mapping
- GPU programming

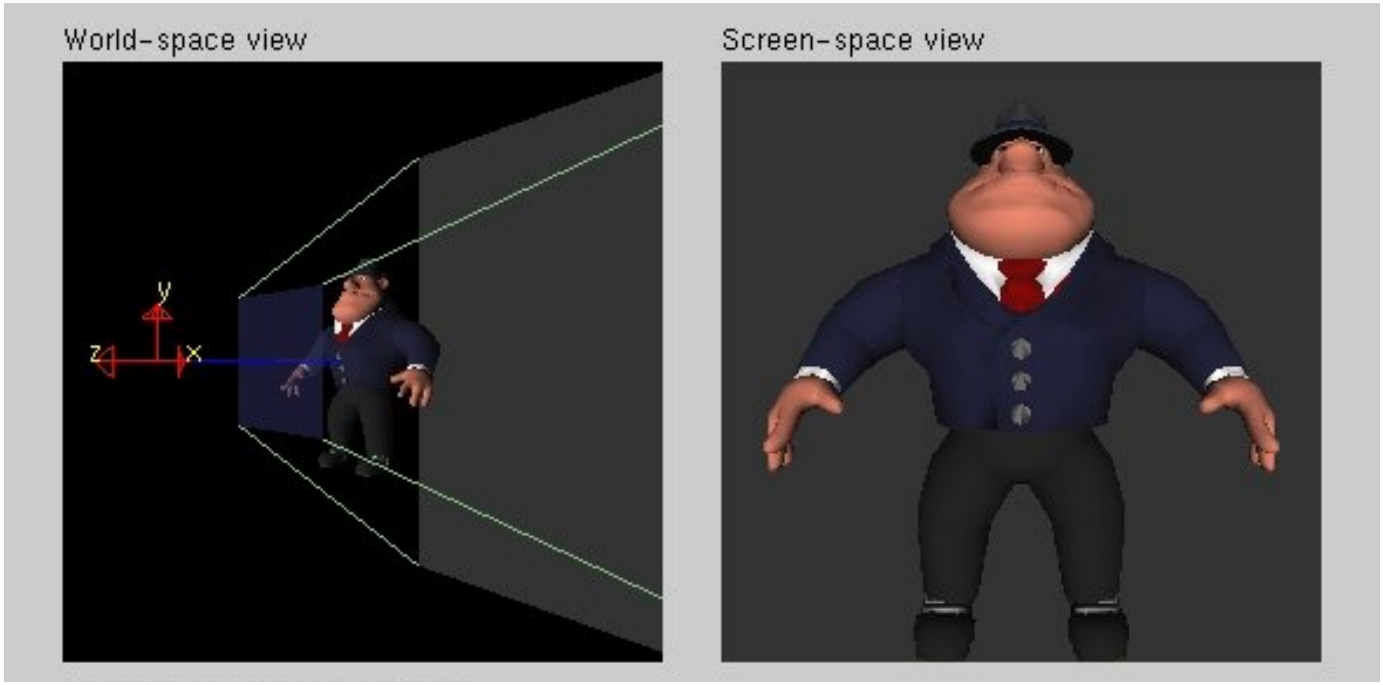
Model Transformation

- Homogeneous coordinates
- 2D & 3D transformation
  - Translation, rotation, scaling



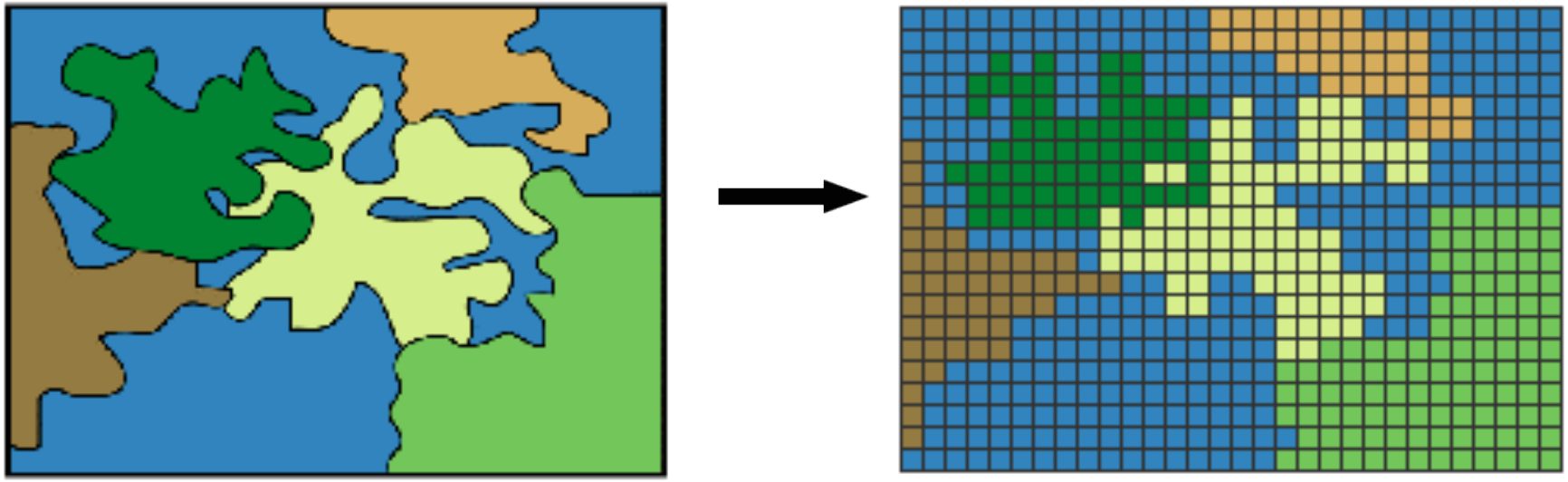
Viewing & Projection

- Viewport transformation
- Orthographic projection
- Projective projection



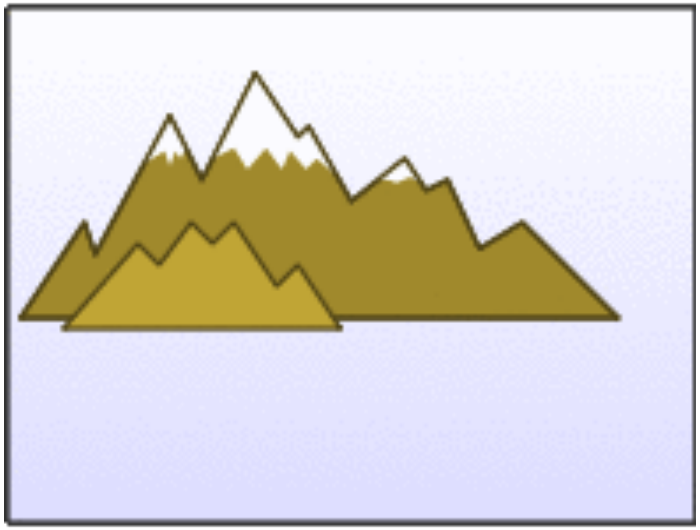
Rasterization

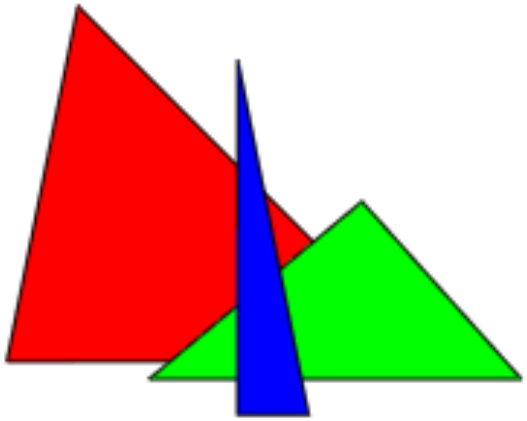
- Line drawing
- Triangle drawing
- Clipping
- Displays and raster devices



Hidden Surface Removal

- Visibility problem
- BSP tree
- Ray casting
- Z buffer



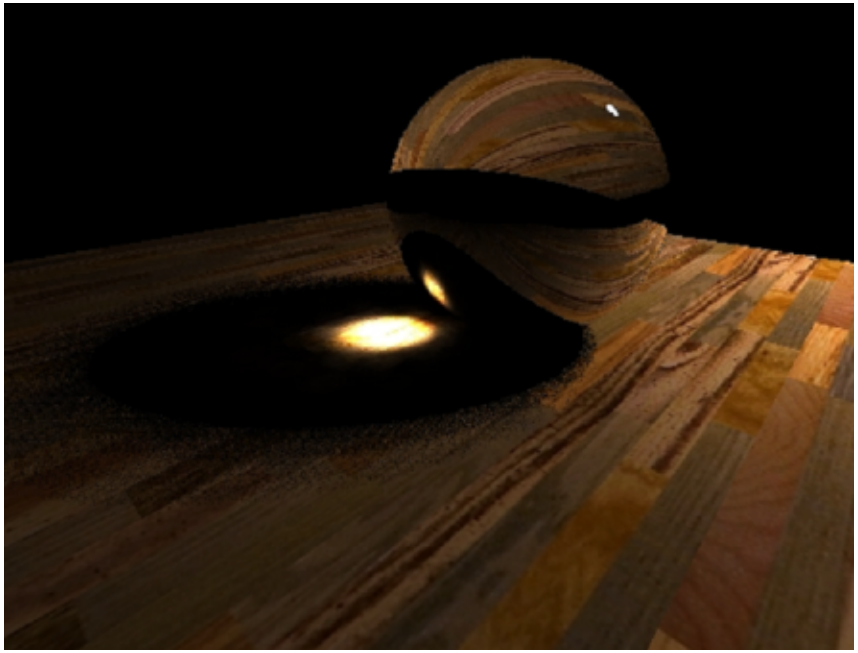


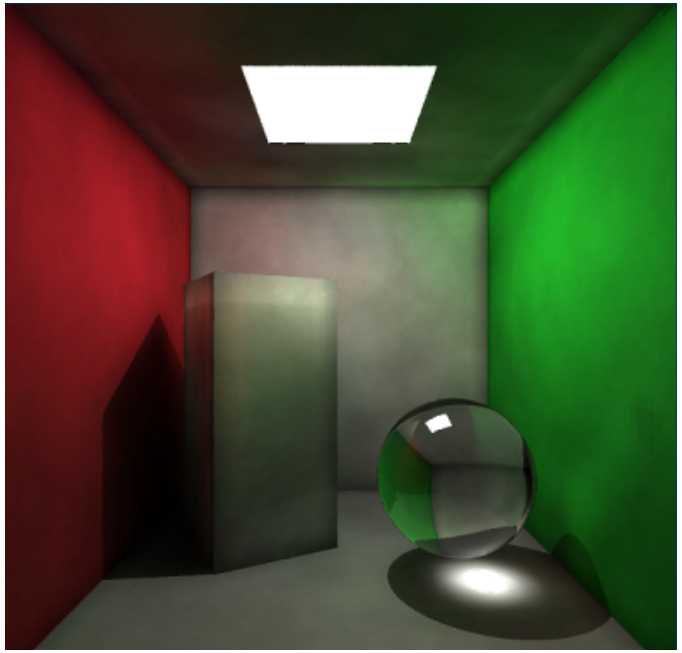
Lighting and Shading

- Illumination model
- Shading models
  - Flat, Gouraud, Phong
- Surface material

Global Illumination

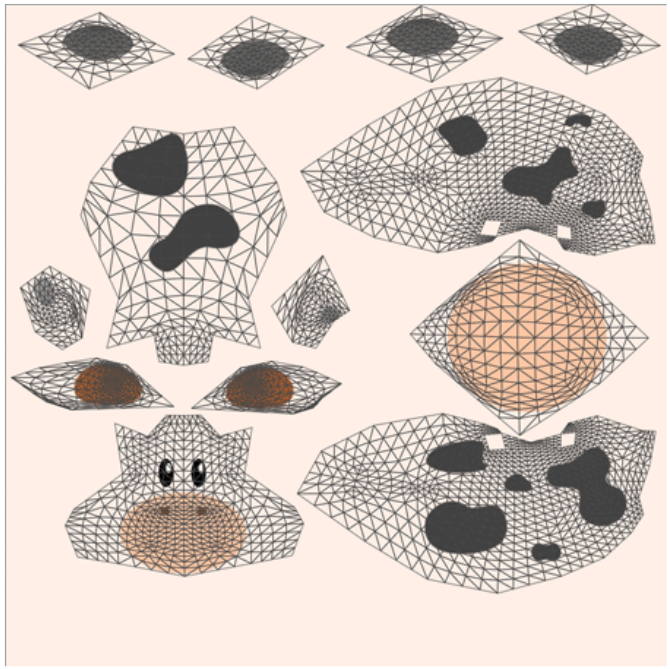
- Ray tracing
- Radiosity lighting
- Photon mapping

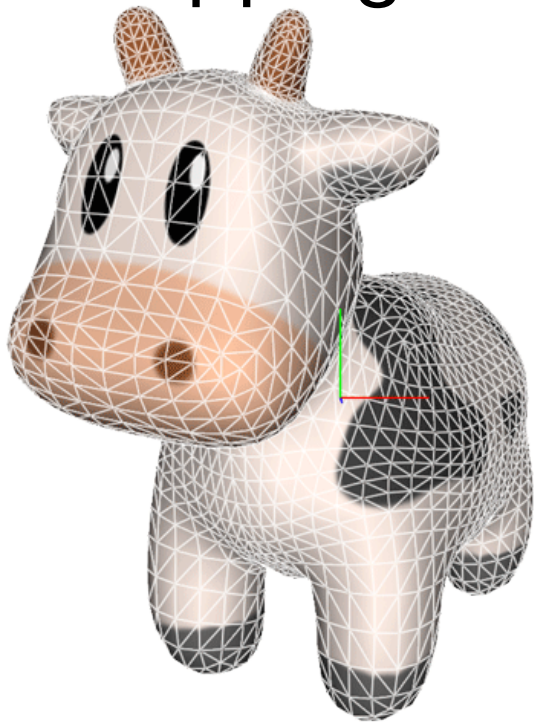




Texture Mapping

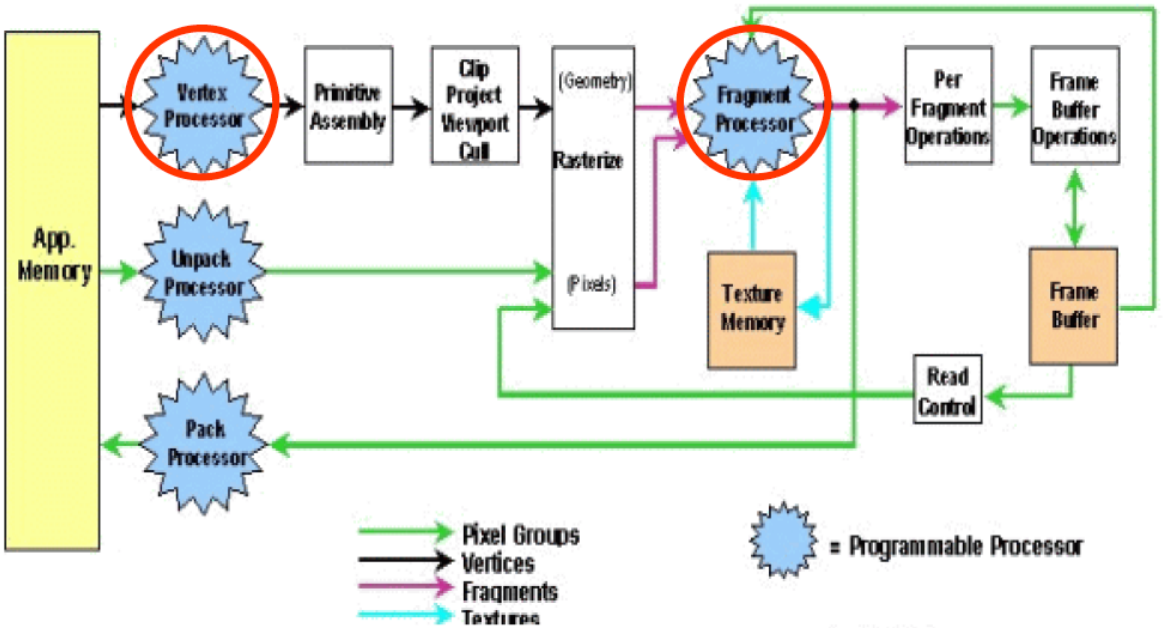
- What is texture
- Mipmaps and anti-aliazing
- Reflection and environment mapping





GPU Programming

- GPU Hardware Architecture
- Shading language (GLSL)
  - Fragment shader & Vertex shader



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Staff

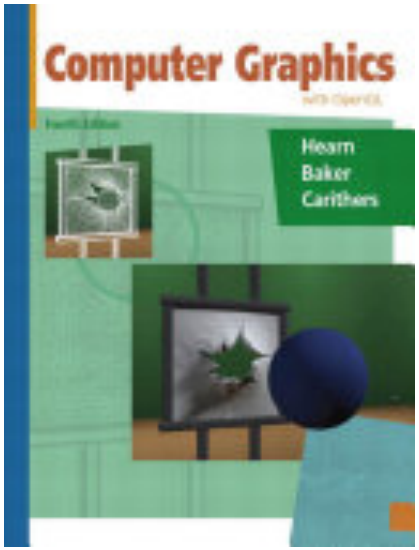
- Instructor: Jinwei Ye (jinweiye@lsu.edu)
- Office hours: 2:00-3:00 pm Tue & Thu
- Location: 3272T PFT

- TA: Simron Thapa (sthapa5@lsu.edu)
- Office hours: 2:00-4:00pm Tuesday
- Location: 174A Coates Hall (may change to PFT soon)

- *No office hour this week!*

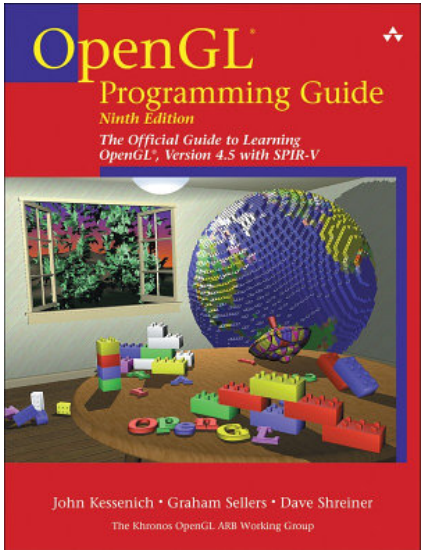
Textbook

- Computer graphics with OpenGL (Fourth Edition)



- Optional:

  OpenGL Programming Guide (the Red Book)



- Other materials available on course website

Pre-requisites

- Basic mathematics
  - For example matrix multiplication, inversion etc.
- Programming in C/C++
- Knowledge in OpenGL is not required

Grading

- Warm-up Math Problem Set (5%)
- Four Programming Assignments
  (4 x 15% = 60%)
- Midterm Exam (15%)
- Final Exam (20%)
- Extra Credit (2%)
  - Course participation
  - Complete course evaluation

Assignment Logistics

- No programming in math problem set
  - Assign next time
  - Due on next Thursday 8/31 (submit in class)
- Programming assignments
  - Submit to CSE Linux server classes.csc.lsu.edu
  - Individual accounts and instruction will be given with the first assignment
  - Due at midnight (11:59pm) on deadline day

Late Policy

- You have three FREE late days
- Use for programming assignments only
- No more free late days?
  - Grade will be reduced by 10% per late day
- No assignment will be accepted more than three days past the deadline

Cheating Policy

- No Cheating! Zero tolerance!
- Do problem set and programming assignments individually
- Code from the web:
  - OK to use as long as it is a SMALL portion of your assignment

Next Time …

- Math Review/Preview
  - Vector, Matrices, Linear Algebra
  - Textbook Appendix A
- Make the rest of the course easier!