COMPUTER GRAPHICS

15-462 / 15-662
Nancy Pollard

T-R: 10:30 am – 11:50am
DH 1212
What is computer graphics?

Who am I?

Administrivia.

Topics
What is computer graphics?

Who am I?

Administrivia.

Topics
GOALS OF COMPUTER GRAPHICS

- Faking reality – convincingly.
- Creating alternative reality.
FAKING REALITY
FAKING REALITY
ALTERNATIVE REALITY
MAKING OF THE GATORADE COMMERCIAL
WHAT IS COMPUTER GRAPHICS?

- 3D Modeling / Geometry
- Simulation / Animation / Character Animation
- Lighting / Light Transfer
- Textures and Color
- Post-Processing: Image Processing
- Camera tricks / Optics
WHAT ELSE IS COMPUTER GRAPHICS

Scientific Visualization

Illustration

NPR / Art

Computational Photography

Virtual Life

and much more....
INTRODUCTION

- What is computer graphics?
- Who am I?
- Administrivia.
- Topics
WHO AM I

- I’m a graphics/robotics researcher.
- I’ve been at SCS (RI and CSD) for 12 yrs.
- Before that, I was at Brown University for 5 yrs.
- PhD 1994 MIT.
WHAT I DO
"Dexterity is the ability to find a motor solution for any external situation, that is, to adequately solve any emerging motor problem correctly (i.e., adequately and accurately) quickly (with respect to both decision making and achieving a correct result) rationally (i.e., expediently and economically), and resourcefully (i.e., quick-wittedly and initiatively).

How can we easily animate the starfish’s escape?

• Appearance of intelligent motion
• Believable physical interaction with the glass box
  • Dynamic, fun actions
• Animation tools accessible to anyone
ANIMATING DEXTEROUS MOTIONS

Videos created by two novice users using our system.
Direct Control of Simulated Non-human Characters

Results (animations)

(No audio)
ROBOTIC TELEMANIPULATION

Goal: intuitive interactive control of dexterous manipulation for a robot arm / hand system

- Remote dexterous manipulation
- Scripting new behaviors
- Learning from demonstration
http://www.cs.cmu.edu/~jialiu1/database.html
How can we compare motions of different species?

Motivation for Evolutionary Biology:

• Trace evolution of locomotor movements through the tree of life, using comparative methods
  • Clarify relationships between species
  • Deduce likely movement patterns of common ancestors
  • Answer questions such as “How did T-Rex run?”
Reference

Are these motions the same?

Pinocchio
Automatic Rigging and Animation of 3D Characters
Ilya Baran and Jovan Popović
SIGGRAPH 2007
papers_0030

Baran and Popovic
What is computer graphics?

Who am I?

Administrivia.

Topics
Web Page is up!

http://www.cs.cmu.edu/~15462/

It will also be linked from my web page

Use Piazza for announcements / discussion

https://piazza.com/class#spring2015/15462
TA Office Hours

- TAs:
  - Felipe Gomez-Frittelli (fgomezfr@andrew.cmu.edu)
  - Nathan Dobson (ndobson@andrew.cmu.edu)
  - Anna Etzel (aetzel@andrew.cmu.edu)

- Office hours will be announced on Thursday
Shirley, 3rd Edition (with the red cover)

OpenGL Red Book

http://www.glprogramming.com/red/

For Thursday:

Red Book Chapters 1 and 2
Pre-requisites

- Talk to us if you’re missing these!
  - 15-213/18-213: Introduction to Computer Systems

And either

Or both of
  - 21-241: Matrix Algebra (matrix & vector algebra)
  - 21-259: Calculus in Three Dimensions

- Basic 3-D geometry / C++
GRADING

- Project 1 (10%)
- Project 2 (15%)
- Project 3 (15%)
- Project 4 (15%)
- Project 5 (15%)
- Midterm (15%)
- Final Exam (15%)
LATE POLICY

- 3 late days for projects.
- No further extensions without explicit permission 2 days before deadline.
Please don’t cheat! Using code from the web is ok as long as it is a SMALL percentage of the code for written the assignment and you acknowledge your sources.

Do projects and homeworks individually.
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SYLLABUS AND SCHEDULE

http://www.cs.cmu.edu/~15462/
Five Projects:

- Starter project - OpenGL
- Geometry and Meshes
- Ray Tracing
- Global Illumination
- Physics Engine
PROJECT 1: BASICS OF OPENGL
PROJECT 2: GEOMETRY AND MESHES AND SHADERS
PROJECT 4: GLOBAL ILLUMINATION

Figure 3: Cornell Box scene

Figure 4: Ring scene

Figure 5: Dragon scene

Figure 6: Glass dragon
PROJECT 5: PHYSICS ENGINE
Basics of OpenGL

How to access CMU machines and start programming

Project 1 assigned
LET'S HAVE FUN