

Questions to Start With



- Why are you here?
- What is Computer Graphics?

- What do you want to get out of it?
- What do you expect?
- What have you heard?

- Do not want to blow a lecture on mechanics

Topics du Jour



- What is Computer Graphics – the topic

- What is Computer Graphics – the class

- Some basic things to get started

What is Computer Graphics?



- How computers create things we see

alternative

- Geometry
 - Geometry for non-visual stuff, often another field

What kinds of “things we see”



- What?
- Why?

- Computer Displays
- Movies / Video
- Print
- Interactive Media
 - Games
 - Virtual Reality
- Other devices (mobile)
- ...

- Computer Displays
- Entertainment
- Design
- Communication
- Simulation
- Medicine / Science

What is computer graphics?



(almost) Any picture we see!
and a lot more than “computer pictures.”

Computers touch everything ...

- All movies
- Photography (even film is printed digitally)
- Print
- ...

More than Pictures? (3D Displays, ...)

What do we see? What is an Image?



- Basics of Light
 - Electromagnetic radiation
 - Waves, frequencies (later)
 - Particle model
 - Travels from source to receiver
- Source to Viewer?
 - Not known until around 1000
 - Euclid and Ptolemy PROVED otherwise
 - Ibn Al-Haythan (Al-hazen) around 985
 - Triumph of the scientific method
 - Proof by observation – not authority
 - Experiment – stare at sun, burns eyes, ...
 - Also figured out light travels in straight lines

Depth and Distance



- Light travels in straight lines
 - Except in weird cases that only occur in theoretical physics
- Doesn't matter how far away
 - Can't tell where photon comes from
 - Photons leaving source might not all make it to eye
 - Photons might bounce around on stuff
 - Longer distance, more chance of hitting something

Looking at things



- Light leaves source
- Light bounces off object
- Light goes to receiver
 - Eye, Camera
- Receiver is 2D, process is 3D
- Mathematics later
- Could be a picture (per eye)



What is Computer Graphics?



- Images - Visual Computing
- Geometry - Geometric Computing
 - Probably turned into an image at some point
 - Except if it's a 3D printer, hologram, ...
- Not just pictures of world (text, painting, ...)

Images



- Dictionary: a reproduction of the form of a person or object, especially a sculptured likeness
- Math: the range of a function
- A picture (2D)
- A sampled representation of a spatial thing

How to make images?



- Represent 3D World & Make a picture
 - Rendering (act of making a picture from a model)
 - Either simulate physics or other ways
- Capture measurements of the real world
- Make up 2D stuff (like painting text, ...)

Kinds of Image Representations



- Old: Raster vs. Vector
- New: Sampled vs. Geometric
- Raster: regular measurements (independent of content)
- Geometric: mathematical description of content
- Display: vector vs. raster

Color



- Quality of light
 - Energy spectrum / reflectance function
 - Perception
- Can we represent color with 3 numbers?
 - No!
 - Sortof (R,G,B or X,Y,Z, or its variants)
 - Details later in the class
 - For now, pixels have 3 brightnesses

Pixels



- A little square?
 - Bad model – but right idea
- A measurement (at a point)
 - In theory a point – in practice could be average over a region, ...
 - Limited precision...
- Grid? (or any pattern)
 - Key point: independent of content

What is the field of Graphics?



(as far as we're concerned as a part of CS)

- Not content
- Not how to use graphics tools (***)

Related Fields / Courses



- Art
- Image Processing
- Computational Geometry
- Geometric Modeling
- Computer Vision
- Human Perception
- Human-Computer Interaction

- Advanced Graphics

What do you need to know?



- About images
- About geometry
- About 3D

- Importance of images in graphics classes
 - A new thing
 - Not well reflected in texts

What will we try to teach you?



- Eyes and Cameras – where images go
- Images (sampling, color, image processing)
 - Digital Photography
- Drawing and representing things in 2D
 - Raster algorithms, transformations, curves, ...
- Drawing and representing things in 3D
 - Viewing 3D in 2D, surfaces, lighting
 - Making realistic looking pictures
- Miscellaneous topics

How will we teach this to you?



- CS559 – Computer Graphics
- Basic course info – its all on the web
www.cs.wisc.edu/~cs559-1
- Web for announcements – issues with mailing lists

What's new this year?



- Less digital photography (new course)
- Some new topics
 - Programming graphics hardware (shaders, GPU)
 - Rendering
- Experiment with project structure
 - Cut out “non-graphics” aspects to make smaller
 - More emphasis on using sample code
 - Not all projects the same size/weight
 - Mini project

Who



- Prof: Mike Gleicher
- 6385 CS
- Office Hours:
 - Wednesday 11-11:45,
 - Thursday 9:30-10:15
 - Or by appointment
- gleicher@cs.wisc.edu
- TA: Blayne Field
- 1308 CS
- Office Hours:
 - Mondays 3:30-4:30pm,
 - Tuesdays 1:00-2:00pm
- See the website

Books



- Fundamentals of Computer Graphics, 2nd ed
 - By Peter Shirley (and others)
 - NOT the 1st edition
 - Referred to as Shirley
 - or Tiger Book
- OpenGL Programming Guide
 - By Woo et al.
 - “red book” – common reference
 - Any version is OK for class
 - Old version is on the web



Other Books



- RTR
 - 2e – old, but good – have readings from it
 - 3e – just came out. encyclopedic
- C++
 - Evolution of book thickness
 - Books on fancy C++

Collaboration



- Collaboration vs. Academic Misconduct
- We encourage collaboration (to a point)
 - Not on exams
 - You must do your own project work

Parts of the Course



- Exams
 - Midterm (Tues, Oct 28th evening), FINAL
- Assignments
 - Written – double check the theory (exam prep)
 - Programming – try things out (before projects)
- Projects
 - Smaler
- **Something** due every Tuesday
 - Survey next week

Software Infrastructure



- Visual Studio (C++ on Windows)
 - Your program must compile and run on machines in B240!
- FITk
- OpenGL
- LibTarga
- Class is not about tools, but we will help you with them

Other Administrative Questions?



- C++ (vs. GLUT)
- Workload
- Extra Credit
- Grading and Late Policies