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 is the field of Graphics?

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

• Not content
• Not how to use graphics tools (***)
What kinds of “things we see”

- **What?**
  - Computer Displays
  - Movies / Video
  - Print
  - Interactive Media
    - Games
    - Virtual Reality
  - Other devices (mobile)
  - …

- **Why?**
  - 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, Models…)

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, …)
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-Haytham (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
Displays

- Monitors / Projectors / …
  - Sampled displays
- Inkjet/LaserJet

- Pixels (grids) - sampled
- Primary mixture color
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, …)
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)
How to generate images

• Simulate photons, count what gets to eyes
• Simulate painter

• Primitives vs. Physically-Based
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
• 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 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 – it's all on the web
  www.cs.wisc.edu/~cs559-1

- Web for announcements – issues with mailing lists
What’s new this year?

• Re-order things
  – Put image processing later in the class
Who

- Prof: Mike Gleicher
- 6385 CS
- Office Hours:
  - Monday 11-11:45, Tuesday 10-11
  - Or by appointment
- gleicher@cs.wisc.edu

- TA: Suphadip Ghosh
- 1301 CS
- Office Hours
  - TBD
- See the website
Books

- **Fundamentals of Computer Graphics, 3rd ed**
  - By Peter Shirley (and others)
  - NOT the 2nd 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
  – 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 (Weds, Oct 20th evening), FINAL

• Assignments
  – Written – double check the theory (exam prep)
  – Programming – try things out (before projects)

• Projects
  – Smaller

• Things due on Wednesdays
Software Infrastructure

• Visual Studio (C++ on Windows)
  – Your program must compile and run on machines in 1366/1358

• 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