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?
  • 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, …)

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

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 – it’s all on the web [www.cs.wisc.edu/~cs559-1](http://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**
  - Smaller
- **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