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
- 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
• 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
**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

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**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 (***)

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**Related Fields / Courses**

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

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**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

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**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

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**How will we teach this to you?**

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

• Prof: Mike Gleicher
• 6385 CS
• Office Hours:
  – Tuesday: after class (11:00-11:45)
  – Or by appointment
  – Wednesday 9:30-10:15
• gleicher@cs.wisc.edu

• TA: Yoh Suzuki
  office: 3379 CS
  hours: after class Mon
• TA: Chi Man Liu (CX)
  office: 1301 CS
  hours: Thursdays

• 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

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

• Projects
  – Assignments – are part of projects!
  – Programming – make sure you have mechanics
  – Written – double check on the theory

• Something due every Monday
  – 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++

• Workload

• Extra Credit

• Grading and Late Policies