Computer Graphics
(601.457/657)

Prof. Misha Kazhdan
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Outline

• Introduction
• Syllabus
• Coursework
• Miscellaneous
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above
Introduction: What is CG?

2D image processing

- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above

http://paulbakaus.com/
Introduction: What is CG?

- 2D image processing

3D object representation & manipulation

- Simulating physical processes & materials
- Animating any of the above

“Incredibles 2” Disney / Pixar
Introduction: What is CG?

• 2D image processing
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• Simulating physical processes & materials
• Animating any of the above

Gringold et al. 2004
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials

Animating any of the above (4D)

Team Fortress 2: Meet the Heavy, Valve
Introduction: What is CG?

“You know it when you see it…”

http://www.creativecrash.com/tutorials/
Introduction: What is CG?

“You know it when you see it... maybe.”

http://www.creativecrash.com/tutorials/
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization
- Training & Education
Introduction: Applications

Entertainment

- Computer Aided Design
- Scientific Visualization
- Training & Education

“How to Train Your Dragon 3”
DreamWorks

“Control” Remedy

“Control” Remedy
Introduction: Applications

- Entertainment
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- Training & Education

Completely virtual model built in 3D:
- Shorten the development period
- Shorten the learning curve
Introduction: Applications

- Entertainment
- Computer Aided Design
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- Training & Education

Neutron Star Collision
Courtesy of David Bock

Flow Visualization
Roettger et al.

Aspirin in RasMol
Courtesy of Michael Friendly

The Visible Human
Courtesy of NLM
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization

Training & Education

Image courtesy of Agrawala et al.

Microsoft Flight Simulator
Outline

• Introduction
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Syllabus

- Image Processing (2D)
- Ray Tracing (3D)
- Rendering (3D)
- Modeling (3D)
- Animation (4D)
Syllabus

• Image Processing
  ◦ Quantization and Dithering
  ◦ Sampling
  ◦ Filters
  ◦ Warping, Morphing, and Compositing
Syllabus

• Ray Tracing
  ○ Cameras
  ○ Primitives
  ○ Lights
  ○ Spatial Data Structures
  ○ Reflection, Transparency and Refraction

• Rendering
  ○ Coordinate Systems and Modeling Transformations
  ○ Viewing transformations
  ○ Shading
  ○ Textures
  ○ Visibility
  ○ OpenGL
Syllabus

- **Modeling**
  - Triangles
  - Splines
  - Subdivision Surfaces
  - Procedural Models
  - Point Based Models

- **Animation**
  - Key-Framing
  - Kinematics
  - Dynamics
Outline

• Introduction
• Syllabus
• Coursework
• Miscellaneous
Coursework

• NB: Lots of work!

• Exams (30%)

• Programming assignments (60%)

• Class participation (10%)
Coursework

• NB: Lots of work!

Exams (30%)
  ◦ (Probably) two exams
  ◦ Absolutely no excuses will be accepted for missing the exams. Not taking the exam at the scheduled time = 0!

• Programming assignments (60%)

• Class participation (10%)
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)
  ○ Image Processing (15%)
  ○ Ray Tracing (15%)
  ○ OpenGL Rendering (15%)
  ○ Animation (15%)

• Class participation (10%)
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)
  ○ Knowledge of C/C++ assumed!
  ○ Must be turned in by 23:59 on due date
  ○ 5 late days (combined)
  ○ Notify TA in your readme if you use a late day

• Class participation (10%)
Coursework: Collaboration Policy

• You must write your own code
• You must reference sources of ideas/code

• It’s okay to:
  ◦ Discuss ideas with other students
  ◦ Get ideas from books, web sites, etc.
  ◦ Get “support code” from books, web, etc.
    » REFERENCE IT

• It is not okay to:
  ◦ Share code with other students
  ◦ Copy code from other students
  ◦ Use ideas or code from other sources without attribution
Coursework

- NB: Lots of work!
- Exams (30%)
- Programming assignments (60%)
- Class participation (10%)

Bottom line:
If you don’t **LOVE** programming, don’t take this class!
Coursework

• NB: Lots of work!
• Exams (30%)
• Programming assignments (60%)

Class participation (10%)
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Miscellaneous

• Course web page:
  - http://www.cs.jhu.edu/~misha/Fall21

• Piazza page:
  - http://piazza.com/jhu/fall2021/600457657
    » I will not look at posts unless explicitly notified!
  - No required text book.
  - Additional reading:
    » Computer Graphics: Principles and Practice in C
      Foley, van Dam, Feiner, and Hughes
    » Computer Graphics, C Version
      Hearn and Baker
      Neider, Davis, and Woo
    » Fundamentals of Computer Graphics
      Shirley

• Will not cover GPU programming (e.g. shaders)
Miscellaneous

• Office hours:
  » Misha’s (Professor): TBA
  » Tommy’s (TA): TBA
  » Aaron’s (CA): TBA
  » …

• Keeping in touch:
  ◦ Email: cs457@cs.jhu.edu
  ◦ Note:
    » Do not send code snippets.
    » Do not ask us if your implementation is correct.
Assignment 1:

- Image Processing
- Due September 25 @ 11:59 pm
- Even if you won't start working on the code until later, download it and try compiling ASAP to make sure that things are correctly set up on your system.