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

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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

- 3D object representation & manipulation

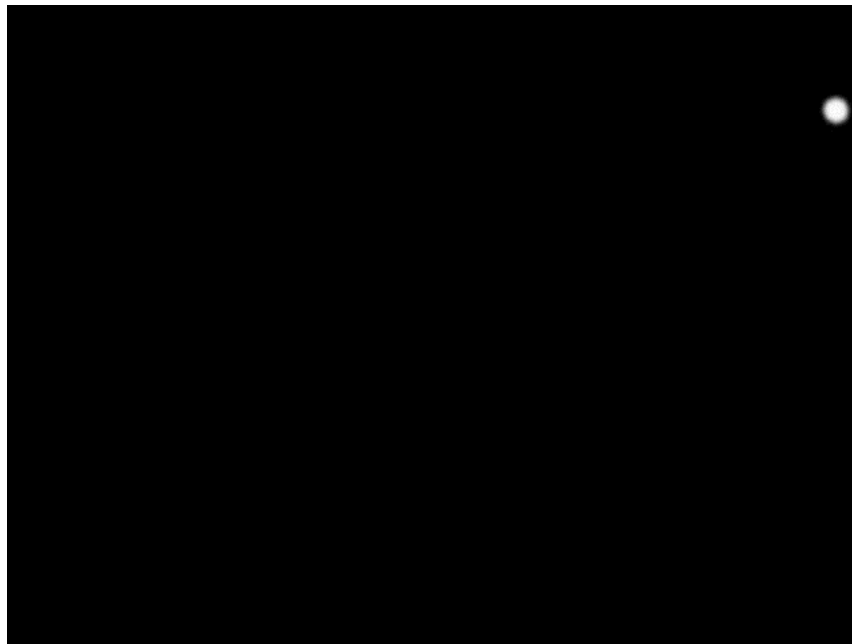→ Simulating physical processes & materials

- 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)

Fallen Art

Introduction: Applications

- Entertainment

- Computer Aided Design

- Scientific Visualization

- Training & Education

Introduction: Applications

➡️ Entertainment

- Computer Aided Design

- Scientific Visualization

- Training & Education

"The Wild Robot"
DreamWorks

"Donkey Kong" Nintendo
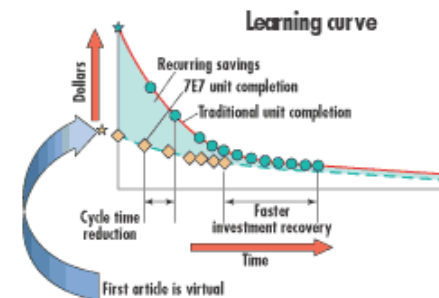
Introduction: Applications

- Entertainment

→ Computer Aided Design

- Scientific Visualization

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Completely virtual model built in 3D:

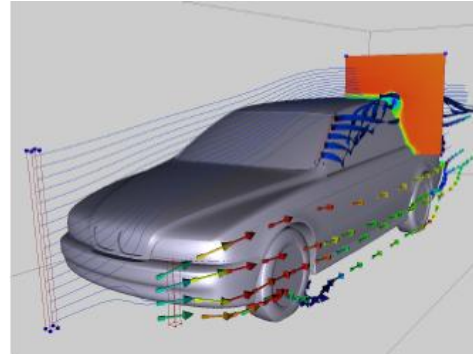· Shorten the development period

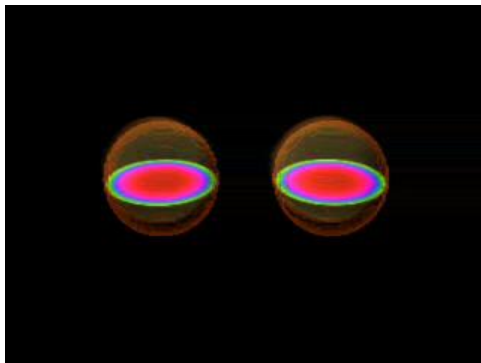· Shorten the learning curve

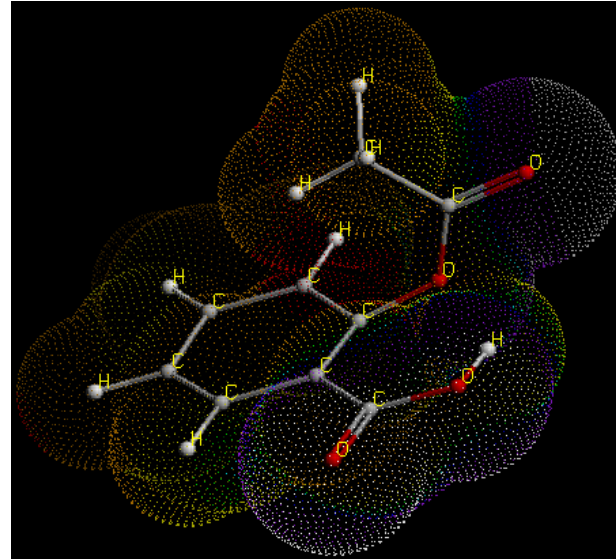Boeing 7E7

Introduction: Applications

- Entertainment

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➡ Scientific Visualization

- Training & Education

Flow Visualization
Roettger et al.

Right Side

Neutron Star Collision
Courtesy of David Bock

Aspirin in RasMol
Courtesy of Michael Friendly

The Visible Human
Courtesy of NLM

Introduction: Applications

- Entertainment

- Computer Aided Design

- Scientific Visualization

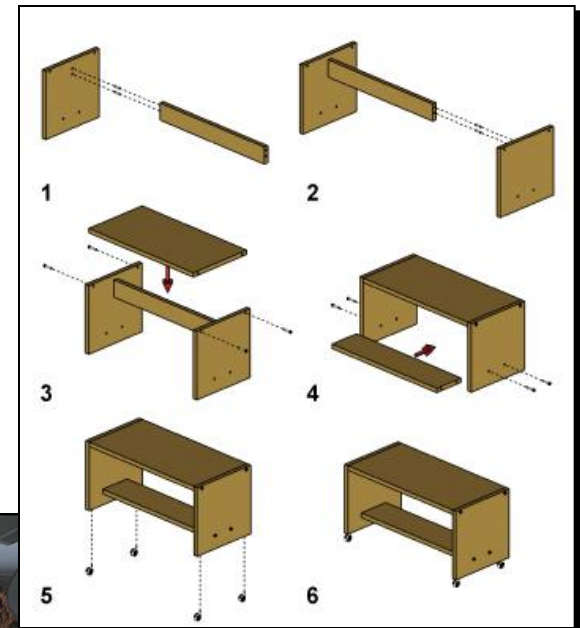➡ Training & Education

Image courtesy of
Agrawala et al.

Microsoft Flight Simulator

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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

- (Offline) Ray Tracing
  - Cameras
  - Primitives
  - Lights
  - Spatial Data Structures
  - Reflection, Transparency and Refraction

- (Real-Time) 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

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- **Coursework**

- Miscellaneous

Coursework

- NB: Lots of work!

- Exams (30%)

- Programming assignments (60%)

- Class participation (10%)

- Labs (Required)

Coursework

- NB: Lots of work!

- Exams (30%)
  - 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%)

- Labs (Required)

Coursework

- NB: Lots of work!

- Exams (30%)

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

- Class participation (10%)

- Labs (Required)

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 **combined** late days
  - Notify TA in your write-up if you use a late day

- Class participation (10%)

- Labs (Required)

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.
    - » **<u>REFERENCE IT</u>**

- It is not okay to:
  - Share code with other students
  - Copy code from other students
  - Use ideas/code from other sources without attribution

Coursework

- NB: Lots of work!

- Exams (30%)

→ Programming assignments (60%)

- Class participation (10%)

- Labs (Required)

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%)

- Labs (Required)

Coursework

- NB: Lots of work!

- Exams (30%)

- Programming assignments (60%)

- Class participation (10%)

➡ Labs (Required)
  - We will have in-class labs to discuss the current assignment/code.
  - Attendance is **mandatory**

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Miscellaneous

- http://www.cs.jhu.edu/~misha/Fall25
  - Your source for notes, assignments, videos, etc.:
  - No required text book.

- Piazza page:
  - https://piazza.com/jhu/fall2025/601457657
    - » I will not look at posts unless explicitly notified!

- Will <u>not</u> cover GPU programming (e.g. shaders)

Miscellaneous

- Office hours:
    - » Misha's (Professor): Wednesdays 12-1 @ Malone 229
    - » Hongyi (TA): TBD
    - » CAs: TBD

- Keeping in touch:
    - ○ Email: Piazza / misha@cs.jhu.edu
    - ○ Note:
        - » Do not send code snippets.
        - » Do not ask us if your implementation is correct.

Miscellaneous

Assignment 1:

- Image Processing
- Due September 21st @ 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.