



Computer Graphics

(601.457/657)

Prof. Misha Kazhdan

misha@cs.jhu.edu



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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 - Animating any of the above



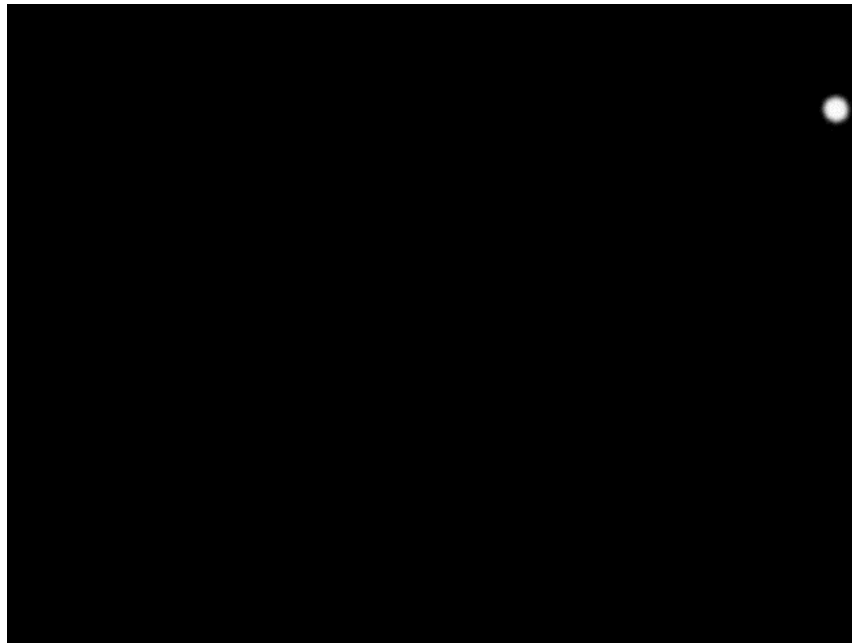
Gringold *et al.* 2004



Introduction: What is CG?

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

 Animating any of the above (4D)



Fallen Art

Introduction: What is CG?



“You know it when you see it...”

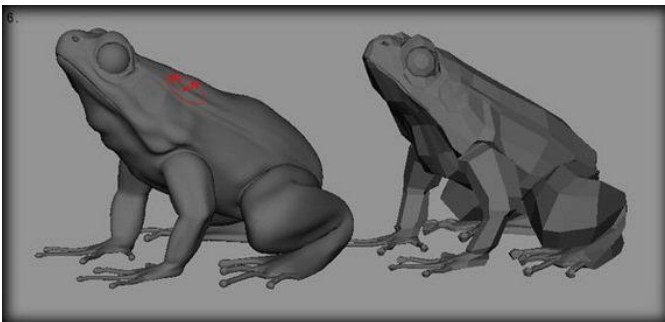
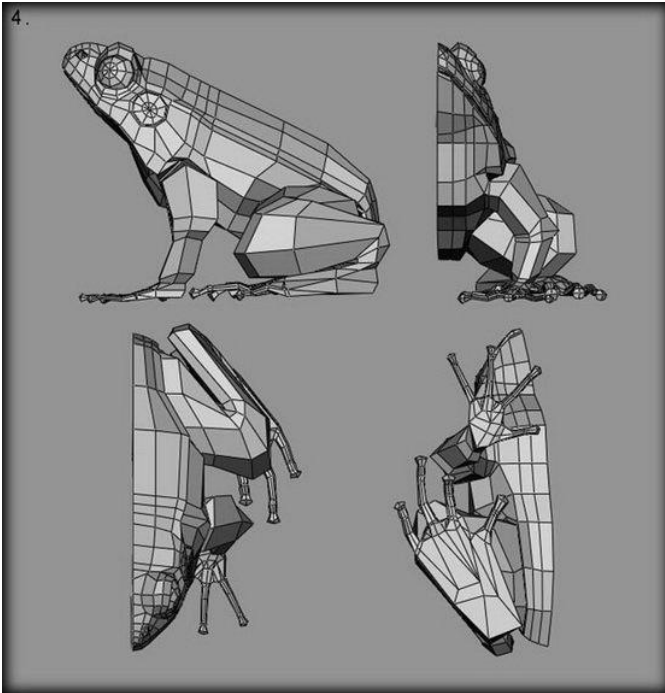


<http://www.creativecrash.com/tutorials/>



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



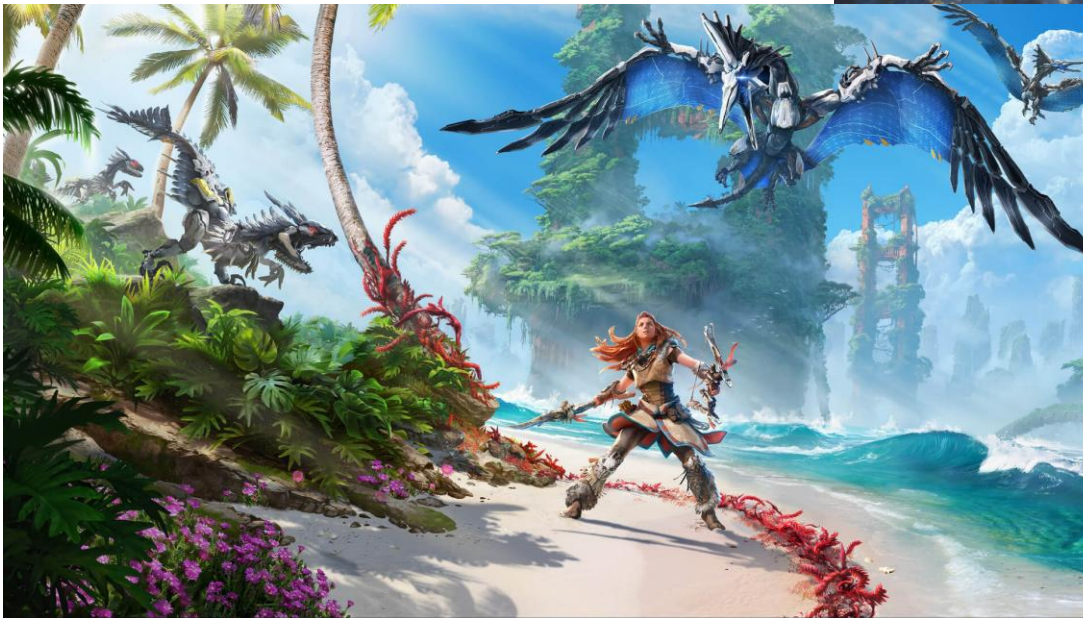
Introduction: Applications

➔ Entertainment

- Computer Aided Design
- Scientific Visualization
- Training & Education



"The Wild Robot"
DreamWorks



"Horizon: Forbidden West" Sony



Introduction: Applications

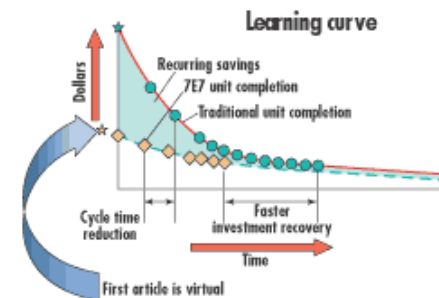
- Entertainment

Computer Aided Design

- Scientific Visualization
- Training & Education

Completely virtual model built in 3D:

- Shorten the development period
- Shorten the learning curve

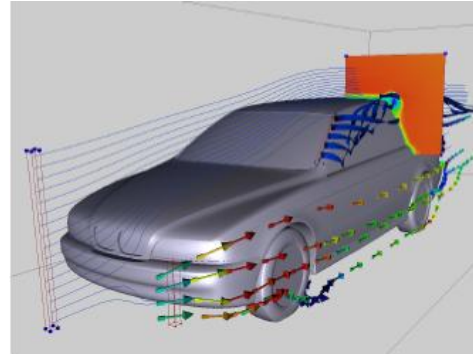


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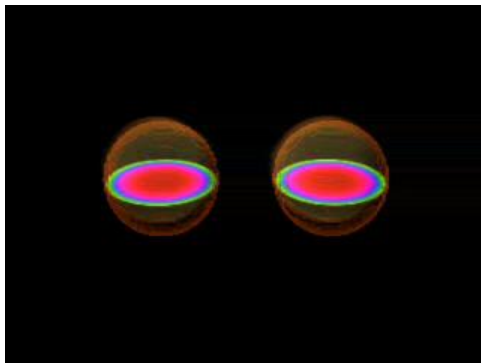


Introduction: Applications

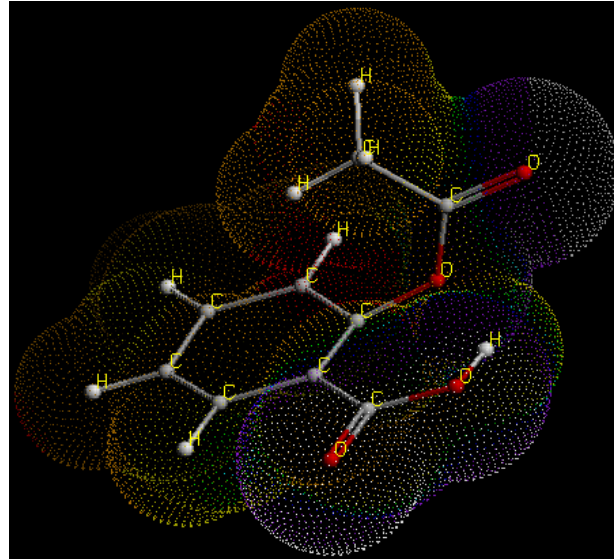
- Entertainment
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Flow Visualization
Roettger et al.



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

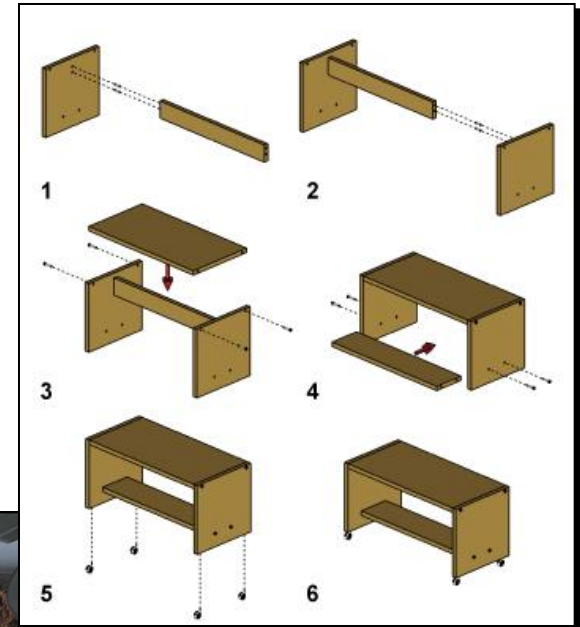


Image courtesy of
Agrawala et al.



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



- 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



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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 late days (combined)
- 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.
» **REFERENCE IT**
- 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)

- (Roughly every other week 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/Spring25>
 - Your source for notes, assignments, videos, etc.:
 - 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
 - » *OpenGL Programming Guide: The Official Guide to Learning OpenGL* Neider, Davis, and Woo
 - » *Fundamentals of Computer Graphics* Shirley
- Piazza page:
 - <https://piazza.com/jhu/spring2025/601457657>
 - » I will not look at posts unless explicitly notified!
- Will not cover GPU programming (e.g. shaders)



Miscellaneous

- Office hours:
 - » Misha's (Professor): Wednesdays 12-1 @ Malone 229
 - » Hongyi (TA): Wednesdays 3-5 @ Malone 216
 - » CAs: TBD
- Keeping in touch:
 - Email: 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 February 15th @ 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.