CS 4810
Introduction to
Computer Graphics

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University of Virginia

Acknowledgement: slides by Jason Lawrence, Misha Kazhdan, Allison Klein, Tom Funkhouser, Adam Finkelstein and David Dobkin

Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above

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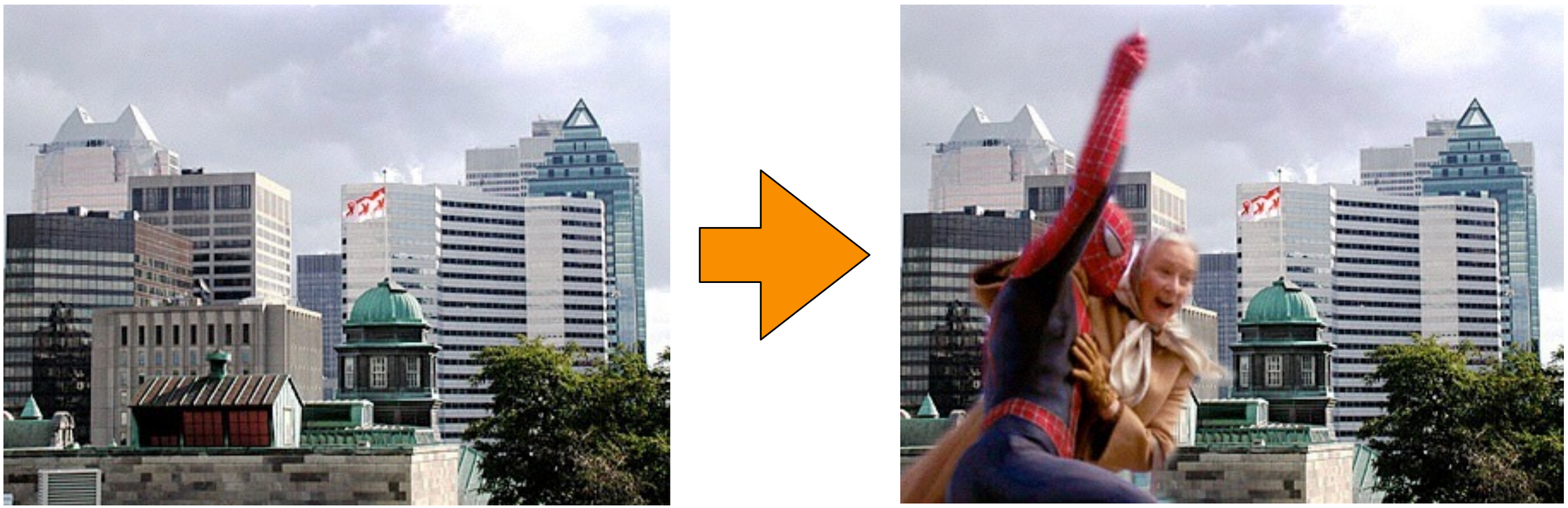

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“Ratatouille” Pixar/Disney

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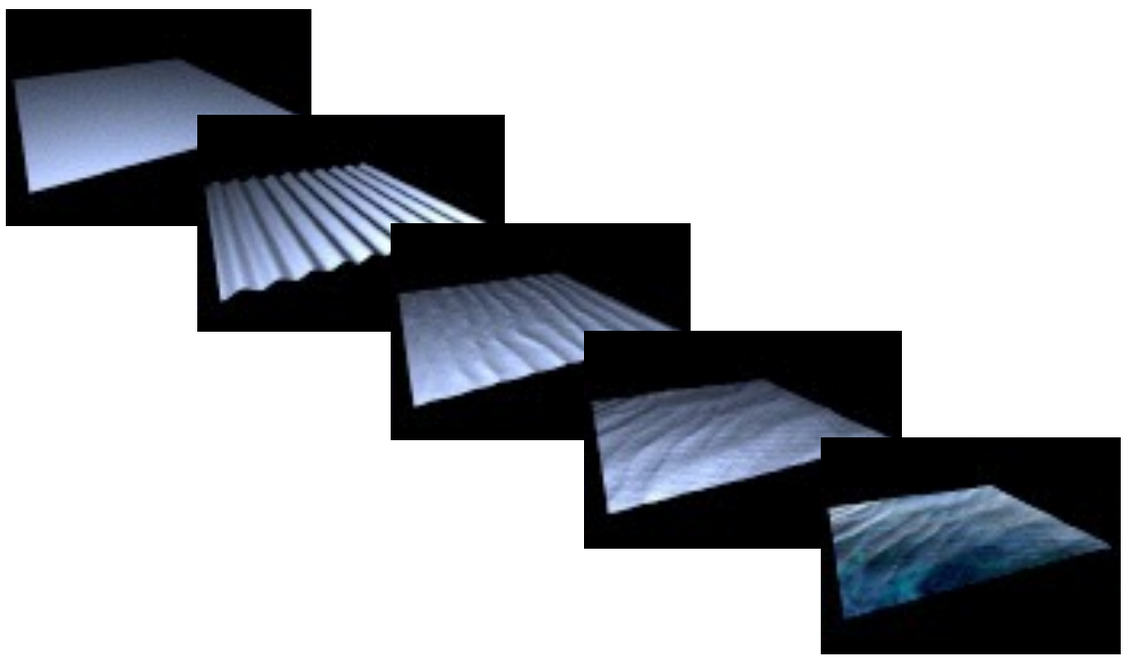

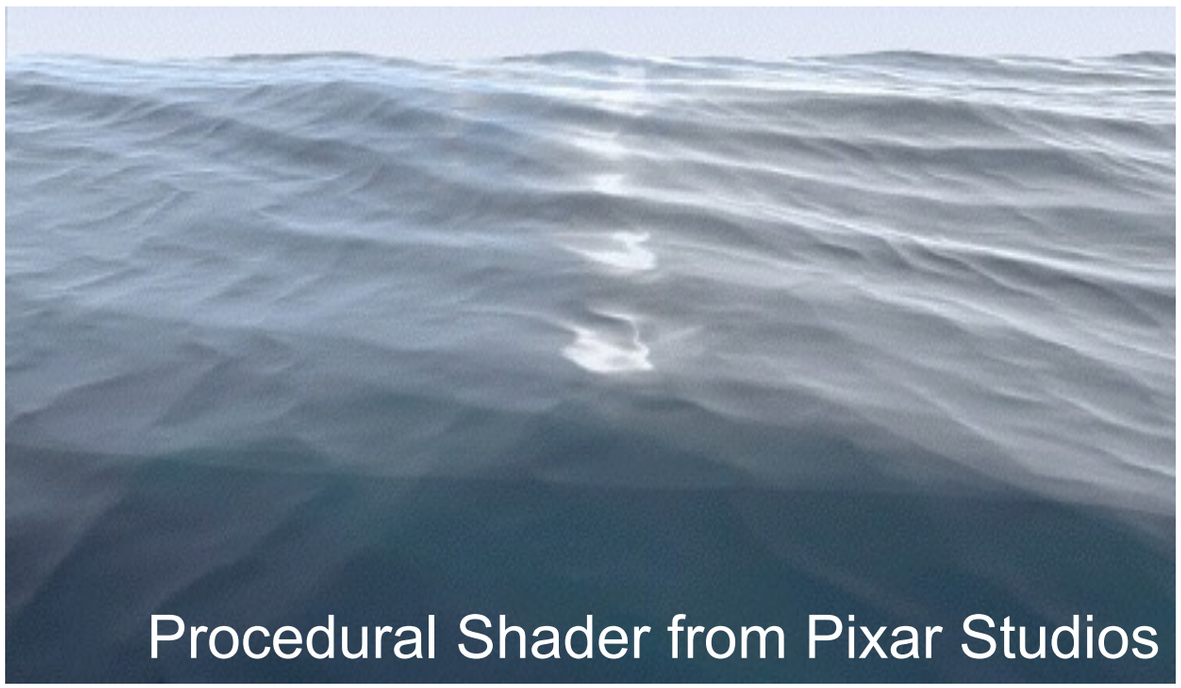

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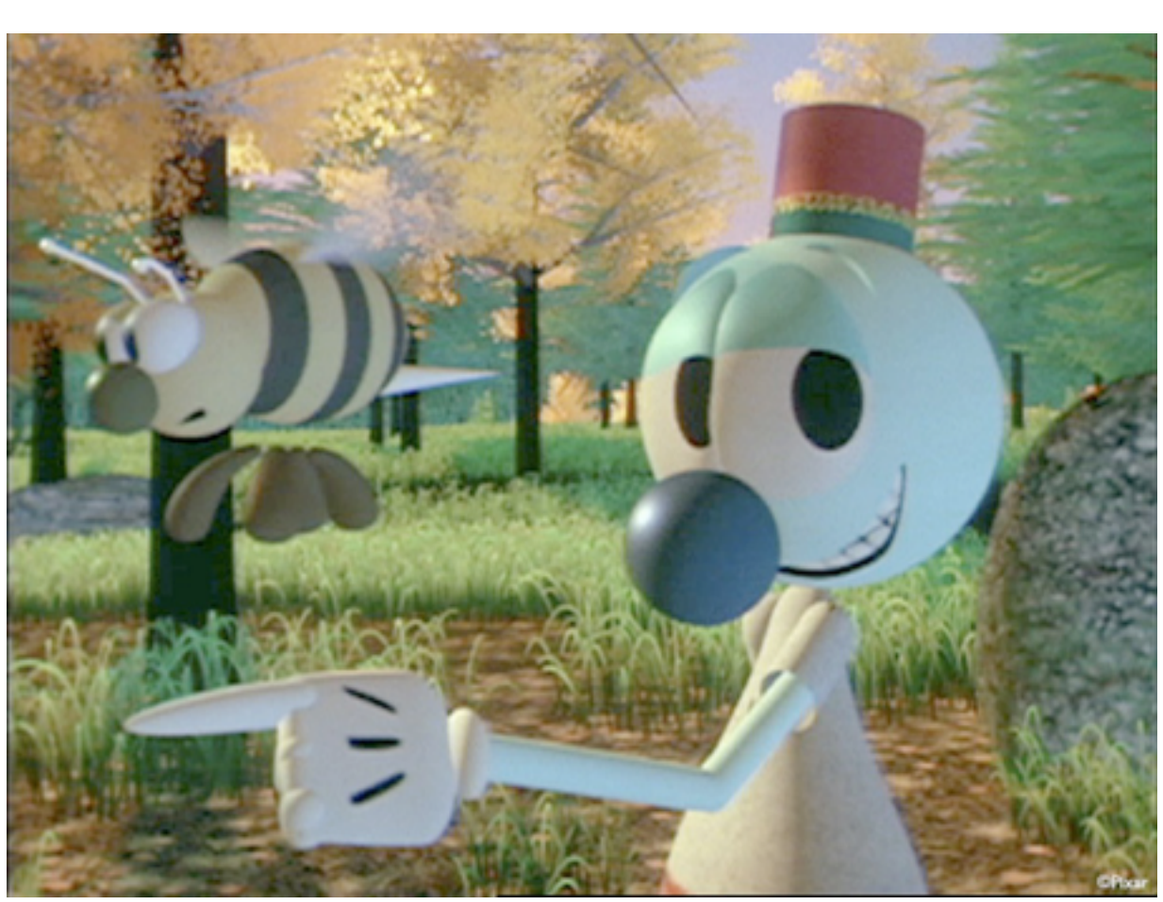
- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- **Animating any of the above (4D)**



Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization
- Training & Education
- Commerce
- Art

Introduction: Applications

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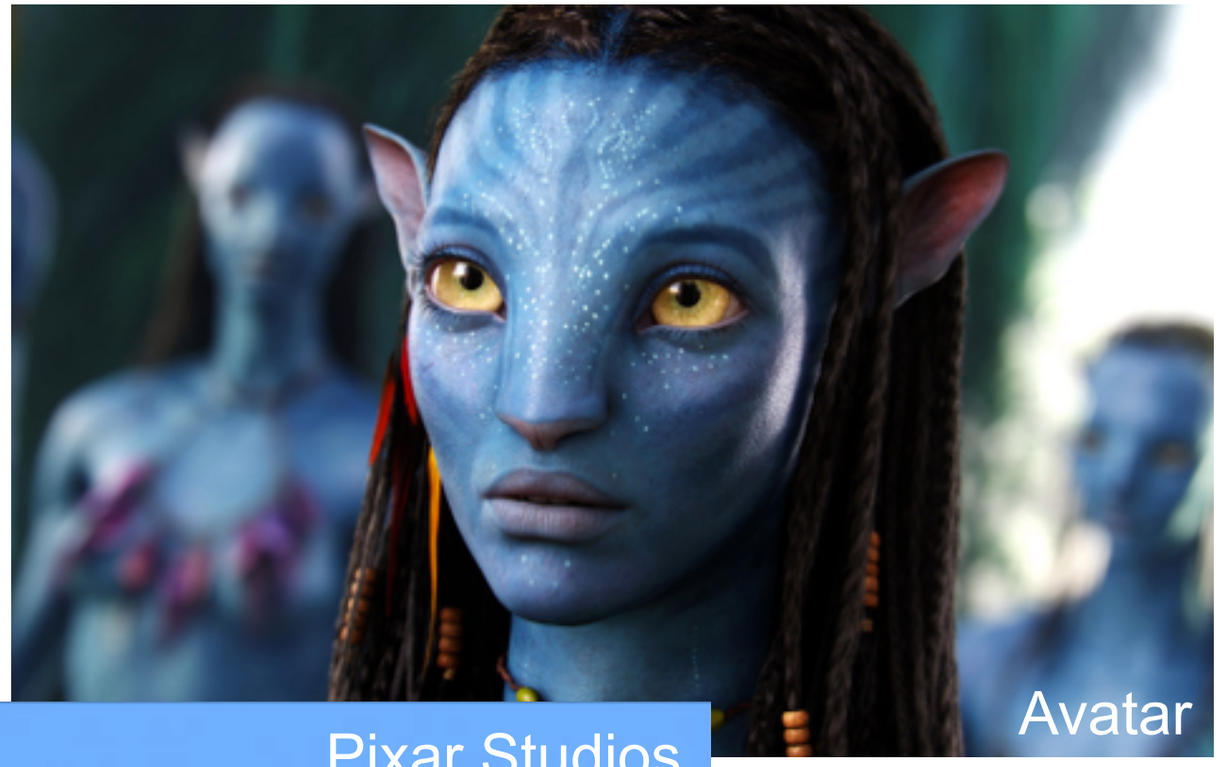

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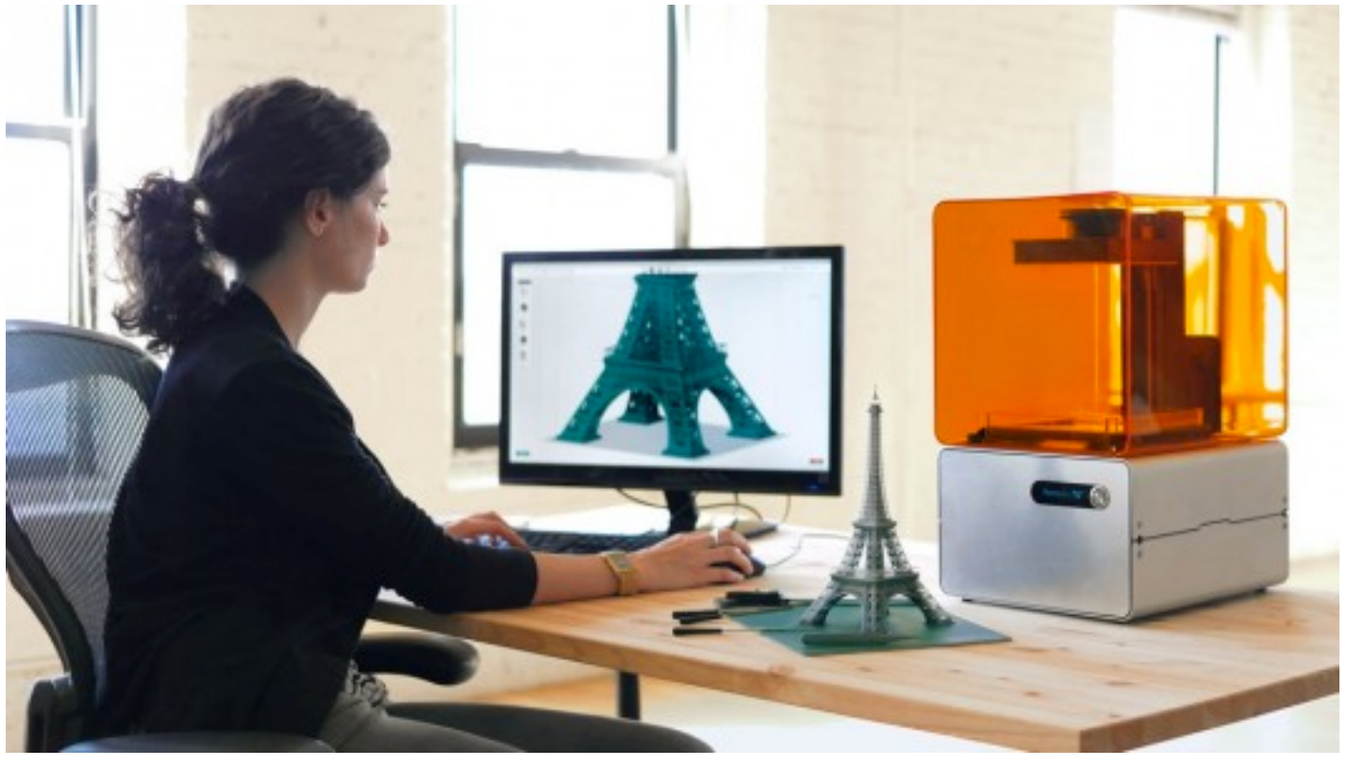

Shorten the development period
Shorten the learning curve

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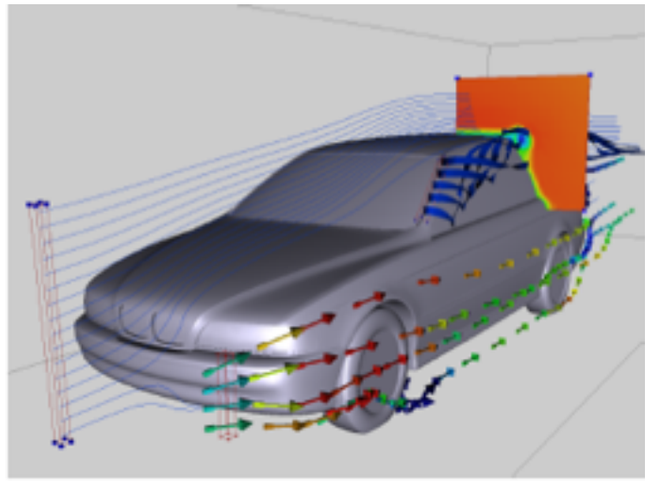
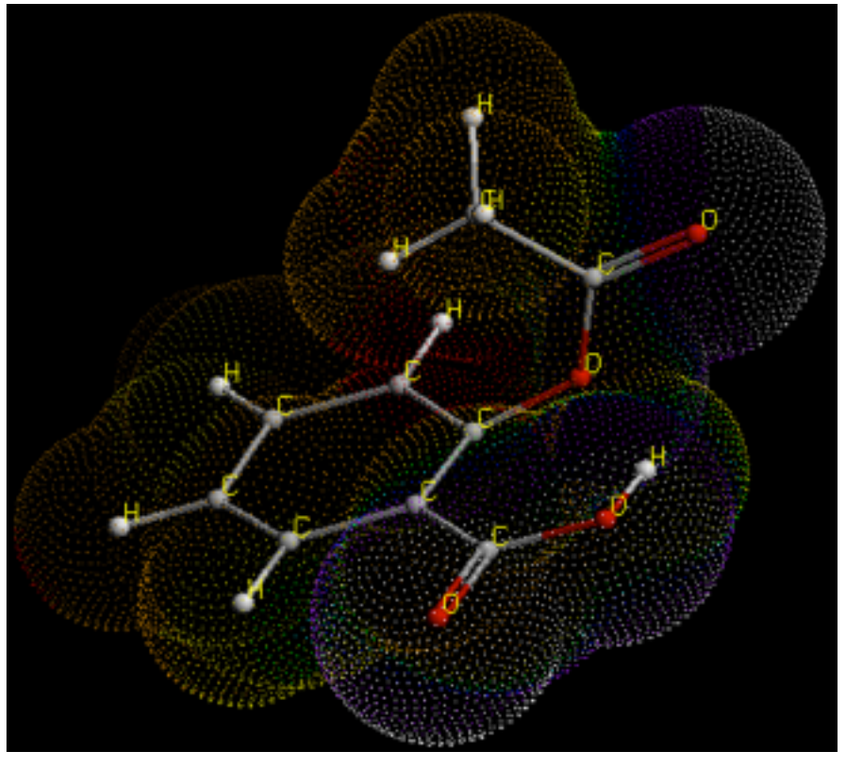


Flow Visualization Roettger et al.



Aspirin in RasMol
Courtesy of Michael Friendly

The Visible Human
Courtesy of NLM

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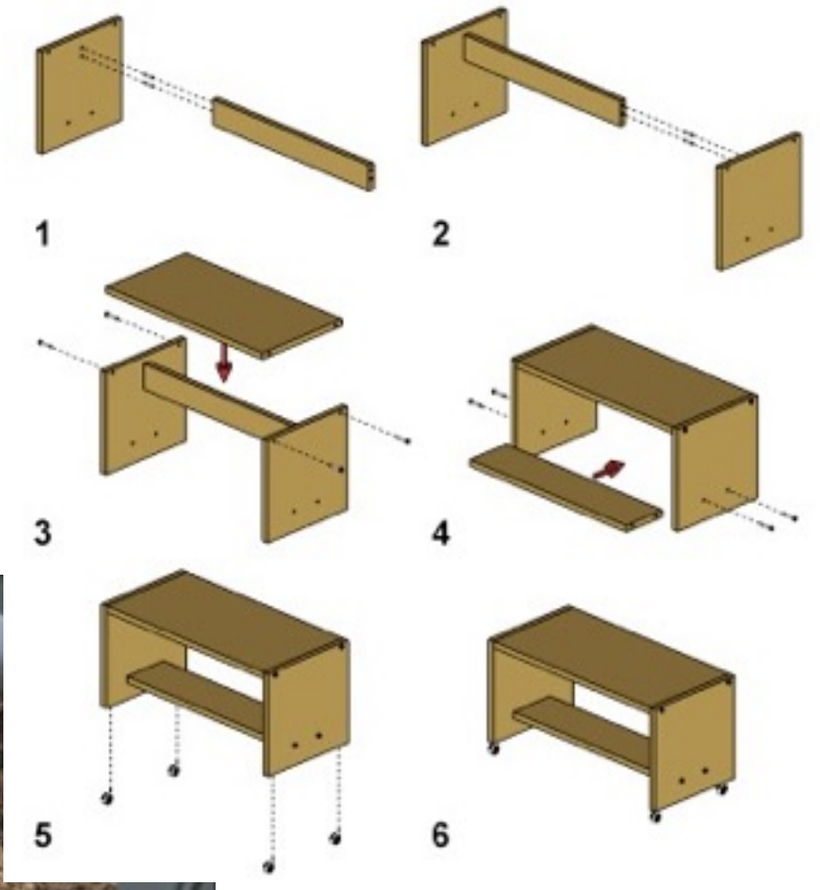

Image courtesy of Agrawala et al.

Microsoft Flight Simulator

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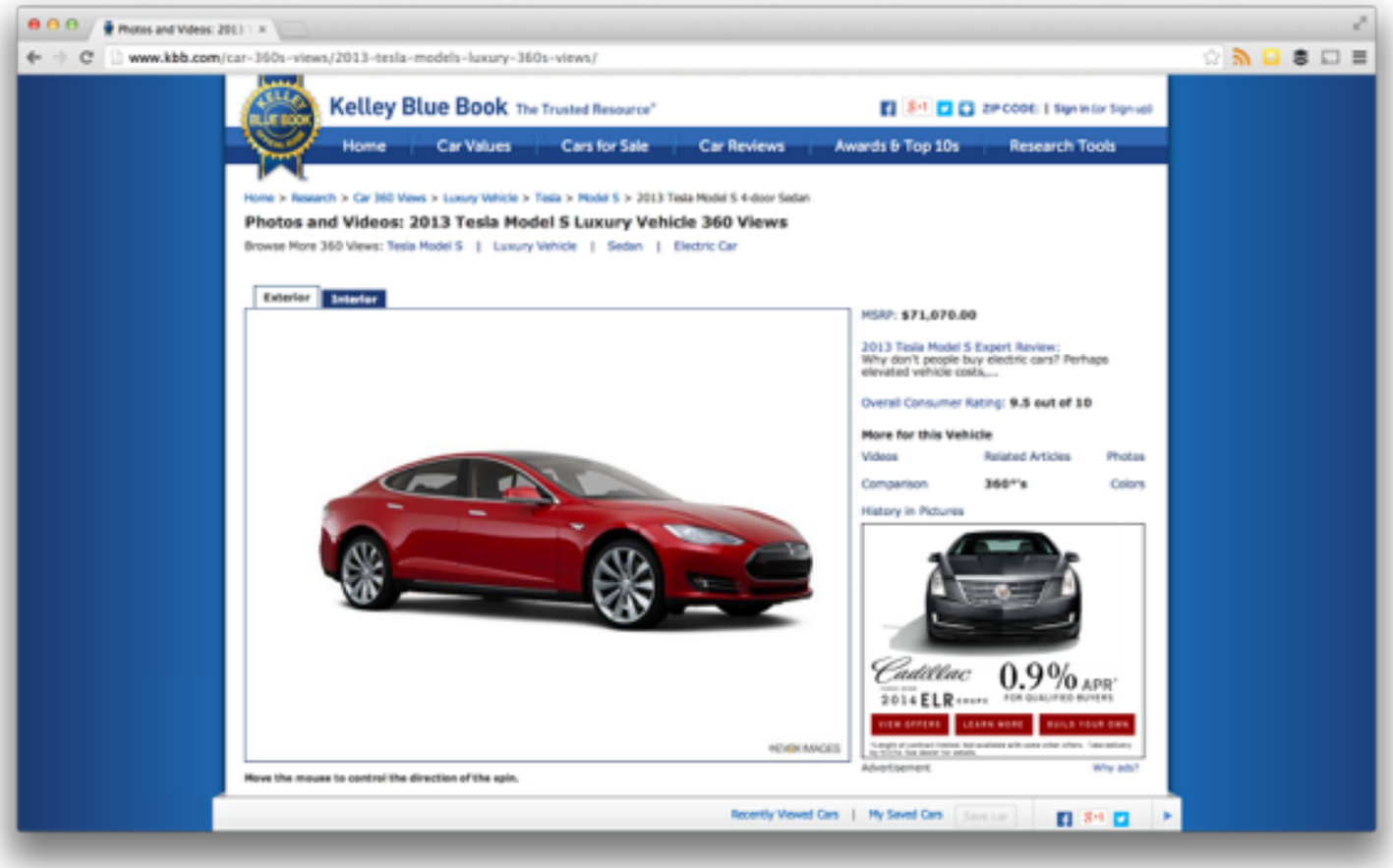

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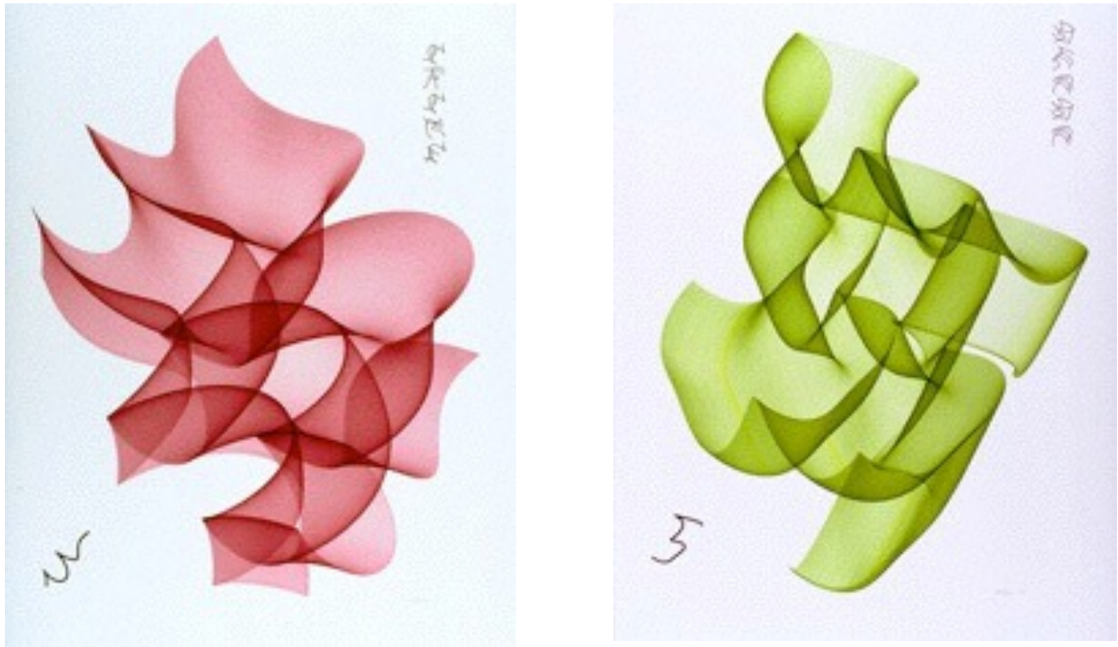

“Cyberflower Duet” by Roman Verostko

“Conflagration” by Diane Vetere

Introduction: More Videos!

https://www.youtube.com/watch?v=XrYkEhs2FdA

https://www.youtube.com/watch?v=KF_a1c7zytw&feature=youtu.be

https://vimeo.com/94220982

https://www.youtube.com/watch?v=dgKjs8ZjQNg

Outline

- Introduction
- **Syllabus**
- Coursework
- Miscellaneous

Syllabus

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

Syllabus

- Image Processing
  - Human Vision
  - Color Models
  - Quantization and Dithering
  - Sampling
  - Filters
- Warping, Morphing, and Compositing

Syllabus

- Ray Tracing
  - Cameras
  - Primitives
  - Lights
  - Intersection Acceleration Data Structures
  - Reflection, Transparency and Refraction
- Scanline Rendering
  - Coordinate Systems and Modeling Transformations
  - Viewing transformations
  - Shading
  - Textures
  - Visibility
  - OpenGL

Syllabus

- Modeling
  - Triangles
  - Splines
  - Subdivision Surfaces
- Animation
  - Key-Framing
  - Kinematics
  - Dynamics

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- Miscellaneous

Coursework

- LOTS of work!
- Exams (30%)
- Programming assignments (60%)
- Class participation (10%)

Coursework

- LOTS of work!
- Exams (30%)
  - Two in-class midterms (no final)
  - 3/3 and 4/28
- Programming assignments (60%)
- Class participation (10%)

Coursework

- LOTS of work!
- Exams (30%)
- Programming assignments (60%)
  - Image Processing (20%)
  - Ray Tracing (20%)
  - OpenGL Rendering (20%)
- Class participation (10%)

Coursework

- LOTS of work!
- Exams (30%)
- Programming assignments (60%)
  - Knowledge of C/C++ assumed
  - Must be turned in by 11:55PM on due date
  - 5 (discrete) late days
- 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.
    - But 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 and first receiving permission from me

Coursework

- LOTS of work!
- Exams (30%)
- **Programming assignments (60%)**
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Bottom line:
Expect to do a LOT of programming in this class!

Coursework

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

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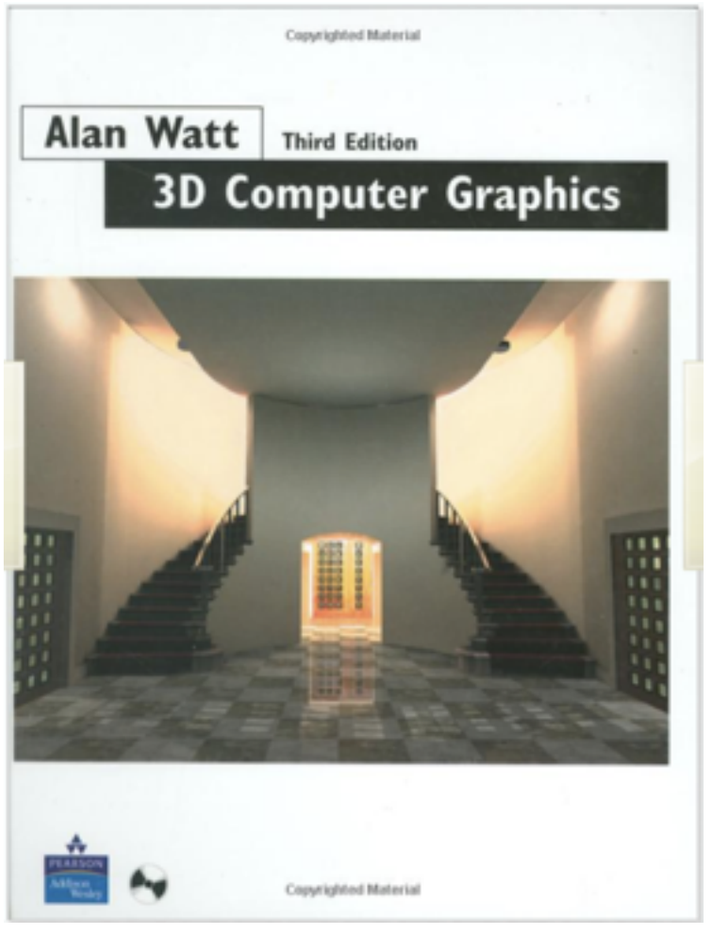
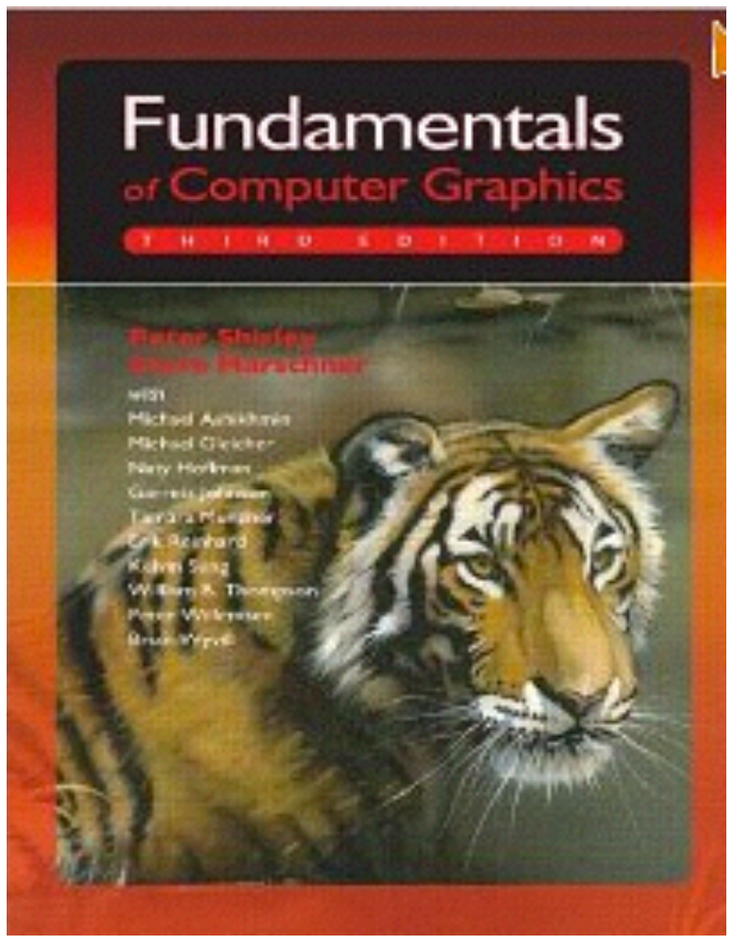
Resources

- Course web page:
  - http://www.cs.virginia.edu/~connelly/class/2015/intro_gfx
- Suggested text books (on reserve at Brown):





Miscellaneous

- UVA Collab:
  - http://collab.itc.virginia.edu
  - We will use collab for submitting work, managing grades, and posting announcements
  - Setup your workspace and find this course NOW!

Discussion

- Where have you seen computer graphics recently? (Any links that we could check out in class today).
- Are there any topics in particular that you would like to learn about in this class?

Examples of Graphics Research

- http://grail.cs.washington.edu/rome/
- http://graphics.cs.cmu.edu/projects/scene-completion/
- http://people.csail.mit.edu/yichangshih/portrait_web/
- http://camouflage.csail.mit.edu/
- http://halide-lang.org/
- https://www.youtube.com/watch?v=FKXOucXB4a8
- http://web.engr.illinois.edu/~dhoiem/projects/popup/index.html