CPSC 314 Computer Graphics

Sept – Dec 2018
Michiel van de Panne

3D in-browser graphics using WebGL

[http://www.cgsociety.org/index.php/cgsfeatures/cgsfeaturespecial/building_3d_with_ikea]

People

- Instructor: *Michiel van de Panne*
  Office hours: Wed 3:30-4:30, ICCS x865
- TAs: *Wu Fan, Zhaoming Xie, Jinfan Yang, Yuan Yao*
- guest lectures
- you!
  - "mathematical maturity": linear algebra
  - "CS maturity": programming experience

Course Communication

- Lectures: MWF 10-11am Dempster 110
- Labs: ICCS 005
  - labs begin next week
  - attendance recommended; face-to-face grading
- Website: http://www.ugrad.cs.ubc.ca/~cs314
  - lectures, assignments, other…
- Discussions & announcements: Piazza
- Grades: handback
- Textbook: none required

Grading

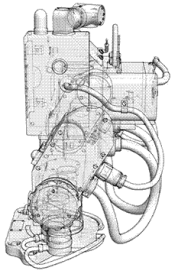
- Assignments (42%) ~6 assmts; theory + coding
- Midterms (2 x 11%)
- Participation (8%)
- Exam (28%)

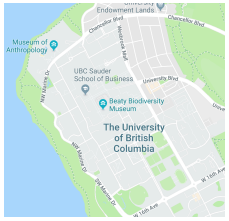
- You have 3 late days for use during the term.
  Most assignments will have face-to-face grading.

What is Computer Graphics?

- CG or real? https://area.autodesk.com/fakeorfoto/
- Non-photorealistic rendering

http://www.cebas.com/images/target_finder.gif





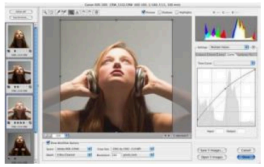
Google maps

What is Computer Graphics?

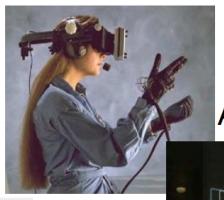
- *The Study of Algorithms and Systems for Generating Images with Computers*
- Includes the study of:

Representation

Manipulation



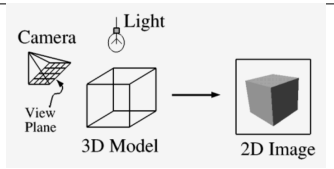
Interaction



Applications

[source: Pai]

What is Computer Graphics?

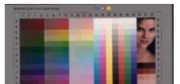


- **Imaging:** representing 2D images
- **Modeling:** representing 3D objects
- **Rendering:** producing 2D images from 3D models
- **Animation:** simulating changes over time
- **Interaction:** interfaces for immersive applications

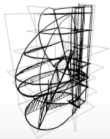
[source: Pai]

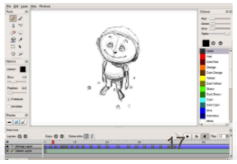
Imaging

- 2D imaging
  - Digital imaging/filtering
  - Color transformations
  - Display technology
  - Compositing and layering
- 2D drawing
  - Sketching, illustration
  - User interface

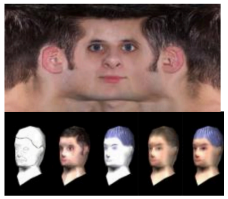
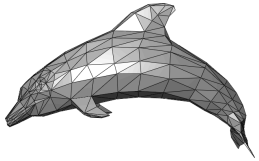






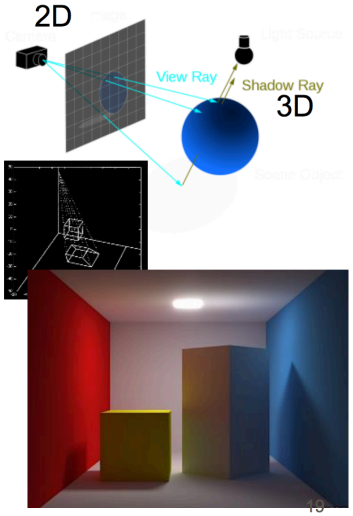
Modeling

- 3D modeling
  - Scanning 3D shapes
  - 2D texture mapping
  - Polygons, curved surfaces
  - Procedural modeling
- More in CPSC 424

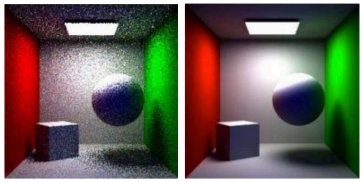


Virtual 3D character



Rendering

- 3D rendering
  - 2D views of 3D geometry
  - Projection and perspective
  - Removing hidden surfaces
  - Lighting simulation



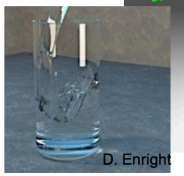
Tracing ray transport

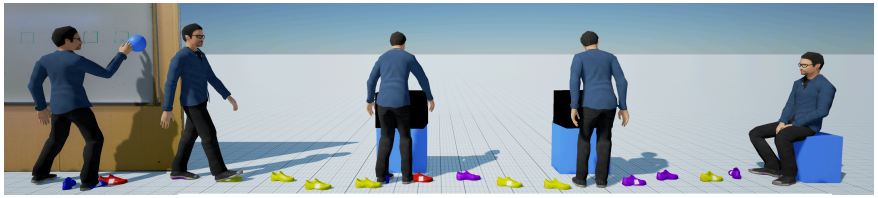

4 rays per pixel

1024 rays per pixel

Animation

- Animation
  - Physical simulation
  - Key-frame animation
- More in CPSC 426 + grad courses

Water




Interaction

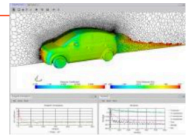
- Virtual Reality / Augmented Reality
- User Interaction
  - 2D graphical user interfaces
  - 3D modeling interfaces

Applications of Computer Graphics


Movies


Games

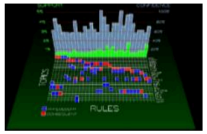

Computer-Aided Design

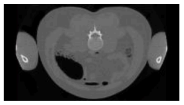

Computer-Aided Analysis


Cultural Heritage


User Interface

Simulation Training


Information Visualization


Medical Imaging

Other Topics

- colour perception
- computational photography
- computational design & fabrication
- reinforcement learning for “smart” characters
- sound simulation
- drone cinematography
- crowd simulation
- …

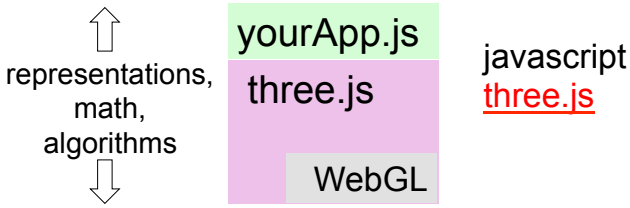
Applications, APIs, and Theory

- focus is on theory + some API knowledge
- many tools and APIs exist (not covered):

MAYA
unity
OpenGL
blender
WebGL
PIXAR RenderMan
UNREAL ENGINE
Microsoft DirectX
AUTOCAD
three.js
Vulkan

WebGL

- runs in your browser! (= OpenGL ES)
- this is a graphics course that uses WebGL
  - **not** a course about WebGL



Next class

- Math review
- Homework
  - Piazza account
  - play with three.js examples
- Questions ??