



# CPSC 314 Computer Graphics

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January – April 2018  
Michiel van de Panne



3D in-browser graphics  
using WebGL



[[http://www.cgsociety.org/index.php/cgsfeatures/cgsfeaturespecial/building\\_3d\\_with\\_ikea](http://www.cgsociety.org/index.php/cgsfeatures/cgsfeaturespecial/building_3d_with_ikea)]

# People

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- Instructor: *Michiel van de Panne*  
Office hours: to be determined, ICCS x865
- TAs: *Farzad Abdolhosseneni, Silver Burla, Fan Wu, Zhaoming Xie, Lotus Zhang, Cindy Zhang*
- guest lectures
- you!
  - “mathematical maturity”: linear algebra
  - “CS maturity”: programming experience

# Course Communication

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- Lectures: MWF 10-11am Dempster 310
- 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: Canvas
- Textbook: none required

# Grading

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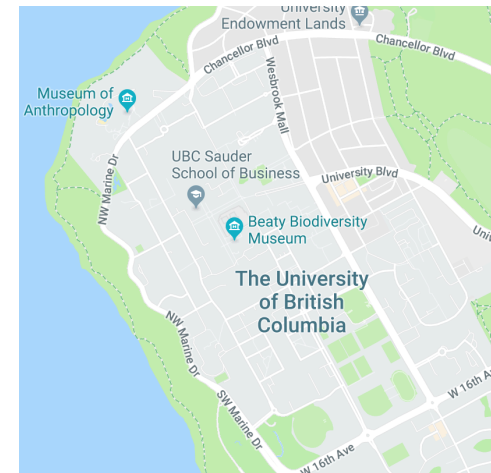
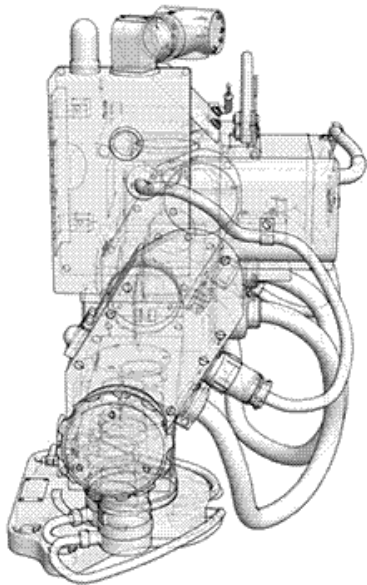
- Assignments (42%)      theory + coding
  - Midterms (2 x 12%)
  - Participation (8%)
  - Exam (26%)
- 
- You have 3 late days for use during the term.  
Most assignments will have face-to-face grading.

# What is Computer Graphics?

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- CG or real? <https://area.autodesk.com/fakeorfoto/>
- Lion <http://zivadynamics.com/lion-project>
- Non-photorealistic rendering

[http://www.cebas.com/images/target\\_finder.gif](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



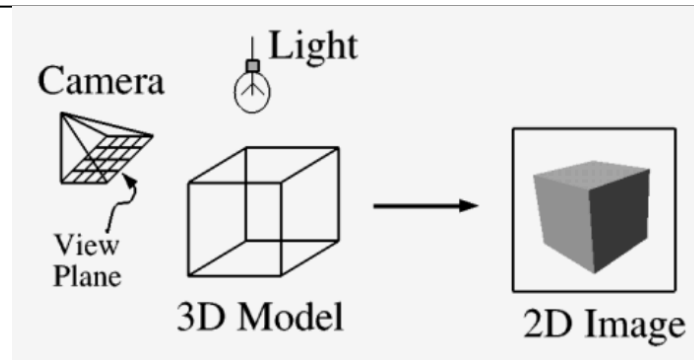
Applications



[source: Pai]

# What is Computer Graphics?

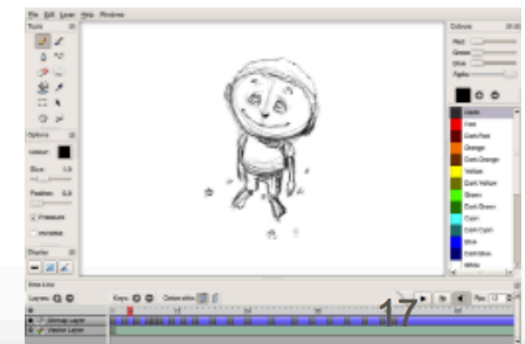
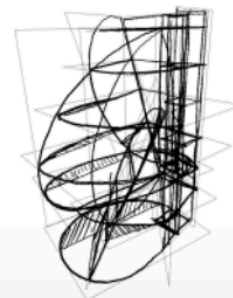
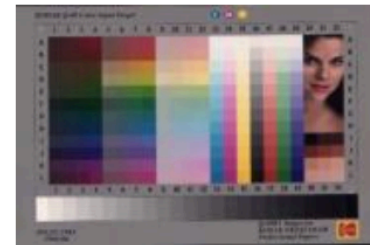
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- **Imaging:** representing 2D images
- **Modeling:** representing 3D objects
- **Rendering:** producing 2D images from 3D models
- **Animation:** simulating changes over time
- **Interaction:** interfaces for immersive applications

# Imaging

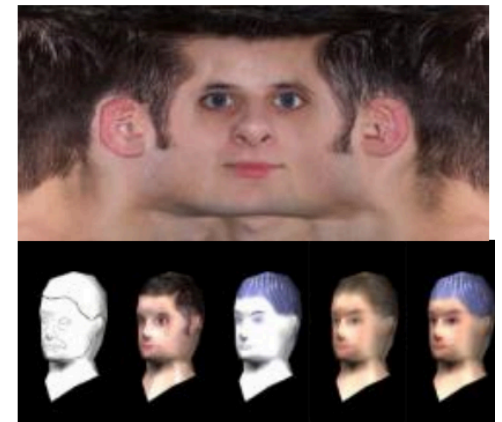
- 2D imaging
  - Digital imaging/filtering
  - Color transformations
  - Display technology
  - Compositing and layering
- 2D drawing
  - Sketching, illustration
  - User interface



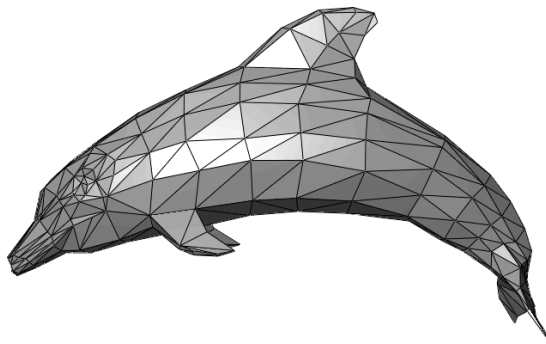


# Modeling

- 3D modeling
  - Scanning 3D shapes
  - 2D texture mapping
  - Polygons, curved surfaces
  - Procedural modeling



Virtual 3D character

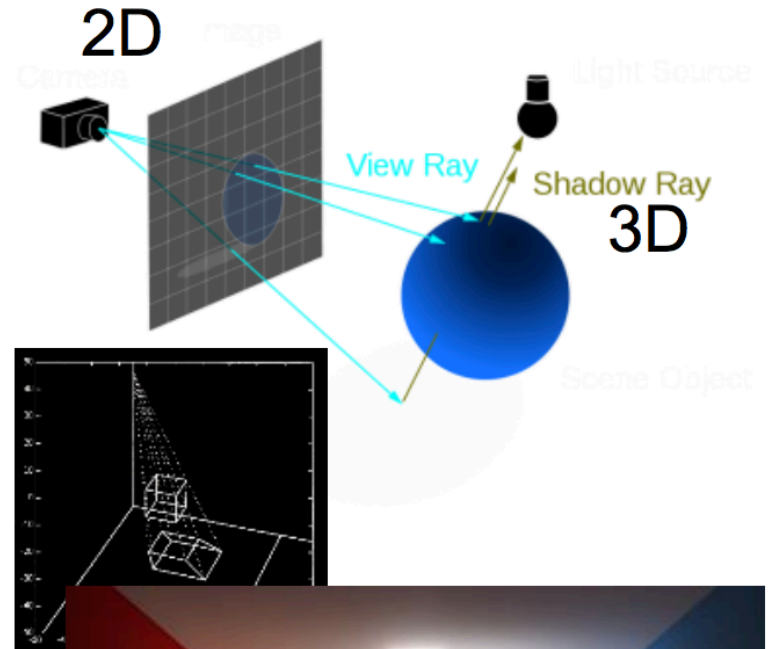


- More in CPSC 424

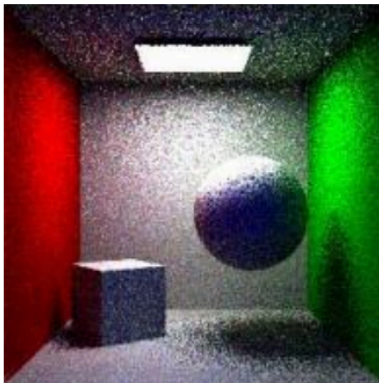


# Rendering

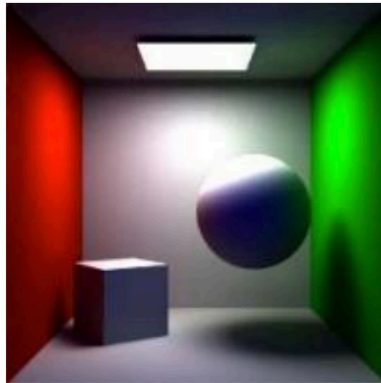
- 3D rendering
  - 2D views of 3D geometry
  - Projection and perspective
  - Removing hidden surfaces
  - Lighting simulation



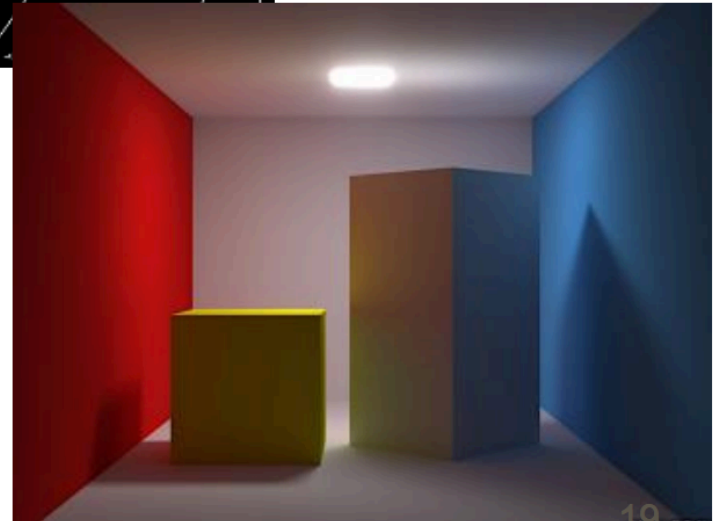
Tracing  
ray  
transport



4 rays per pixel

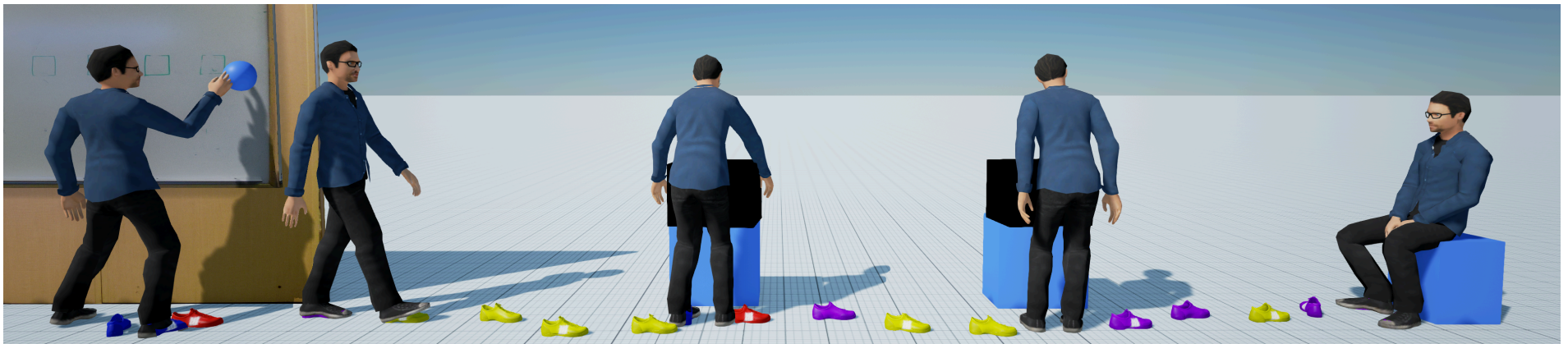
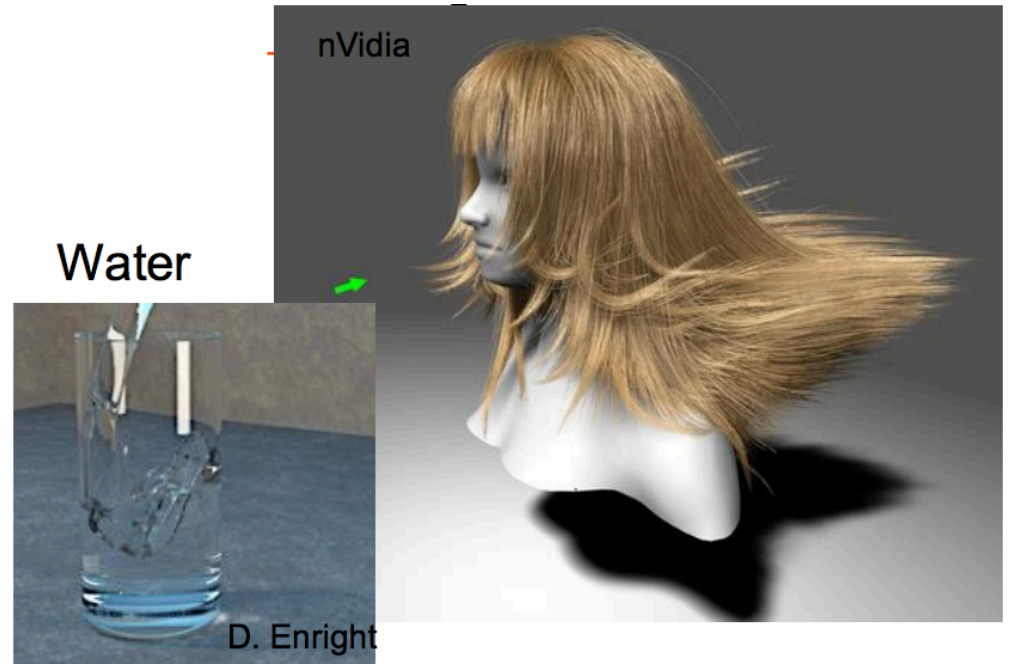


1024 rays per pixel



# Animation

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



# Interaction

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



# Applications of Computer Graphics



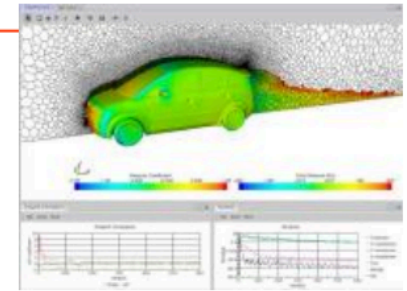
Movies



Games



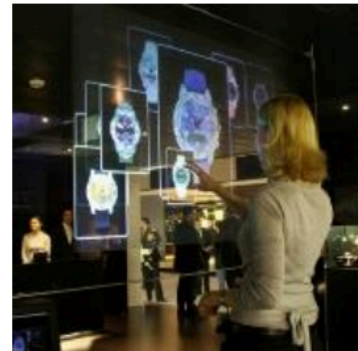
Computer-Aided Design



Computer-Aided Analysis

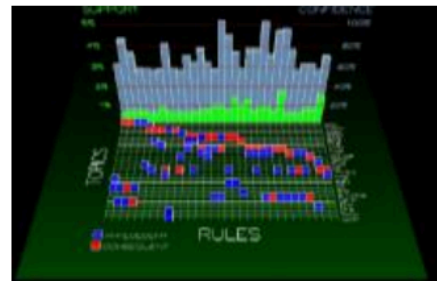


Cultural Heritage



User Interface

Simulation Training



Information Visualization



Medical Imaging

# Other Topics

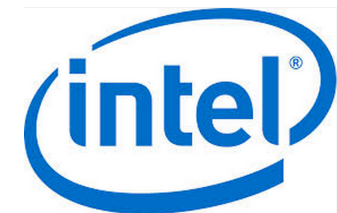
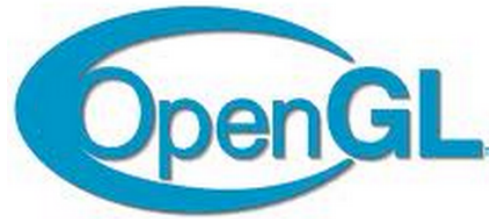
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- colour perception
- computational photography
- computational design & fabrication
- reinforcement learning for “smart” characters
- sound simulation
- drone cinematography
- crowd simulation
- ...

# Applications, APIs, and Theory

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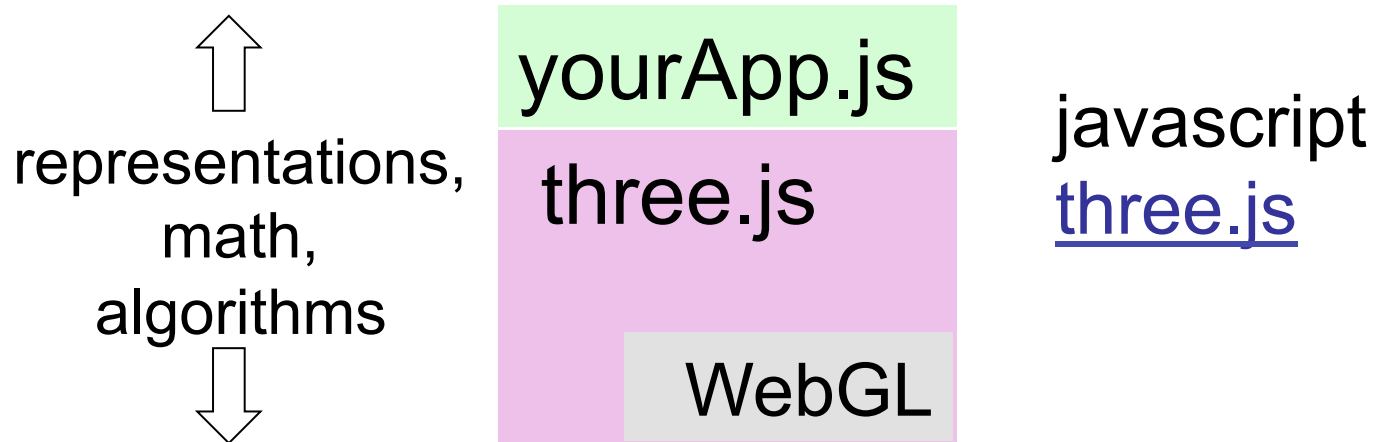
- focus is on theory + some API knowledge
- many tools and APIs exist (not covered):



# WebGL

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





# Next class

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