Introduction

Lecture objectives

- Learning graphics applications, problems, and topics to be covered in this class.

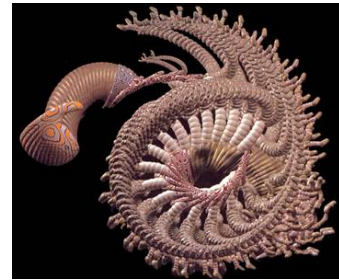# Course missives

Survey

- You have it in front of you.
  - Please answer the questions and give it back to me before you leave.

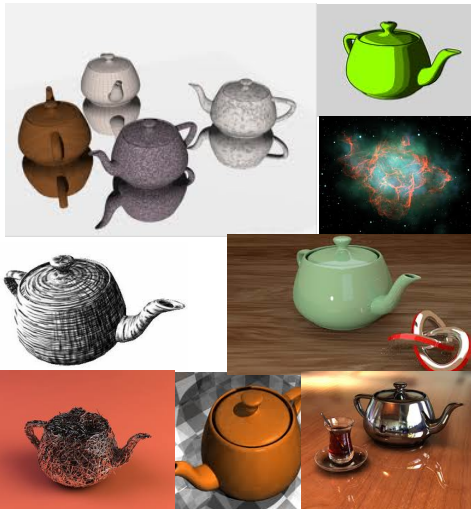## Graphics and its applications

What is Computer Graphics

- The study of creating, manipulating, and using visual images in the computer.

SIGGRAPH 1992

Just a collection of teapots

Graphics Applications

- Entertainment
  - Film production
  - Film special effects
  - Games
- Science and engineering
  - Computer-aided design
  - Scientific and information visualization (big-data problems!)
- Training and simulation
  - Virtual reality
- Graphics arts
  - Non-photorealistic rendering
  - Fine art
- Interaction

Slide 1:
COMPUTER GRAPHICS

Applications: Rendering

Avatar 2009

http://www.youtube.com/watch?v=xTWLBuTak6I

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Slide 2:
COMPUTER GRAPHICS

Supporting technologies

http://www.ro.me/film

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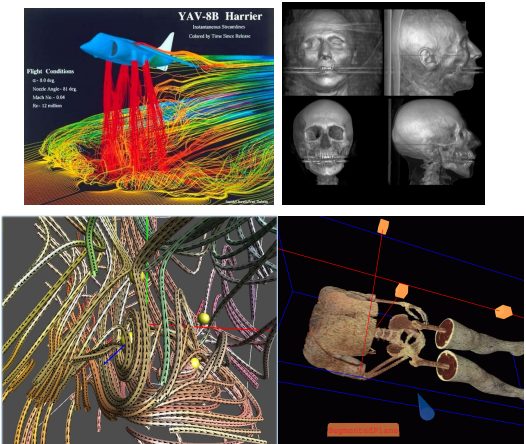
Slide 3:
COMPUTER GRAPHICS

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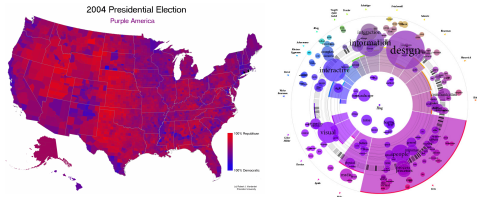 - Fine art
- Interaction

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Slide 4:
COMPUTER GRAPHICS

Applications: Big data problems!

Scientific visualization

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Applications: Big data problems!

Information visualization

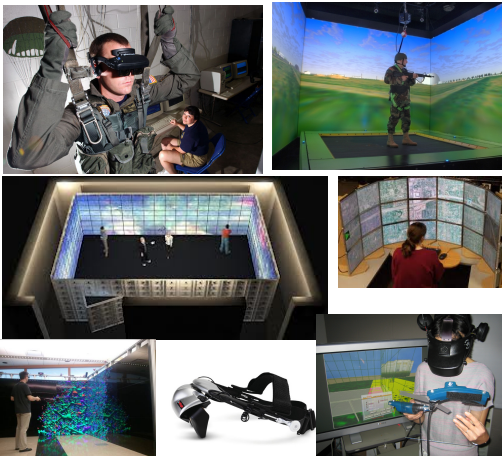2004 Presidential Election
Purple America

Graphics Applications

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  - Scientific and information visualization (big-data problems!)
- **Training and simulation**
  - **Virtual reality**
- Graphics arts
  - Non-photorealistic rendering
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- Interaction

Applications: Virtual Reality

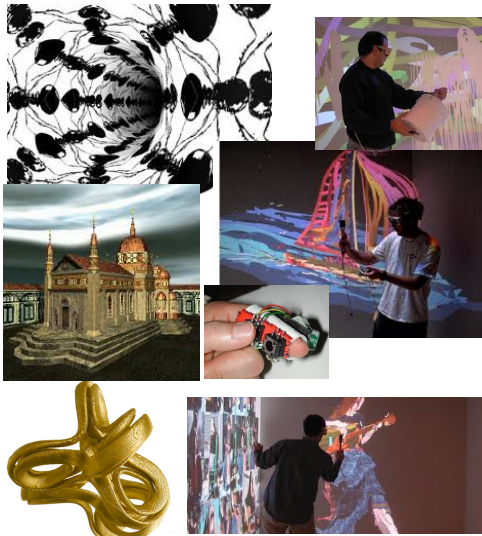- Training, Simulation, and situation awareness

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CAVE2

0:45 / 1:11

https://www.youtube.com/watch?v=d5XDbzy7vuE

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Applications: Virtual Reality

- Immersive design: study what-if-scenarios

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Graphics Applications

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Applications: Art

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## Graphics Applications

- Entertainment
  - Film production
  - Film special effects
  - Games
- Science and engineering
  - Computer-aided design
  - Scientific and information visualization (big-data problems!)
- Training and simulation
  - Virtual reality
- Graphics arts
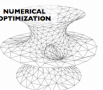 - Non-photorealistic rendering
  - Fine art
- **Interaction**

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Applications: Interaction

http://www.youtube.com/watch?v=vcBIUsQEE3E

http://www.hardwarelook.com/news/microsoft-free-hand-3d-interaction-future-of-gamingmust-see_429.html

nVidia GeForce™ chip

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Problems in Graphics

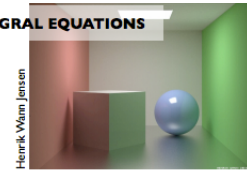CMSC 435/634 — Introduction

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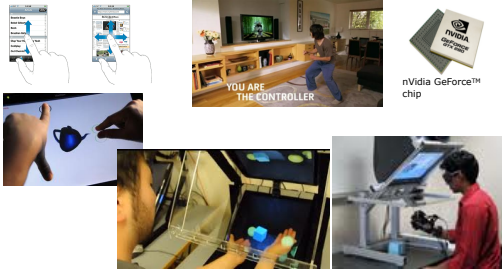
Problems in Graphics

- 2D imaging
  - Compositing and layering
  - Digital filtering
  - Color transformations

SIGNAL PROCESSING

- 2D drawing
  - Illustration, drafting
  - Text, GUIs

POLYNOMIALS &

- 3D modeling
  - Representing 3D shapes
  - Polygons, curved surfaces,.
  - Procedural modeling

NUMERICAL OPTIMIZATION

DIFFERENTIAL GEOMETRY

Headus—Cysurf

GRAMMARS

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Problems in graphics (cont'd)

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

Cornell PCG

INTEGRAL EQUATIONS

Henrik Wann Jensen

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Slide 1

Problems in graphics (cont'd)

http://www.youtube.com/watch?v=su504HbsX8c

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Slide 2

Problems in graphics (cont'd)

- User interaction (We just talked about this)
  - 2D graphical user interfaces
  - 3D modeling interfaces
  - Virtual reality
- Animation
  - http://physbam.stanford.edu/~fedkiw/

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Slide 3

Computer graphics: Math made visible

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Slide 4

Course Overview

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In this class

- You will:
  - Explore the fundamental ideas
  - Learn math & graphics algorithms
    - Modeling | Transformation | Projections | Polygon renderings | Texture mapping | lighting | Ray tracing
  - Implement core algorithms
  - Have fun and learn graphics!
- You will not:
  - Learn a lot about OpenGL
  - Write big programs

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Topics

- Modeling in 2D and 3D
- Rendering 3D scenes
  - Texture mapping | ray tracing
- Image and image processing
- Geometric transformation
- The graphics pipeline

rotate, then translate

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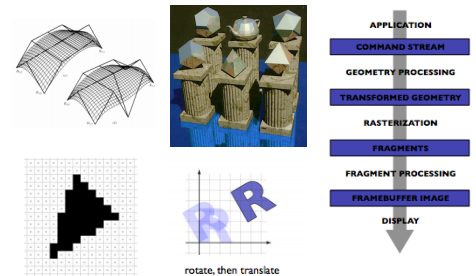
Modeling vs. Rendering

- Modeling
  - Create models
  - Apply materials to models
  - Place models around scene
  - Place lights in scene
  - Place the camera
- Rendering
  - Take "picture" with camera
- Both can be done by modern commercial software:
  - Autodesk Maya™ ,3D Studio Max™, Blender™, etc.

Point Light

Spot Light

Directional Light

Ambient Light
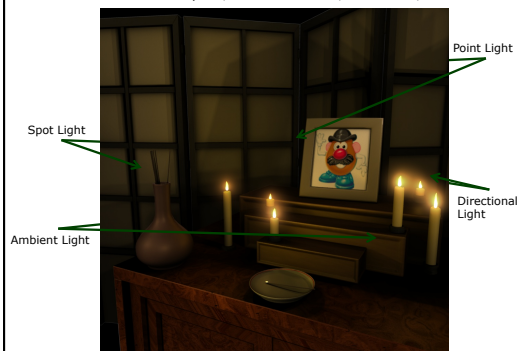
CS128 lighting assignment by Patrick Doran, Spring 2009, Brown U.

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Prereqs (next lecture): Math Review

- Normalized vector
- Matrix multiply
- Vector multiply
- Trigonometry
  - Angles | sin, cos, tan & their relationships
- Dot product
- Cross product
- And more …

Enjoy the adventure!

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