COMPUTER GRAPHICS
CS-314: Fall 2004
Instructor: Alla Sheffer

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http://www.ugrad.cs.ubc.ca/~cs314

What is Computer Graphics ?

- Generation of static/dynamic (realistic) images on computer

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Fake or Photo ?

http://www.alias.com/eng/etc/fakeorfoto/quiz.html

1

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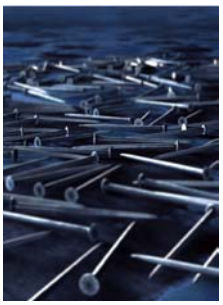
Fake or Photo ?

2



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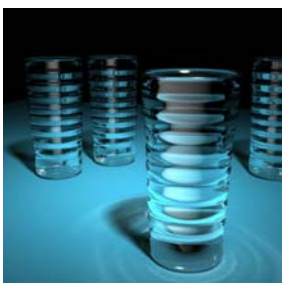
Fake or Photo ?

3



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Fake or Photo ?

4

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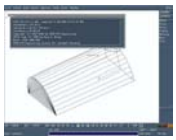
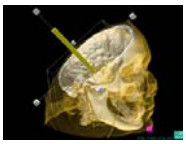
What is CG used for?

- GUI
  - Modeling systems
  - Applications
- Simulations & Visualization



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What is CG used for?

- Movies
  - Animation
  - Special Effects


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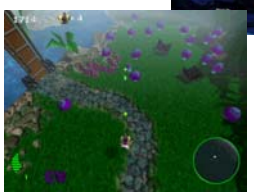
What is CG used for?

- Computer Games



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What is CG used for?

- Images
  - Design
  - Advertising
  - Art


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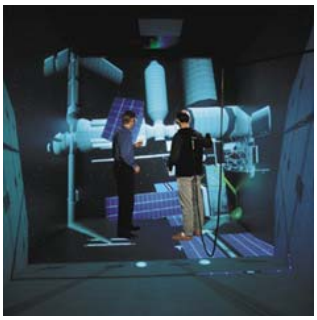
What is CG used for?

- Virtual reality



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What This Course Is About

- Basic **algorithms** for
  - Modeling – generating models
  - Rendering – displaying models
  - (Animation – generating motion)

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What This Course is **NOT** About

- NOT covered:
  - Artistic and design issues
  - Usage of commercial software packages

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Other graphics courses

- CPSC 424: Geometric Modeling
- CPSC 426: Computer Animation

- CPSC 514: Image-based Modeling and Rendering
- CPSC 526: Computer Animation
- CPSC 533A: Digital Geometry
- CPSC 533B: Animation Physics
- CPSC 533C: Information Visualization

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Basic Rendering – 2D

- Raster display – discrete grid of elements
- Terminology
  - **Pixel:** basic element on device
  - **Dynamic Range**: ratio between min (not zero!) & max light intensities of pixel
  - **Resolution:** number of rows & columns in device
    - Measured in
      - Absolute values (1K x 1K)
      - Density values (300 dots per inch)
  - **Screen Space:** Discrete 2D Cartesian coordinate system of the screen pixels

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Basic Rendering – 2D

- Algorithms for:
  - Scan Conversion
    - Draw (lines)
      - Anti-Aliasing
    - Fill (polygons)
    - Clipping
  - Color

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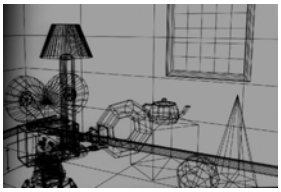
3D Graphics Components

- Geometric Modeling
  - polygons,
  - smooth surfaces,
  - etc…



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3D Graphics Components

- Material Properties
  - Opacity/Transparency
  - Texture
  - Reflectance

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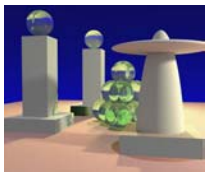
3D Graphics Components

- Light
  - Shading
  - Light absorbance/Reflection
  - Shadows



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Rendering - 3D

- Geometric transformations
  - Project 3D geometry to image plane
- Hidden surface removal
  - What is visible?
- Scan conversion (similar to 2D)
- Color
  - lighting, shading, texture mapping

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Animation

- Generating motion
  - Frame/State interpolation
  - Physical simulation
  - Motion capture

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Lecture Syllabus

- Introduction
- Math Review (week 2)
- Transformations (week 2/3)
- Rasterization (week 4)
- Hidden Surface Removal (week 5)
- Geometric Modeling
  - Solid & Free-form (week 6)
  - Meshes & Subdivision (week 7)
- Lighting Models (week 8)
- Color Theory (week 9)
- Methods for improving realism (week 10)
  - Shadows
  - Texture
- Image Improvement (week 11)
  - Aliasing and Anti-aliasing
  - Image manipulation
- Ray Tracing (week 12)

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Grading

- **Assignments (programming):** 40%
  - 3D Transformations (13%)
  - Rendering pipeline (13%)
  - OpenGL Extravaganza (14%)

- **Two Quizzes:** (30%)
  - 15% each

- **Final Exam:** (30%)

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Course Organization

- Programming assignments:
  - C++, Windows or Linux
  - OpenGL graphics library / GLUT for user interface
- Collaboration:
  - Individual solutions unless stated otherwise
  - See plagiarism policy

http://www.ugrad.cs.ubc.ca/~cs314/Vsep2004/plag.html

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Course Organization

- Up-to-date information:
  - http://www.ugrad.cs.ubc.ca/~cs314
  - WebCT (follow link from course home page)
    - Bulletin board
    - REQUIRES INTERCHANGE ACCOUNT!

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Teaching Staff

- Instructor: Alla Sheffer
  - Office hrs: CICSR 217, Tue 4-5pm
  - Contact info:
    - sheffa@cs.ubc.ca
      - do not use for
        - assignment related questions
        - anything else which might be relevant to other students
- TAs: Dan Julius, TBD, Wei Li
  - Contact info:
    - TBD

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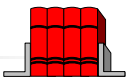
Literature



- Fundamentals of Computer Graphics
  - Peter Shirley, A.K. Peters

- OpenGL Programming Guide
  - J. Neider, T. Davis and W. Mason, Addison-Wesley

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