CSE 167:
Introduction to Computer Graphics

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University of California, San Diego
Fall Quarter 2015

Today

- Course organization
- Course overview
- Math review

Course Staff

Instructor

- Jürgen Schulze, Ph.D.
  Adjunct Professor in CSE
  Research Scientist at Qualcomm Institute

Assistants

- Teaching Assistants:
  - Dylan McCarthy (Head TA)
  - Ching Lee
  - Kevin Lim
- Tutors:
  - Phillip Ho
  - David Nuernberger
  - Hoang Tran

Course Organization

Lecture

- Tue/Thu, 9:30am-10:50am, Center Hall 105

Homework Discussion

- Monday afternoons, 3:00-3:50pm, PCYNH 121

Homework Grading

- Due dates are Fridays at 1:00pm
- Turn in by demonstration in CSE lab 260 or 270

Written Examinations

- Two in class closed book

Office Hours

Instructor

- Tue 11am-noon at Atkinson Hall, room 2125

TAs/Tutors

- See Piazza

Prerequisites

Expected is familiarity with:

- Solid C++, or strong Java or Python skills
- Object oriented programming concepts
- Formally taught in CSE 100

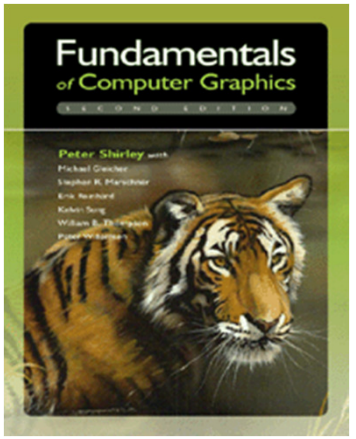
Course Web Site

- URL: http://ivl.calit2.net/wiki/index.php/CSE167F2015
- Class schedule
- Lecture slides
- Textbook recommendations
- Homework assignments
- Grading + exam information

Ted

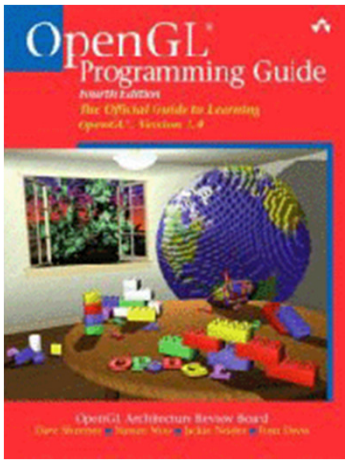
- Go to
  `http://ted.ucsd.edu`
  and select CSE167
  - Log in with your Active Directory account
- Lists homework and exam grades
  - Check your grades often

Textbooks



Recommended textbooks:

- Peter Shirley: *Fundamentals of Computer Graphics*, any edition (Google Books has full text version)
- *OpenGL Programming Guide*
  Older versions available on-line, no need to buy the book



Programming Projects

- 7 programming assignments
  - Last one is team project and counts more towards grade
- Find assignments and schedule on home page
- Base code and documentation on home page
- Use CSE basement labs or your own PC/laptop
- Individual assistance by TA/tutor during office hours
- Turn in by demonstration to TA, tutor or instructor during homework grading hours on Fridays.
  - Demonstration can be done on lab PC or personal laptop
  - Grading from 1pm until at least 2:15pm
  - Required: submit source code by 1pm

If you can't come to grading session

- Submit source code by 1pm on due date
- Email instructor:
  - reason of absence
  - when you want to demo instead (in TA/tutor office hours)

Written Examinations

Two in-class written exams.

Closed book. No cheat sheets.

For dates see course schedule on web site.

Grading

- Homework Projects 1-6: 10% each
- Written exams: 10% each
- Final project: 20%
- Late submission policy for homework projects:
  - Allowed within 1 week of due date, with 25% penalty
  - Example: for perfect score of 110 points (including extra credit), when submitted late you will get 83 points)

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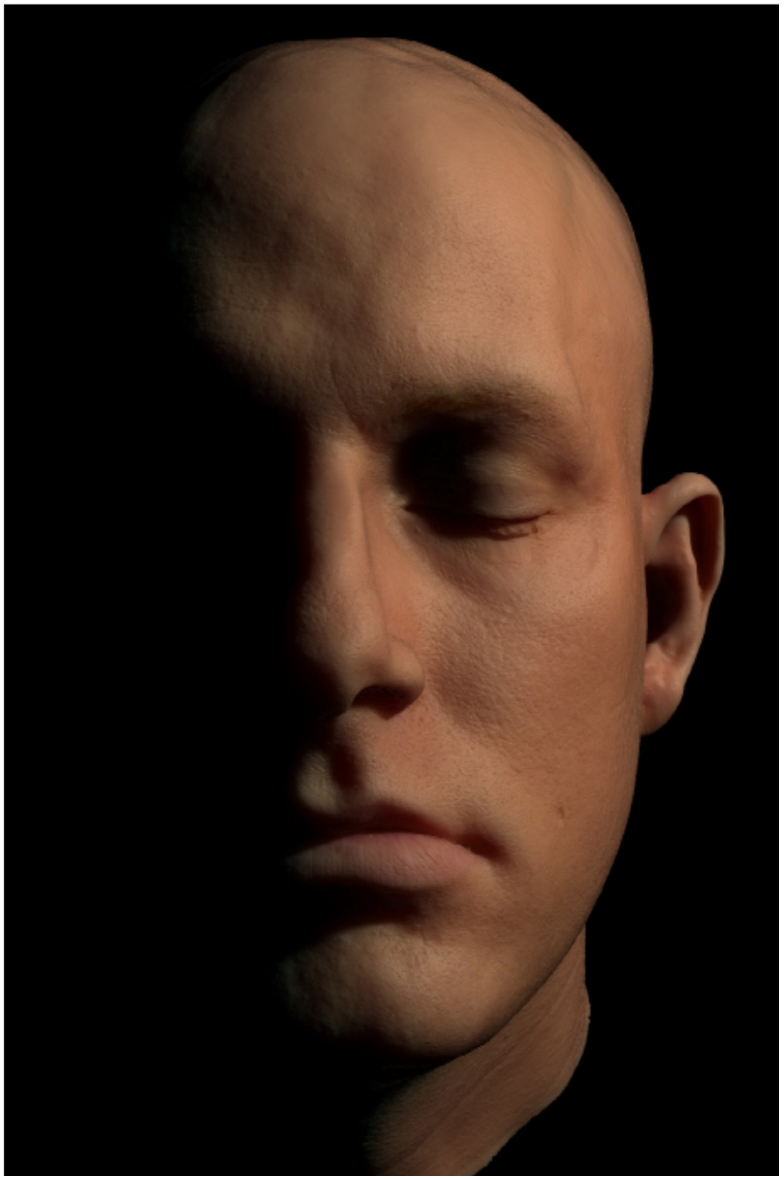
Rendering

- Synthesis of a 2D image from a 3D scene description
  - Rendering algorithm interprets data structures that represent the scene in terms of geometric primitives, textures, and lights
- 2D image is an array of pixels
  - Red, green, blue values for each pixel
- Different objectives
  - Photorealistic
  - Interactive

Photorealistic rendering

- Physically-based simulation of light, camera
- Shadows, realistic illumination, multiple light bounces
- Slow, minutes to hours per image
- Special effects, movies
- CSE168: Rendering Algorithms

Photorealistic rendering



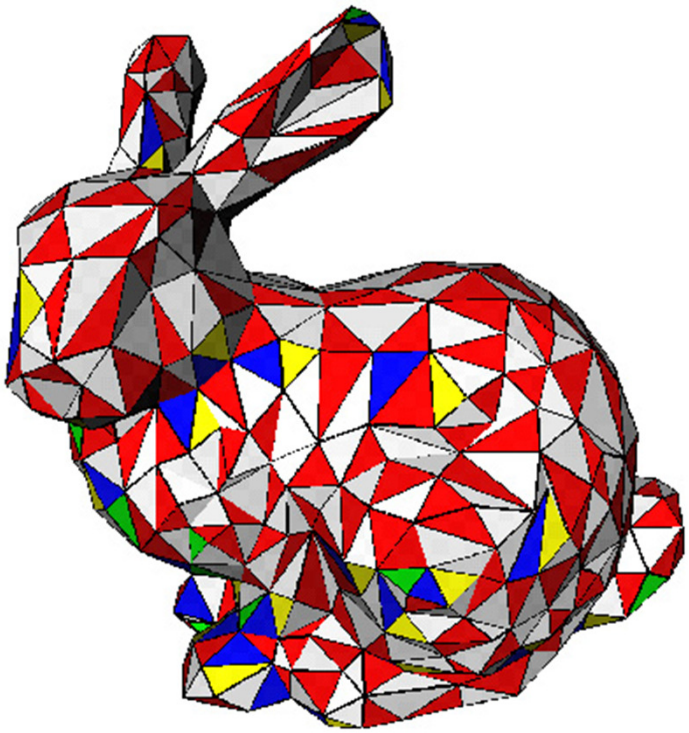
Interactive rendering

- Produce images within milliseconds
- Using specialized hardware, graphics processing units (GPUs)
- Standardized APIs (OpenGL, DirectX)
- Often "as photorealistic as possible"
- Hard shadows, fake soft shadows, only single bounce of light
- Games
- CSE167

Interactive rendering

Modeling

- Basic 3D models consist of array of triangles

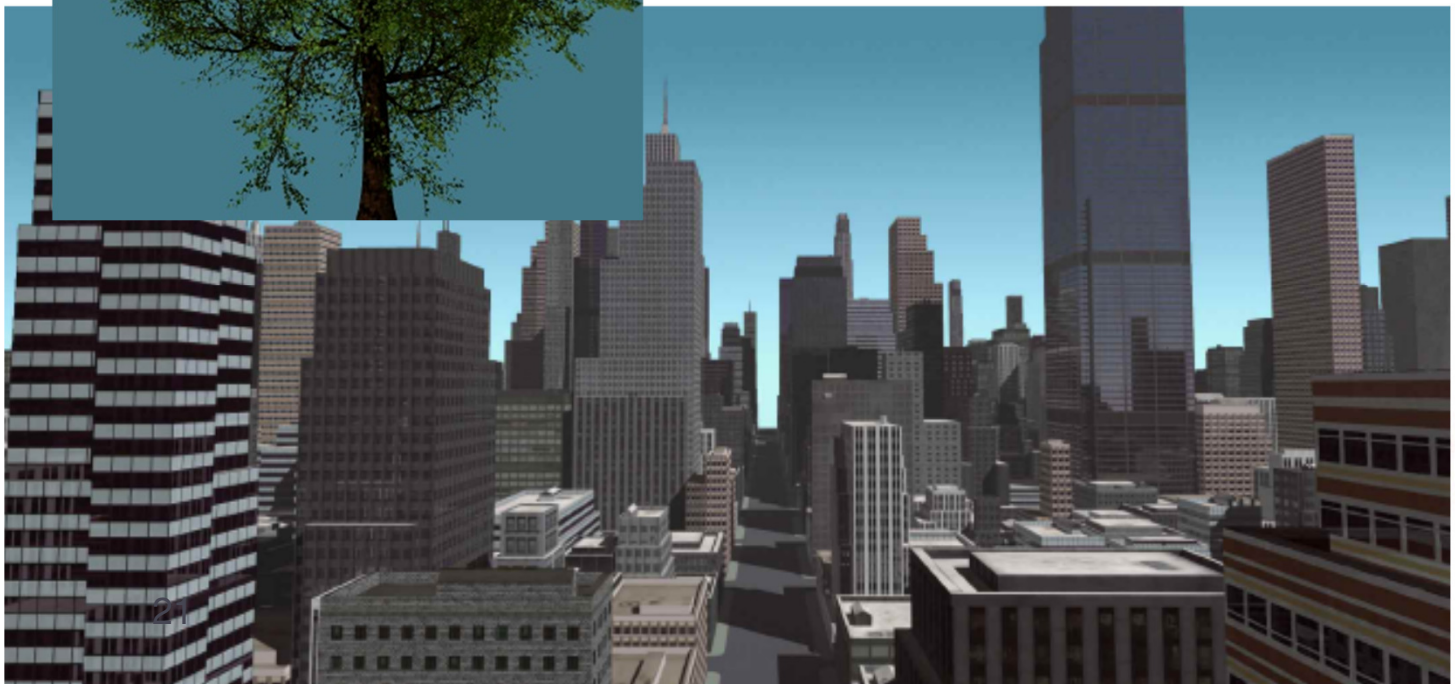


- Procedural: by writing programs
- Scanning real-world objects

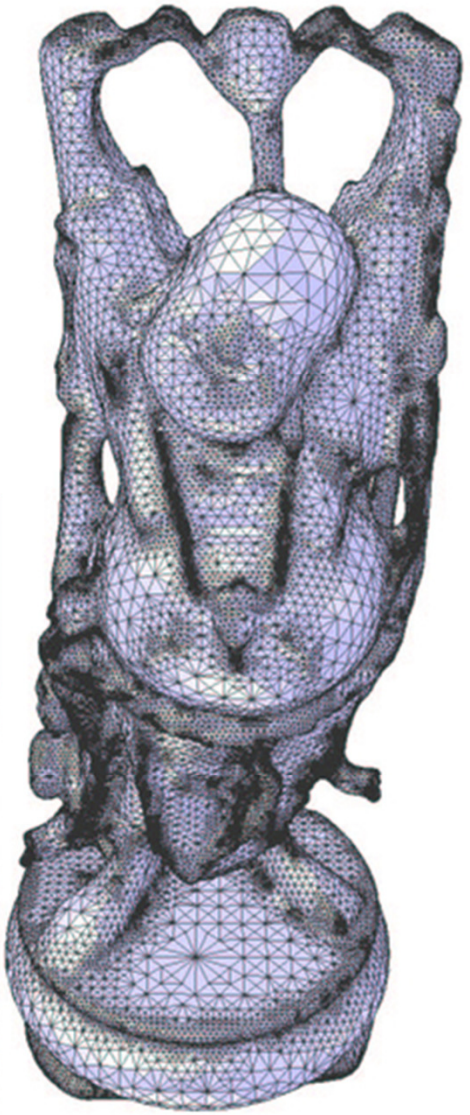
Modeling

Procedural tree

Procedural city



Scanned statue



Topics

- Basic skills:
  - Vector and matrix mathematics
  - Coordinate system transformations
  - 3D to 2D projection
  - Rasterization

Topics

- OpenGL:
  - Lighting
  - Texturing
  - Shading
  - GL Shading Language

Topics

- High Level Concepts:
  - Scene Graph
  - Culling
  - Parametric Curves and Surfaces
  - Procedural Modeling

Topics

- Visual Effects:
  - Environment Mapping
  - Shadows
  - Deferred Rendering

Examples of Previous Final Projects

- https://www.youtube.com/watch?v=rE3NC5ZwdSk
- https://www.youtube.com/watch?v=cbaKCi14uCw
- https://www.youtube.com/watch?v=LYgu9i7GZXE

Next Week

- Monday, Sept. 28
  - Homework discussion by Dylan on 3-3:50pm
  - Pepper Canyon Hall (PCYNH) 121
- Tuesday Sept. 29 + Thursday Oct. 1
  - Lecture 9:30-10:50am, Center Hall 105
- Friday Oct. 2
  - Homework project 1 due at 1pm
  - Demonstrate in CSE basement labs 260 or 270
  - Add your name to list on whiteboard in room 260