Introduction to Computer Graphics

0. Overview

I-Chen Lin

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About the course

- Course title: Introduction to Computer Graphics
- Lectures:
  - EDB27, 10:10~12:00(Mon.) & 9:00~9:50 (Wed.)
- Pre-requisites:
  - Computer programming skills in C/C++.
  - Programming with data structures, such as arrays, trees, linked lists.
  - Essential concepts of matrix computation.
- Teacher:
  - I-Chen Lin (林奕成), Associate Professor
  - Email: ichenlin@cs.nctu.edu.tw
  - Office: EC 704 (工程三館)
  - Tel ext: 56684

About the course (cont.)

- TAs:
  - 黃偉倫、魏彣彧、楊志新、張皓婷
  - Office: EC229b
  - Phone ext.: 56676
- Course web page: E3 (e-Campus, NCTU)
  - Previous course web page: http://caig.cs.nctu.edu.tw/course.html
- Text book:
  - Edward Angel, Dave Shreiner, *Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL*, 6th Edition, 5th Ed., Pearson, 2012.

About the course (cont.)

- Reference:
  - Donald D. Hearn, M. Pauline Baker, Warren Carithers, *Computer Graphics with OpenGL* (4th Edition), Pearson, 2010.
  - J. D. Foley, A. van Dam, S. K. Feiner, J. F. Hughes, R. L. Phillips. *Introduction to Computer* Graphics, Addison-Wesley, 1993.

What's CG?

- Computer Graphics.
  - Mainly focuses on 3D graphics.
  - Displays a realistic virtual environment by computers.
  - Or synthesizes virtual objects in the real world.

FF 15, Square-Enix corp.
Image from gameranx.com

Avatar,
20th Century Fox.

Avengers: Infinity War,
Marvel Studio

What's CG? (cont.)

- Or displays a virtual world with specific styles. (e.g. non-photorealistic rendering)

- CG tech. is the foundation of modern 3D animation, special effects and games.

DragonBall Z3 (PS2), BANDAI

NPR demo, AMD/ATI

Graphics and related fields

- 3 related fields.

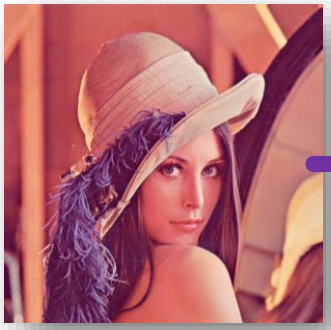
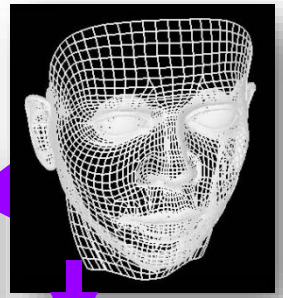


Image Processing

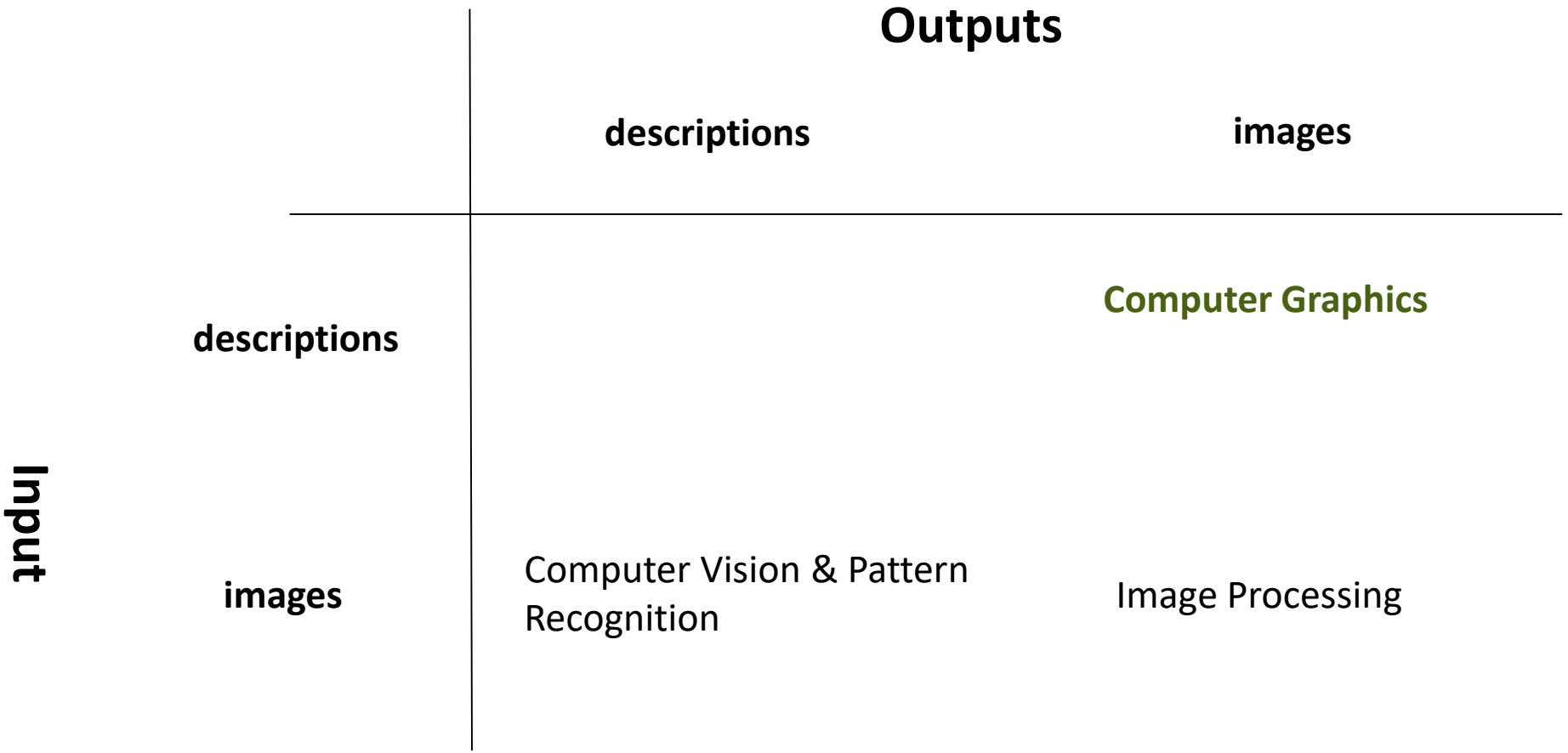
- Find features.
- Eyes? a nose?
- A face?
- Structure?
- 0-0?

Computer Vision & Recog.

Computer Graphics



Graphics and related fields



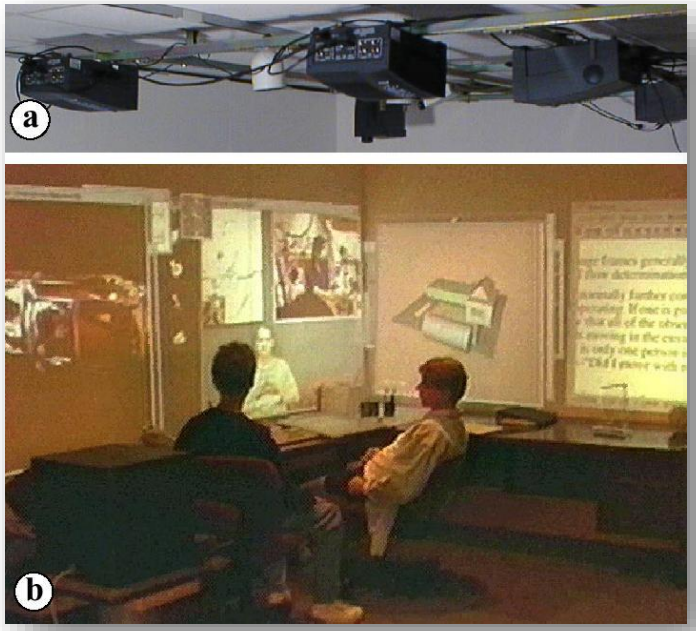
Nevertheless, the boundaries between these fields, especially CG and CV, are getting indistinct.

Applications

- Movies
- Games
- Virtual characters

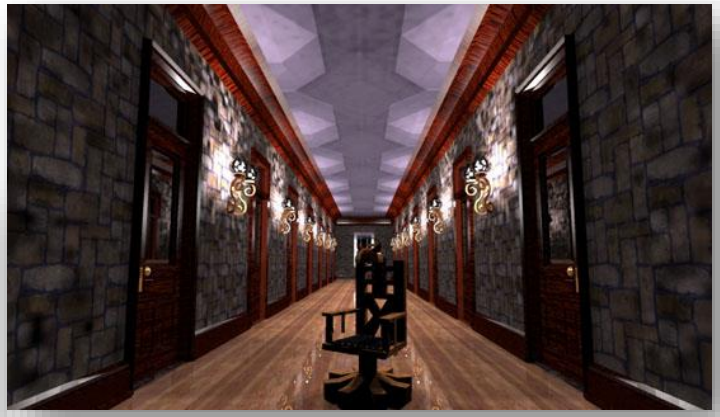
Applications (cont.)

- Virtual reality (VR)



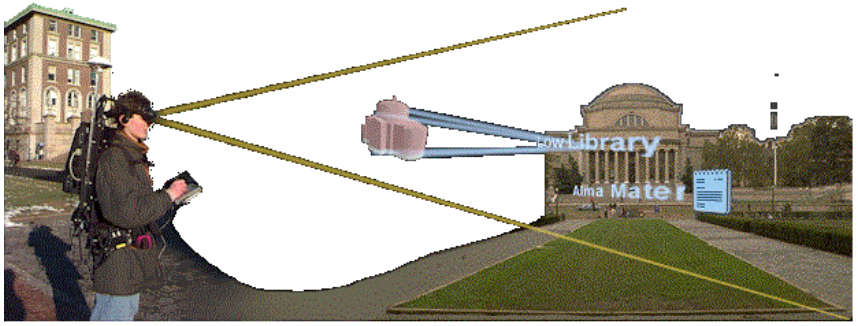
Office of the future, UNC

Virtuix Omni

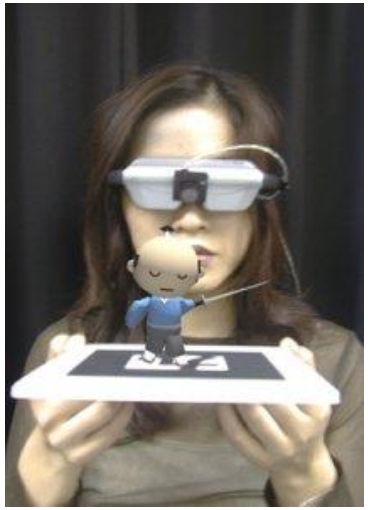


Applications (cont.)

- Augmented reality (AR)
- Advanced human computer interfaces



AR, U. Columbia

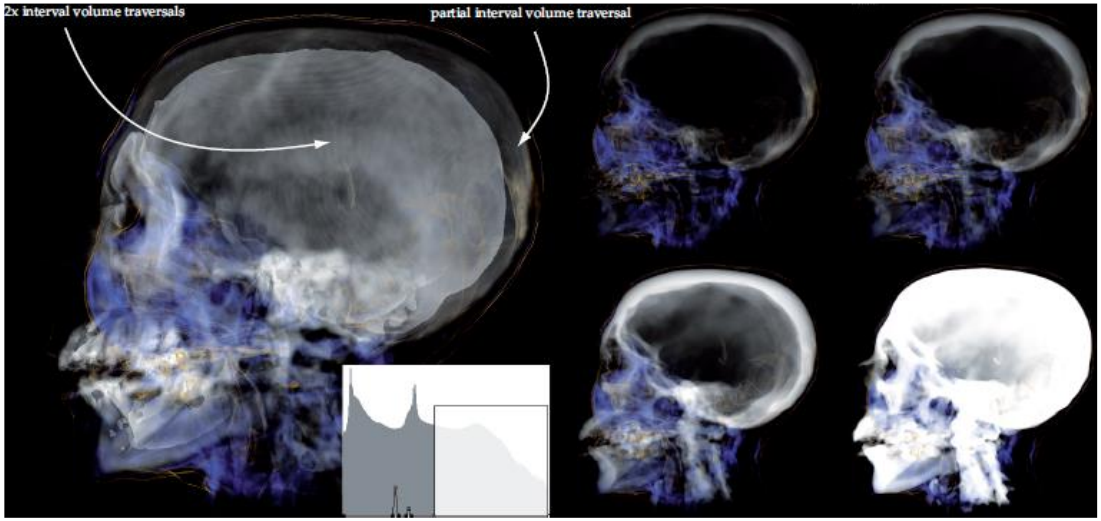


AR Toolkit

Microsoft Hololens

Applications (cont.)

- Medical diagnosis.
- Virtual Surgery.



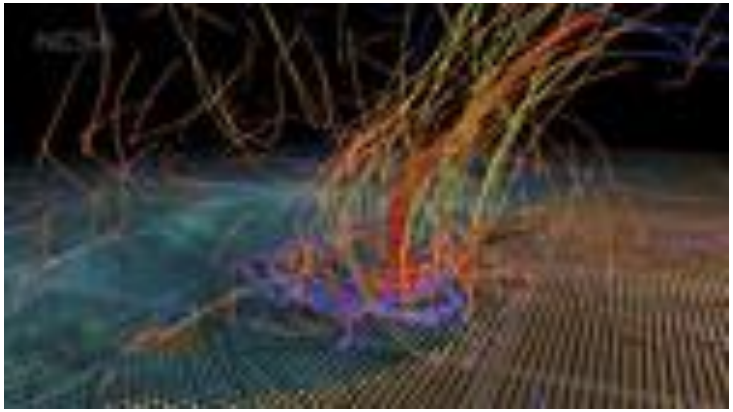
Direct Interval Volume Visualization, IEEE Vis'10

The Karlsruhe Endoscopic Surgery Trainer

Applications (cont.)

- Computer aided design (CAD)
  - Collaborating on cyberspace.
  - Ex. Cabin design (Boem Inc.)

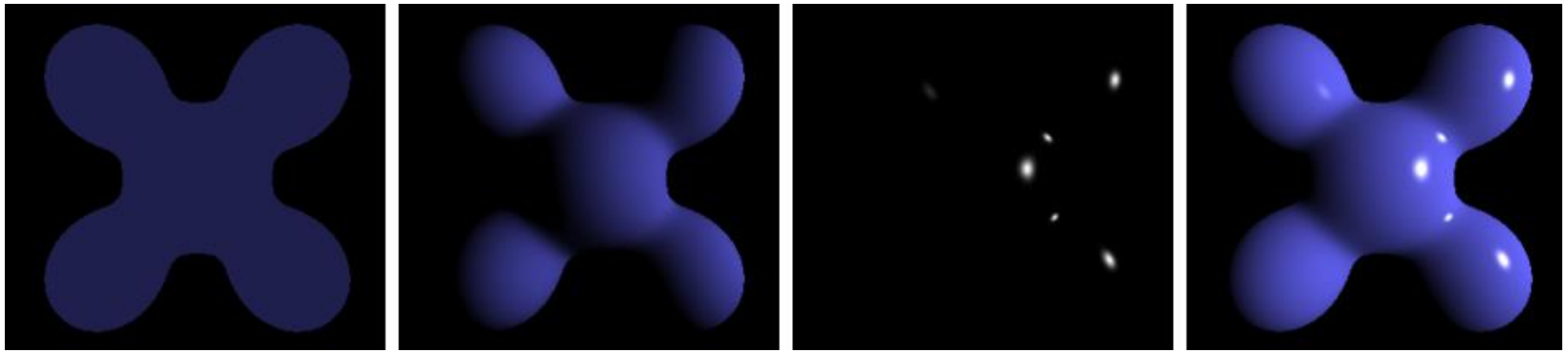
- Visualization tools
  - Meteorology



http://ilab.cs.ucsb.edu/projects/helly.html

Syllabus

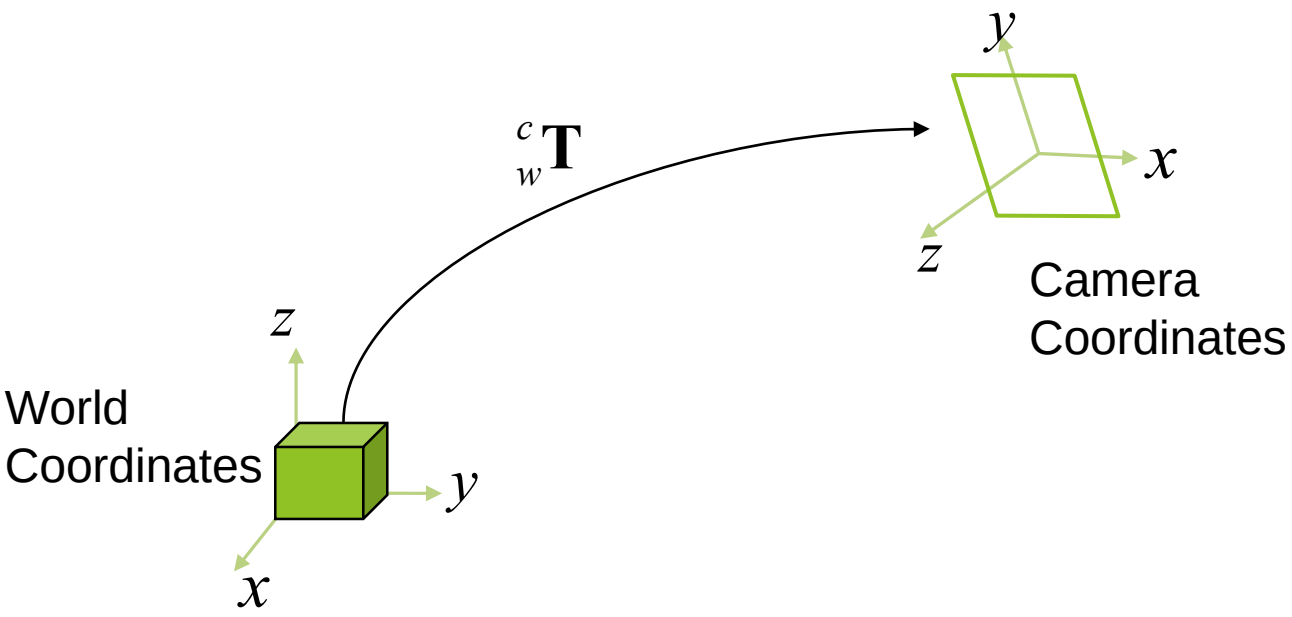
1. Introduction.
2. Graphics primitives
3. Illumination and surface rendering



Ambient + Diffuse + Specular = Phong reflection

Syllabus (cont.)

4. Geometric transformations
5. Viewing in 3D
6. Visible-surface detection

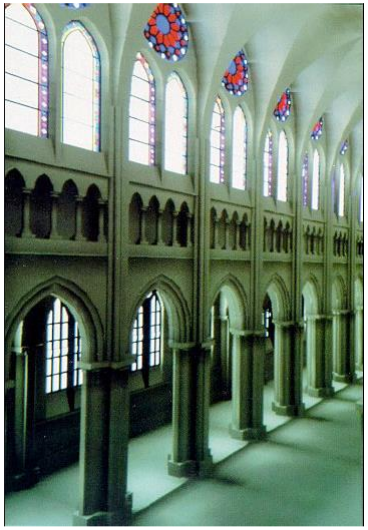


Syllabus (cont.)

7. Texture mapping
8. Global illumination
9. Curves and surfaces
10. Advanced topics and research in CG

http://www.ozone3d.net/tutorials/bump_mapping.php

- Advanced courses in NCTU:
  - 3D game programming
  - Advanced computer graphics
  - Computer animation
  - Image-based modeling and rendering
  - Interactive shape manipulation
  - Real-time rendering
  - Texture synthesis
  - ……

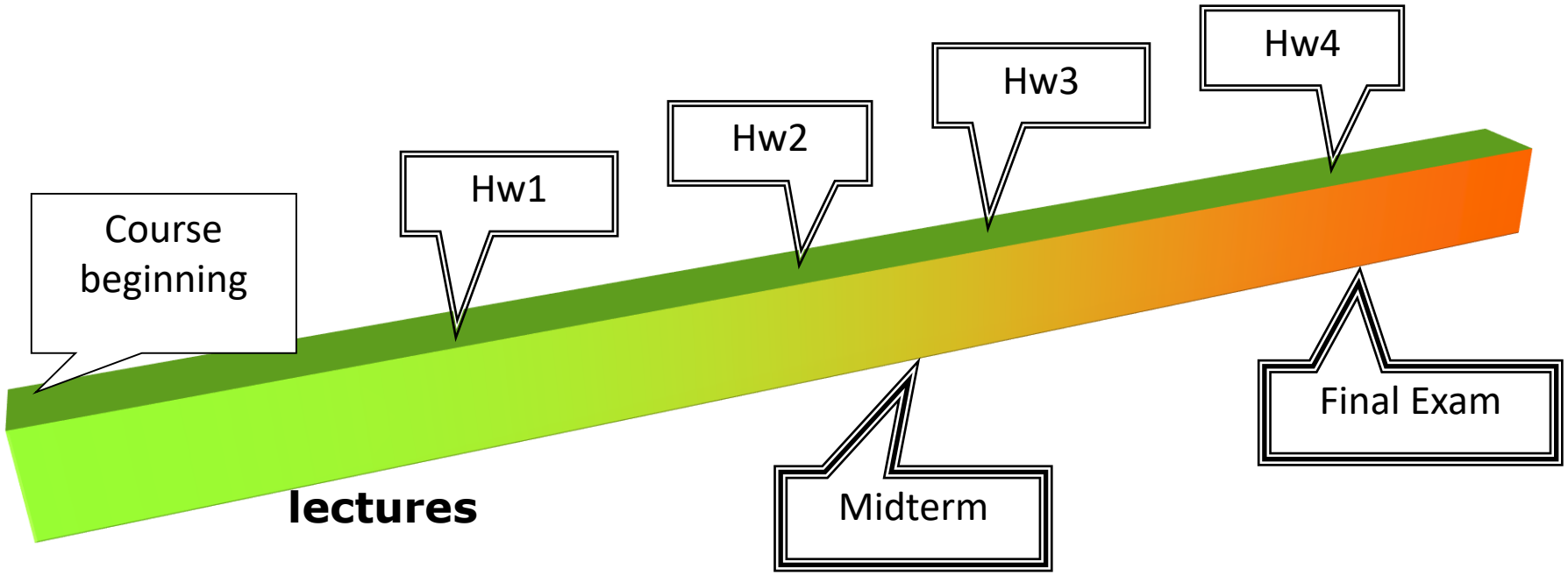


the Chartres Cathedral
www.graphics.cornell.edu

About the course (cont.)

- Grades: (provisional)
  - Homework (4~5 programs)
    - OpenGL viewer: transformation.
    - OpenGL viewer: shading and texture.
    - Visual effects with buffers.
    - Animation or effects with shaders.
    - ……
  - Exam
    - Midterm (20% ± 5%)
    - Final (20% ± 5%)
  - Class participation: bonus

Schedule


Course beginning
Hw1
Hw2
Hw3
Hw4
lectures
Midterm
Final Exam

What can I obtain in this course?

- Fundamentals of computer graphics techniques.
- Programming ability for 3D graphics.
- Preliminary concepts on advanced graphics-related topics, e.g. 3D games, movies.

What can I obtain in this course?

- 2D image special effects.

Somewhat

- Digital art styles.

- Usage of editing tools.
  - Photoshop, 3DMax, Maya, etc.

Conclusion

- The role of graphics people in CS
  - Improving faithfulness or visual effects
  - Speed-up of CG generation
  - (by computer techniques)

We give “wizards” the “wands” and “spells” !