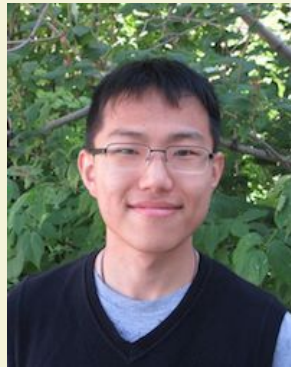


Introduction to
Computer Graphics
CPSC 453 - 2019F

CPSC453 - 2019W

- ❖ **Instructor:** Przemyslaw Prusinkiewicz
 - Office: Math Sciences (MS) 622
 - Office hours: TR, 3:30 – 4:30
(please let me know if you want to see me)
 - Phone: (403) 220-5494
 - Email: pwp@ucalgary.ca

- ❖ **TAs:**



Philmo Gu



Andrew Owens

- ❖ **Useful info:**
 - Submit assignments via D2L
 - Some course materials may be posted at:
<http://algorithmicbotany.org/courses/Fall2019>

Formalities

Grading

- ❖ 4 lab assignments: 50%
- ❖ Midterm Exam: 20%
- ❖ Final Exam: 30%

Schedule and due dates:

- 1) Intro to openGL: sponge ~ Thursday, Oct. 3
- 2) Rendering ~ Tuesday, Oct. 22
- Midterm Thursday, Oct. 24
- Term break November 10-16
- 3) Ray-tracer ~ Tuesday, Nov. 19
- 4) Modeling ~ Thursday, Dec. 5

Other:

- ❖ Take notes on paper.
- ❖ No phones, computers, tablets etc. allowed, unless:
 - o you can use them to write formulas and draw figures faster than on paper or you have my explicit permission.
- ❖ Preferably no eating, definitely no wrapping / unwrapping.

Texts

❖ Text :

- S. Marshner, P. Shirley *Fundamentals of Computer Graphics, 4th Edition*, AK Peters/CRC 2014 (required)
(3rd edition, authored by Shirley/Marschner, will do)

❖ Online resources:

- <http://www.glprogramming.com/red>
- <https://sgar91.files.wordpress.com/2010/12/opengl-programming-guide-7e.pdf>
- <https://www.opengl.org/documentation/>
- + more, as may be suggested by the TAs.

What is Computer Graphics?



... any use of computers to create and manipulate images.

Modeling

What is Computer Graphics?



... any use of computers to create and manipulate images.

Rendering

After CPSC 453...



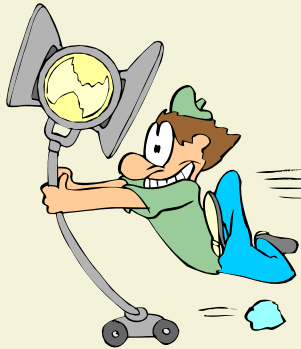
❖ Modeling (form):

CPSC 589



❖ Rendering (appearance):

CPSC 591



❖ Animation (behavior):

CPSC 587

Sample applications of CG

- ❖ Movie industry:
 - Computer animation
 - Special effects
- ❖ Games
- ❖ Immersive environments
 - Virtual reality, e.g. virtual tourism
- ❖ Information visualization; visual analytics
 - Business
 - Scientific
- ❖ Computer aided design
- ❖ Digital photography and cinematography
 - Changing lighting of a scene
 - Changing depth of the field
 - Taking a picture without closed eyes
 - Inferring 3D from 2D
- ❖ Medical imagery
- ❖ (Digital) publishing
- ❖ Architectural / landscape visualization
- ❖ Art

Course objectives

How to make graphics software and programs:

- o Basic concepts of synthesizing images using computers
- o How to write programs with graphics components
- o How to write graphics software
- o OpenGL (taught through the labs)

❖ *Not !*

- o How to use Paint and Imaging packages (Adobe Photoshop)
- o How to use CAD packages (AutoCAD)
- o How to use Graphics packages (3D Studio MAX, MAYA)
- o Graphics Hardware Design

- o Artistic aspects of image creation

Brief history of CG (1)

1960s

- ❖ Ivan Sutherland: Sketchpad (MIT)
 - interactive graphics,
 - constrained graphics,
 - the notion of objects underlying images
 - stereoscopic head-mounted display (1966)

1970s

- ❖ University of Utah
 - Dave Evans 1968 recruited Ivan Sutherland in 1968
 - Edwin Catmull became student in 1970, goal: computer animation, first animation: his hand opening and closing. Invented texture mapping, algorithms for antialiasing, Catmull-Rom splines (1974) subdivision surfaces (Catmull-Clark).
 - John Warnock, Jim Clark, Alan Kay, Jim Blinn
- ❖ NYIT – founded by Alexander Schure
 - 1974 – Catmull recruited by NYIT as the director of Computer Graphics Lab
 - 1975 – Alvy Ray Smith joins NYIT.
 - Co-invented Superpaint (one of the first paint programs) with Dick Shoup.
 - Invented alpha channel.
- ❖ National Film Board (Canada)
 - Marcelli Wein and Nestor Burtnyk: computerized key-frame animation. Sample movie: Hunger

Brief history of CG (2)

1980s

❖ Lucasfilm

- 1979 – Catmull becomes VP of Graphic Division, with Alvy Ray Smith a co-founding member.
- 1982 - Star Trek 2 – the birth of a planet
- 1984 – The Adventures of Andre and Wally B. Directed by John Lasseter (Chief Creative Officer at Pixar and Walt Disney Animation Studios until 2018).

❖ Pixar

- 1986 – Jobs bought Lucasfilm's digital division and founded Pixar. Catmull becomes CTO. Name "Pixar" invented by Alvy Ray Smith. (Catmull was until 2014-2019 the president of Pixar and Walt Disney Animation studios).

❖ Silicon Graphics

- Funded in 1981 by Jim Clark.
- Graphics Engine (developed by Jim Clark at Marc Hannah at Stanford). VLSI implementation of a geometric pipeline.
- GL → Open GL (1992)

❖ 1990s → now

- Diversification of the scope of Computer Graphics. HCI separates.
- Games, efficiency and the GPU. NVIDIA (founded in 1993)
- Mobile computing
- The rise and fall of OpenGL. The GUI saga.
- VR

References of historical interest

- ❖ David A. Price: *The Pixar touch: The making of a company*. Vintage Books 2008, 2009.
- ❖ Walter Isaacson: *Steve Jobs*. Simon & Schuster, 2011.
- ❖ Ed Catmull: *Creativity, Inc.: Overcoming the Unseen Forces That Stand in the Way of True Inspiration*. Random House Canada 2014.
- ❖ <http://openglbook.com/chapter-0-preface-what-is-opengl.html>