Choosing the right course

**CS 148**
- Winter, Hanrahan, not SCPD
- undergraduates only
- requires 107
- terminal course
- broad and conceptual
- CS 248 “lite” +
  - 2D image processing
  - media technologies
  - video technologies
  - some visualization
- more, smaller assignments

**CS 248**
- Autumn, Levoy, SCPD
- mainly MS and PhD
- requires 108
- feeds CS 348A,B, 448
- narrow and mathematical
- the “graphics pipeline” for
  - entertainment
  - games
  - CAD
  - visualization
- monster project at end
CS 178 – digital photography

university-wide
mainly undergraduate
science, engineering, and art
photography assignments and crits
no programming experience required
must have camera with manual shutter & aperture
Spring quarter, Tue/Thu, 2:15 – 3:30
History of computer graphics

CS 248 - Introduction to Computer Graphics
Autumn quarter, 2008
Slides for September 23 lecture
Ivan Sutherland (1963) - SKETCHPAD

- pop-up menus
- constraint-based drawing
- hierarchical modeling
Display hardware

vector displays
- 1963 – modified oscilloscope
- 1974 – Evans and Sutherland Picture System

raster displays
- 1975 – Evans and Sutherland frame buffer
- 1980s – cheap frame buffers → bit-mapped personal computers
- 1990s – liquid-crystal displays → laptops
- 2000s – micro-mirror projectors → digital cinema
- 2010s – high dynamic range displays?

other
- stereo, head-mounted displays
- autostereoscopic displays
Input hardware

2D

- light pen, tablet, mouse, joystick, track ball, touch screen, etc.
- 1970s & 80s - CCD analog image sensor + frame grabber
Input hardware

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Input hardware

2D

- light pen, tablet, mouse, joystick, track ball, touch panel, etc.
- 1970s & 80s - CCD analog image sensor + frame grabber
- 1990s & 2000’s - CMOS digital sensor + in-camera processing
  → high
tone mapping is still hard to do

no cameras automatically take HDR pictures (How much to bracket?)
Input hardware

2D

- light pen, tablet, mouse, joystick, track ball, touch panel, etc.
- 1970s & 80s – CCD analog image sensor + frame grabber
- 1990s & 2000’s – CMOS digital sensor + in-camera processing
  → high-dynamic range (HDR) imaging
  → cell phone cameras
Unretouched pictures from Nokia N95
(5 megapixels, Zeiss lens, auto-focus)
Input hardware

2D
- light pen, tablet, mouse, joystick, trackball, touch panel, etc.
- 1970s & 1980s - CCD analog image sensor + frame grabber
- 1990s & 2000s - CMOS digital sensor + in-camera processing
  → high-dynamic range (HDR) imaging
  → cell phone cameras

3D
- 1980s - 3D trackers
- 1990s - active rangefinders
Input hardware

2D
- light pen, tablet
- 1970s & 80s - CCD analog image sensor + frame grabber
- 1990s & 2000’s - CMOS digital sensor + in-camera processing
- high-dynamic range (HDR) imaging
- cell phone cameras

3D
- 1980s - 3D trackers
- 1990s - active rangefinders

4D and higher
- multiple cameras
- multi-arm gantries
Rendering

1960s - the visibility problem

- Roberts (1963), Appel (1967) - hidden-line algorithms
- Sutherland (1974) - visibility = sorting
1960s - the visibility problem

- Roberts (1963), Appel (1967) - hidden-line algorithms
- Sutherland (1974) - visibility = sorting

1970s - raster graphics

- Gouraud (1971) - diffuse lighting
- Phong (1974) - specular lighting
- Blinn (1974) - curved surfaces, texture
- Crow (1977) - anti-aliasing
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- Crow (1977) - anti-aliasing
early 1980s - global illumination

- Whitted (1980) - ray tracing
- Goral, Torrance et al. (1984), Cohen (1985) - radiosity
- Kajiya (1986) - the rendering equation
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- Whitted (1980) - ray tracing
- Goral, Torrance et al. (1984), Cohen (1985) - radiosity
- Kajiya (1986) - the rendering equation

late 1980s - photorealism

- Cook (1984) - shade trees
- Perlin (1985) - shading languages
- Hanrahan and Lawson (1990) - RenderMan
  → shaders
early 1990s - non-photorealistic rendering

- Drebin et al. (1988), Levoy (1988) - volume rendering
- Haeberli (1990) - impressionistic paint programs
- Salesin et al. (1994-) - automatic pen-and-ink illustration
- Meier (1996) - painterly rendering
early 1990s - non-photorealistic rendering

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- Meier (1996) - painterly rendering
late 1990s - image-based rendering

- Chen and Williams (1993) - view interpolation
- McMillan and Bishop (1995) - plenoptic modeling
- Levoy and Hanrahan (1996) - light field rendering