

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

A spiral-bound notebook with a light brown, textured cover and a dark brown border. The spiral binding is on the left side. The text is centered on the page.

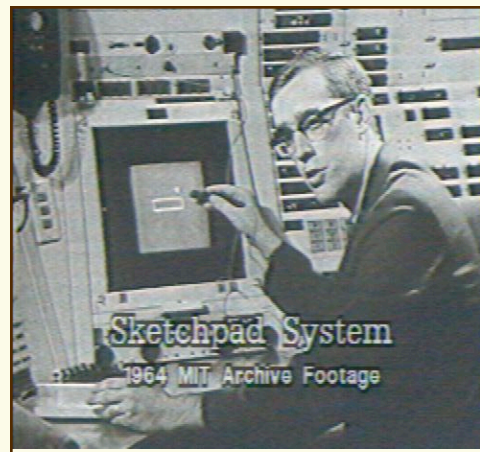
History of computer graphics

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

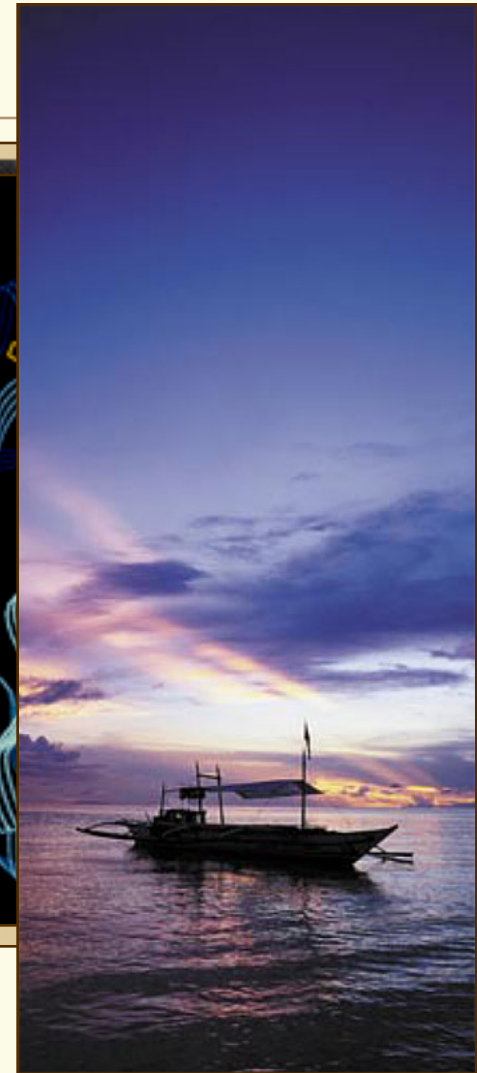
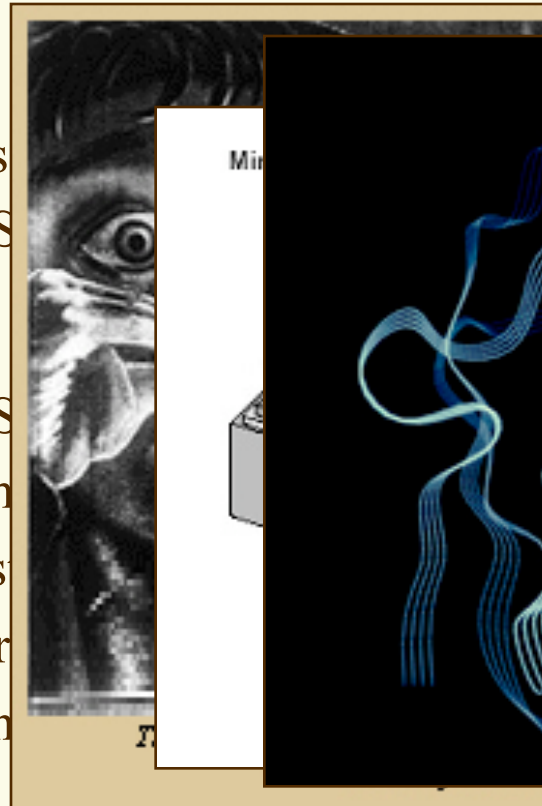
- 1963 – modified oscilloscope
- 1974 – Evans and Sutherland

raster displays

- 1975 – Evans and Sutherland
- 1980s – cheap frame buffers
- 1990s – liquid-crystal displays
- 2000s – micro-mirrors
- 2010s – high dynamic range

other

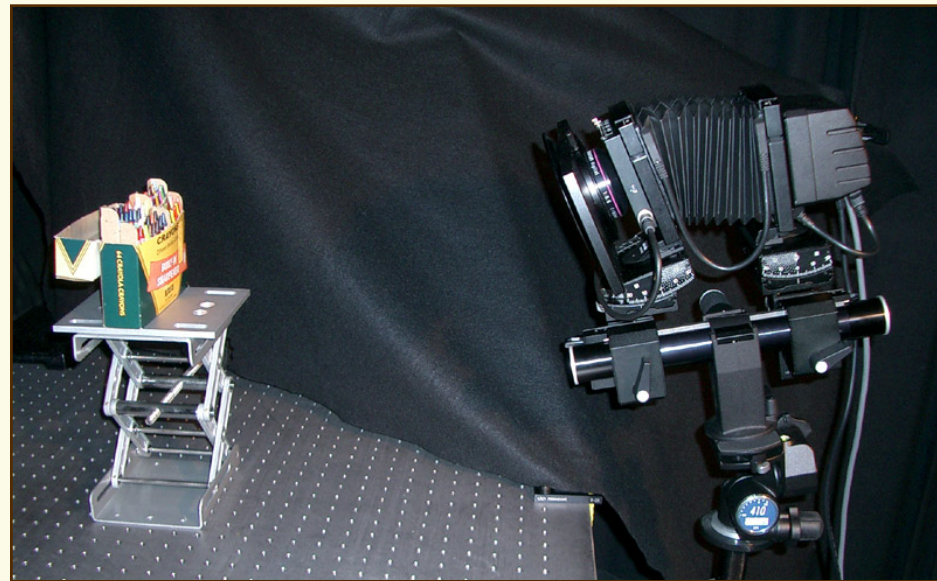
- stereo, head-mounted displays
- autostereoscopic displays



Input hardware

2D

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



Input hardware

2D



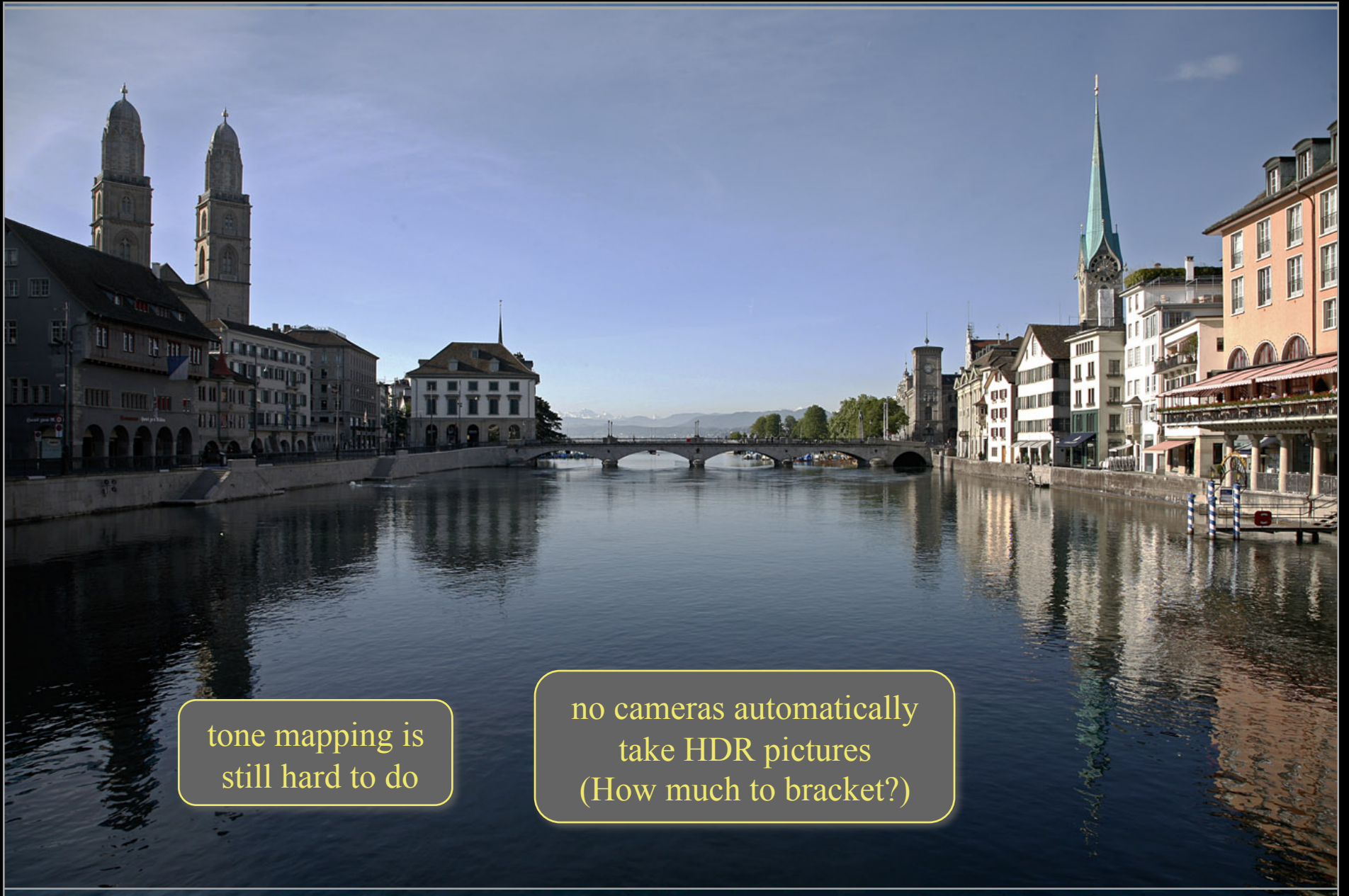
Input hardware

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)



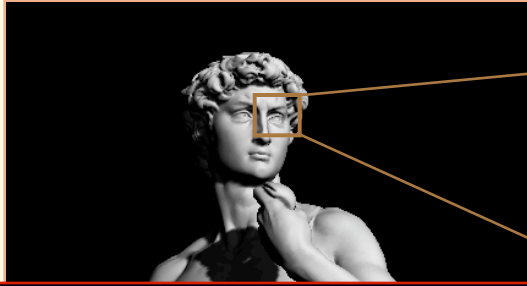






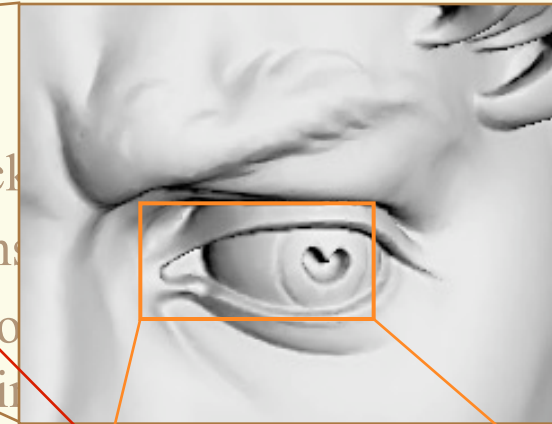


Input hardware

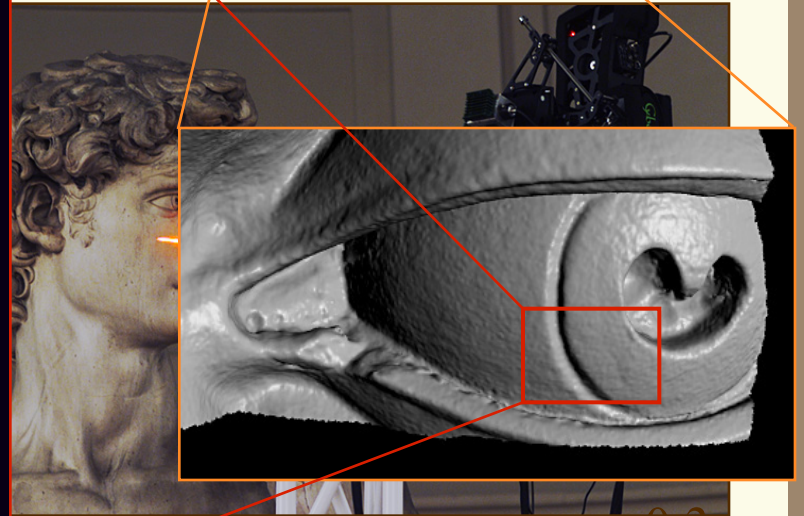
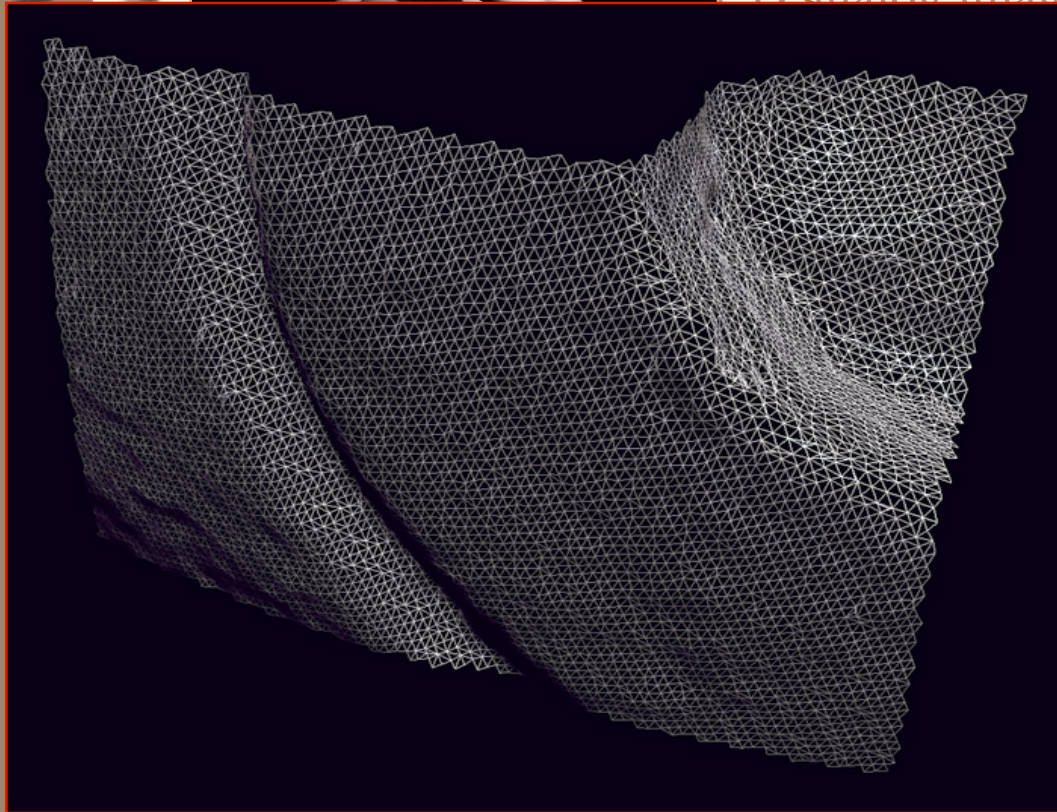


3mm
mesh

mouse, joystick, track
CD analog image sens
sensor
magi



1mm



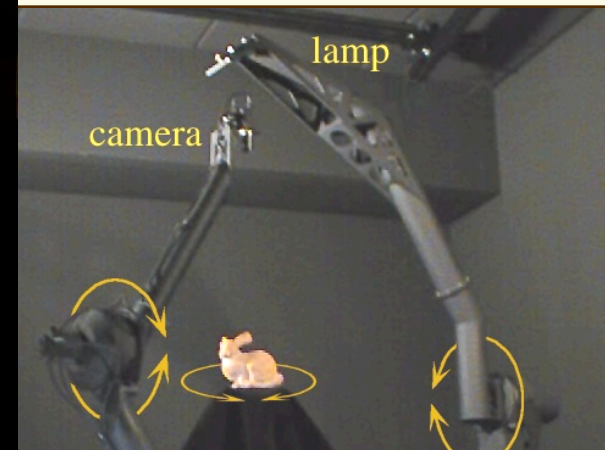
0.3mm

©2008 Marc Levoy

Input hardware

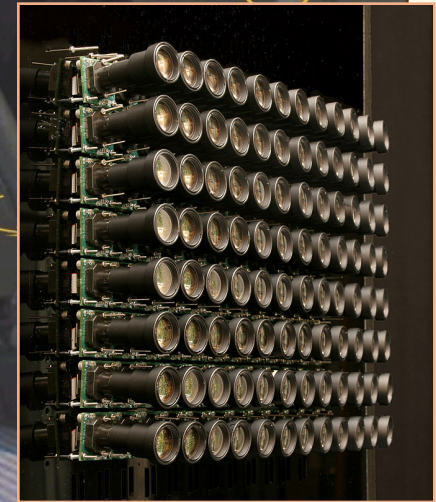
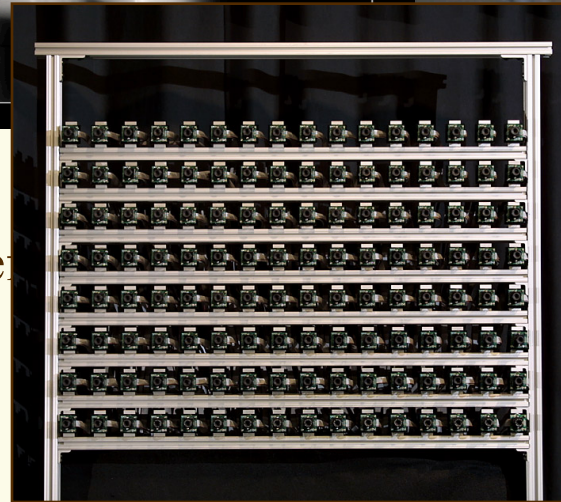
2D

- light pen, tablet
- 1970s & 80s - C
- 1990s & 2000's
 - high-dynam
 - cell phone c



3D

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



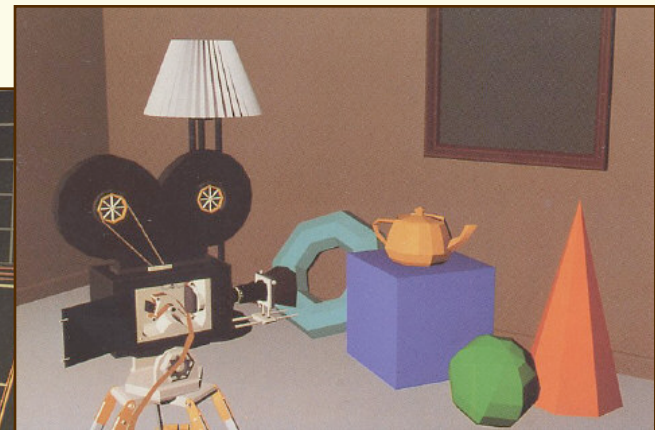
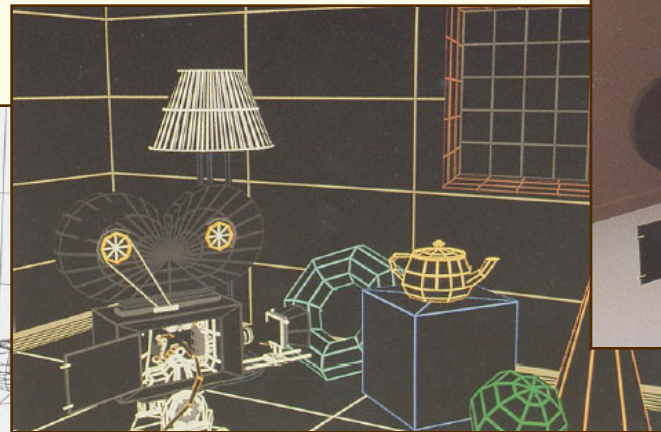
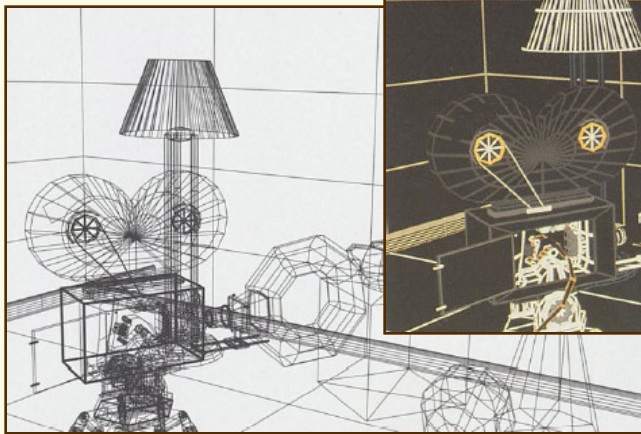
4D and higher

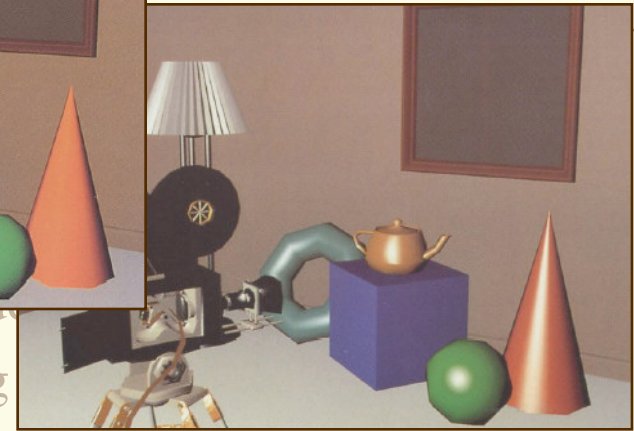
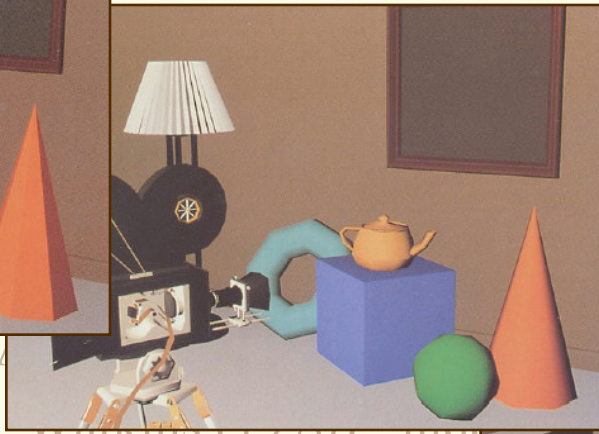
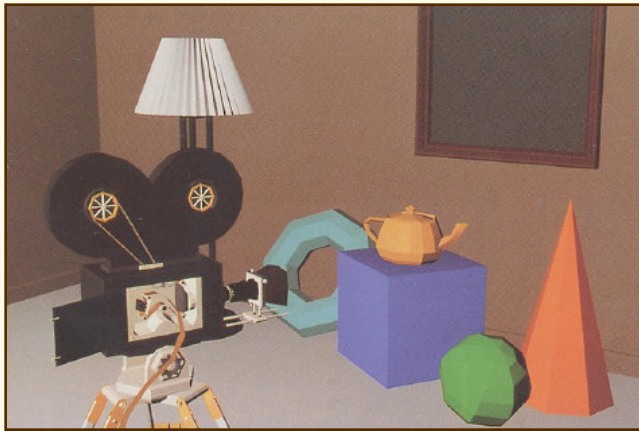
- multiple cameras
- multi-arm gantries

Rendering

1960s - the visibility problem

- Roberts (1963), Appel (1967) - hidden-line algorithms
- Warnock (1969), Watkins (1970) - hidden-surface algorithms
- Sutherland (1974) - visibility = sorting

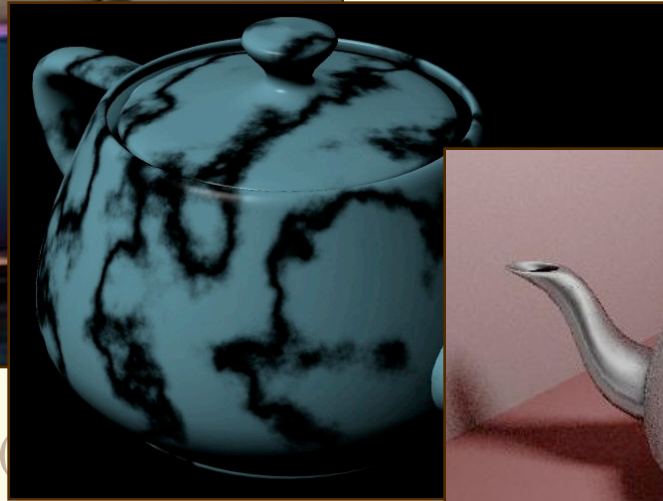




- Roberts (1963),
- Warnock (1969),
- Sutherland (1974) - visibility = sorting

1970s - raster graphics

- Gouraud (1971) - diffuse lighting
- Phong (1974) - specular lighting
- Blinn (1974) - curved surfaces, texture
- Catmull (1974) - Z-buffer hidden-surface algorithm
- Crow (1977) - anti-aliasing



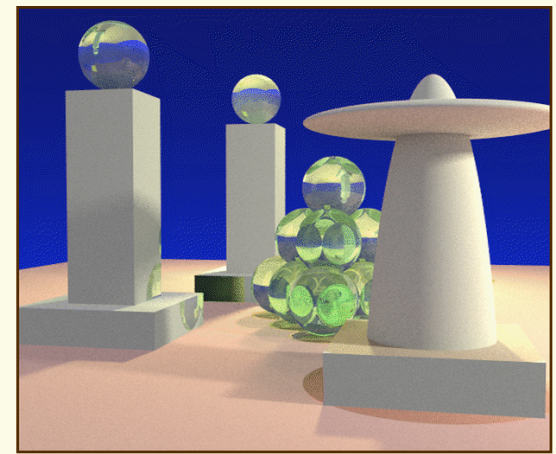
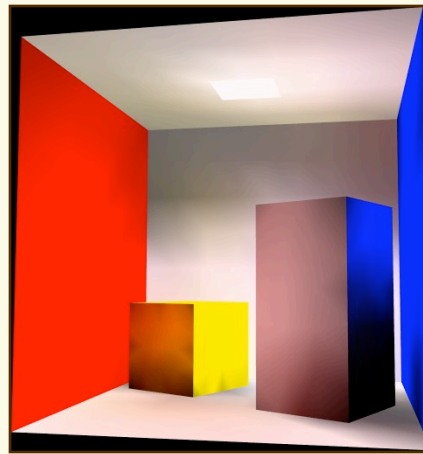
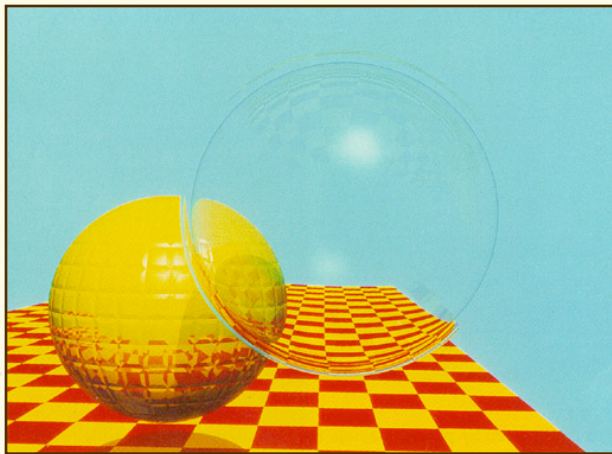
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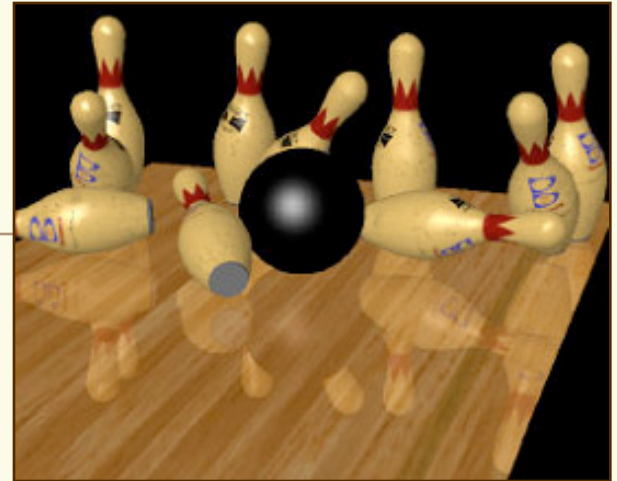
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early 1980s - global illumination

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





- Whitted (1980) - ray
- Goral, Torrance et al. (1984) - global illumination
- Kajiya (1986) - the

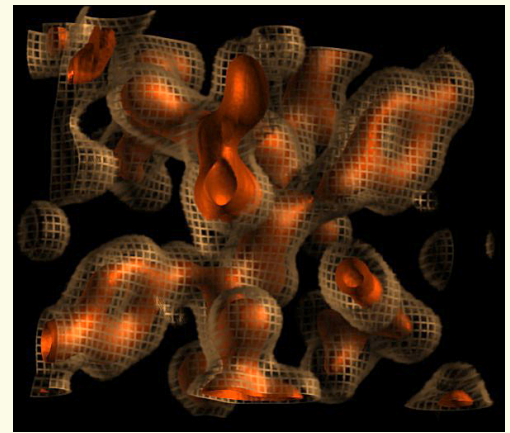
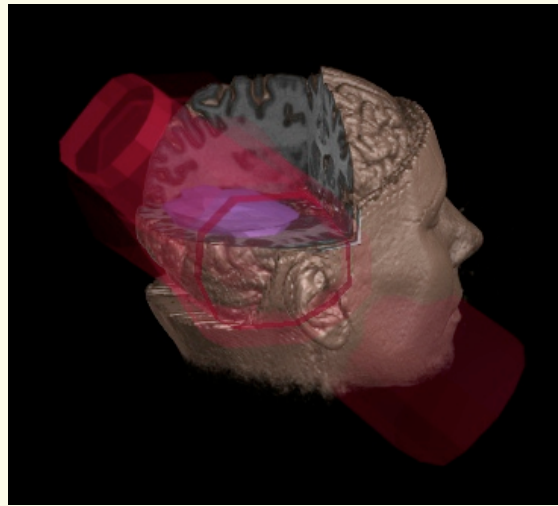
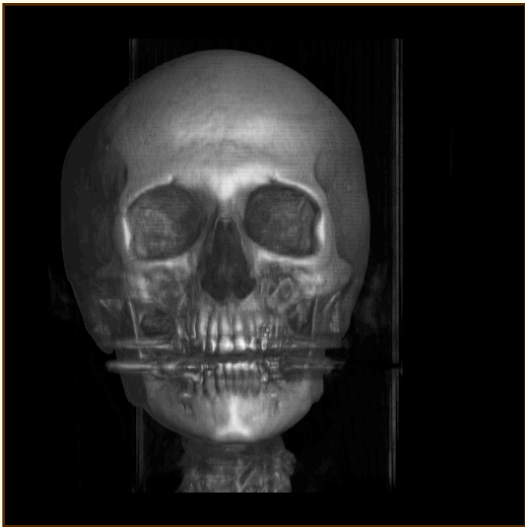
(1985) - radiosity

late 1980s - photorealism

- Cook (1984) - shade trees
- Perlin (1985) - shading languages
- Hanrahan and Lawson (1990) - RenderMan
→ shaders

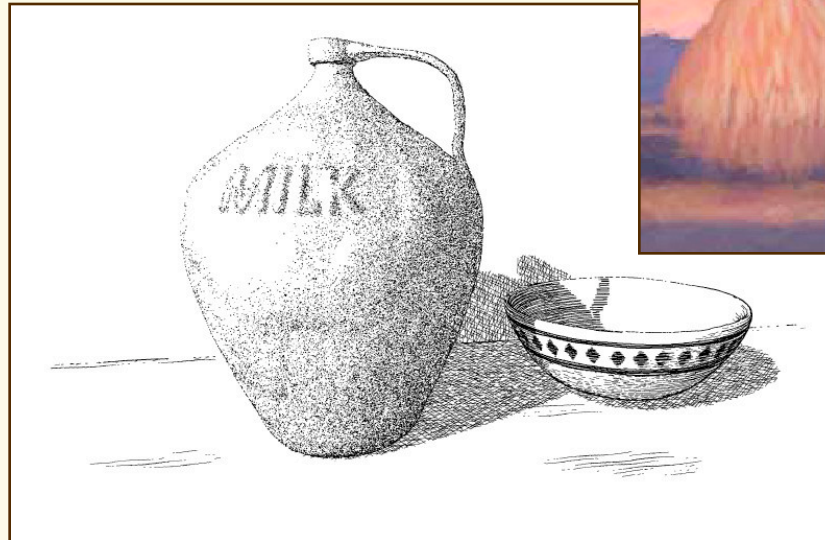
early 1990s - non-photorealistic rendering

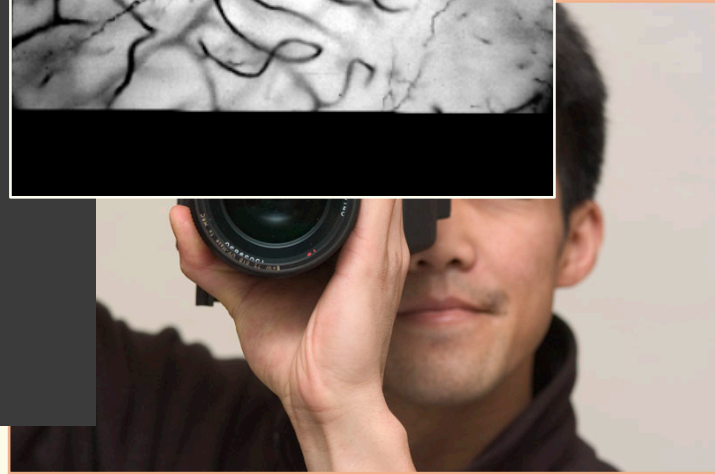
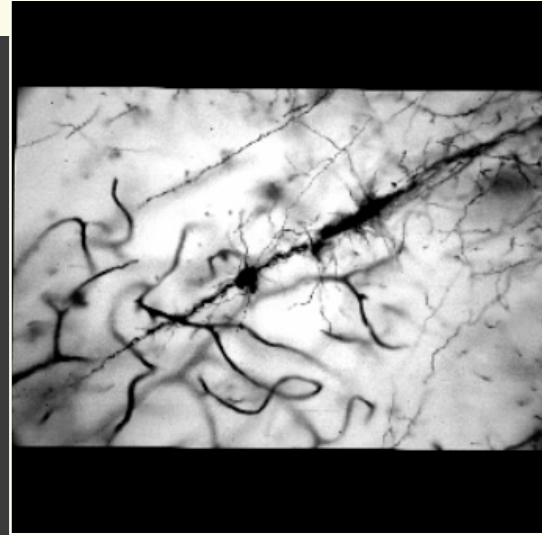
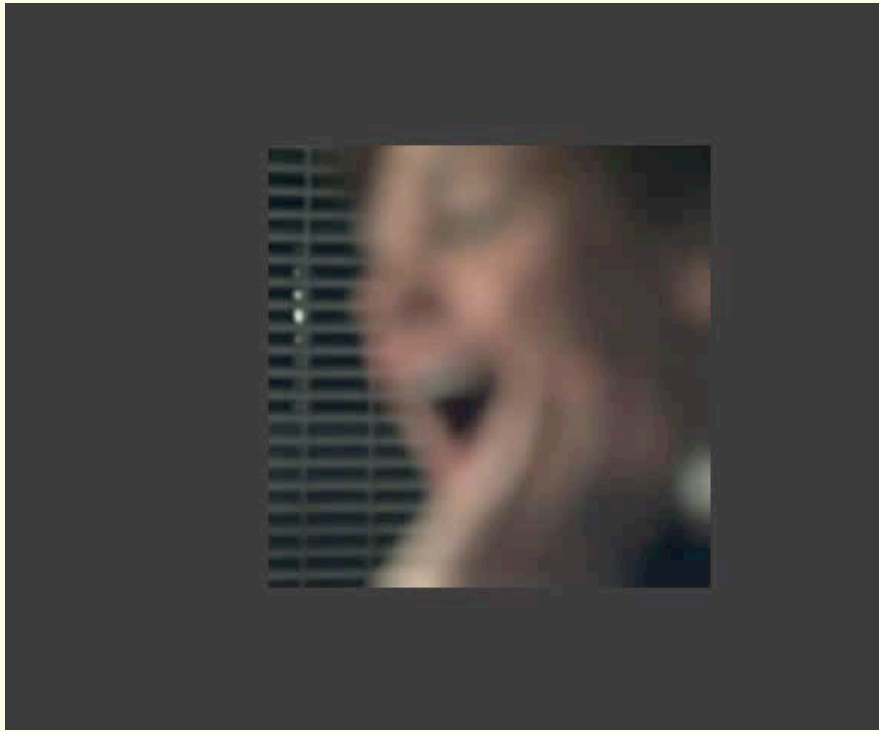
- Drebin et al. (1988), Levoy (1988) - volume rendering
- Haeberli (1990) - impressionistic paint programs
- Salesin et al. (1994-) - automatic pen-and-ink illustration
- Meier (1996) - painterly rendering



early 1990s - non-photorealistic rendering

- Drebin et al. (1988), Levoy (1988) - volume rendering
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late 1990s - image-based rendering

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