History of computer graphics

CS 248 - Introduction to Computer Graphics

Autumn quarter, 2002

Slides for September 26 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
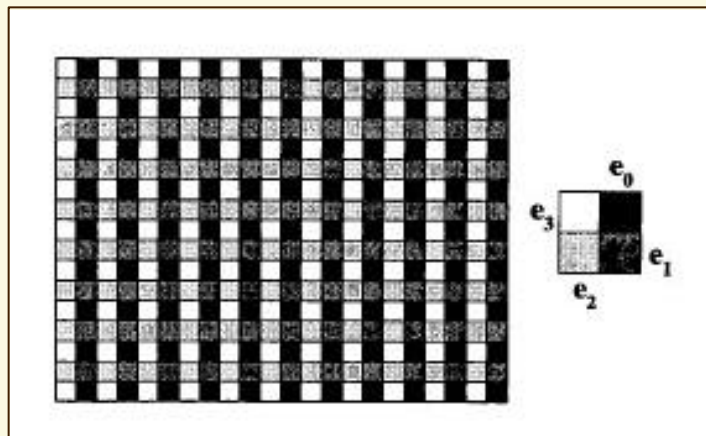- 2000s – micro-mirror projectors ?   digital cinema

other

- stereo, head-mounted displays
- autostereoscopic displays
- tactile, haptic, sound

? ?????Marc Levoy

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

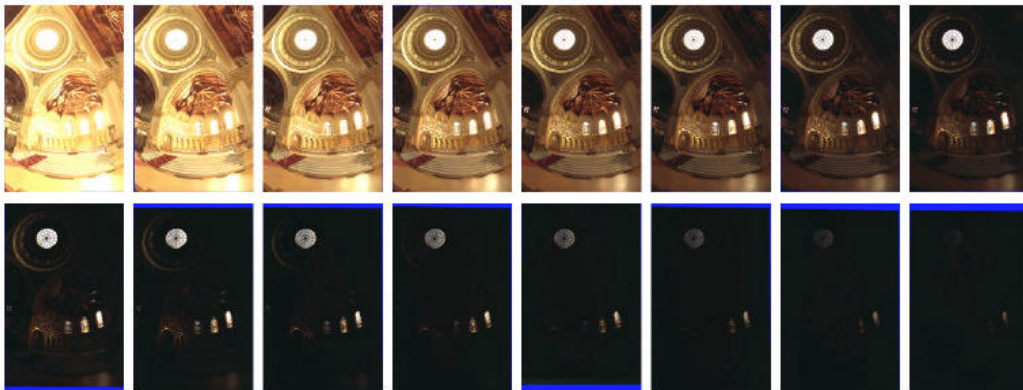? high-X imaging (dynamic range, resolution, depth of field,…)
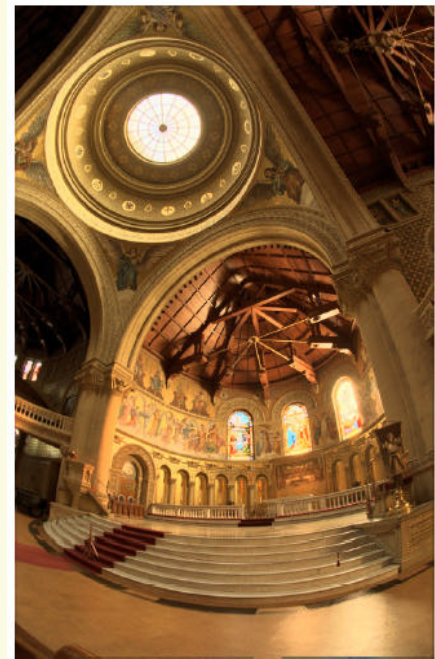

[Nayar00]

negative film = 130:1 (7 stops)

paper prints   = 46:1

[Debevec97] = 250,000:1 (18 stops)

?

Input hardware

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? high-X imaging (dynamic range, resolution, depth of field,…)

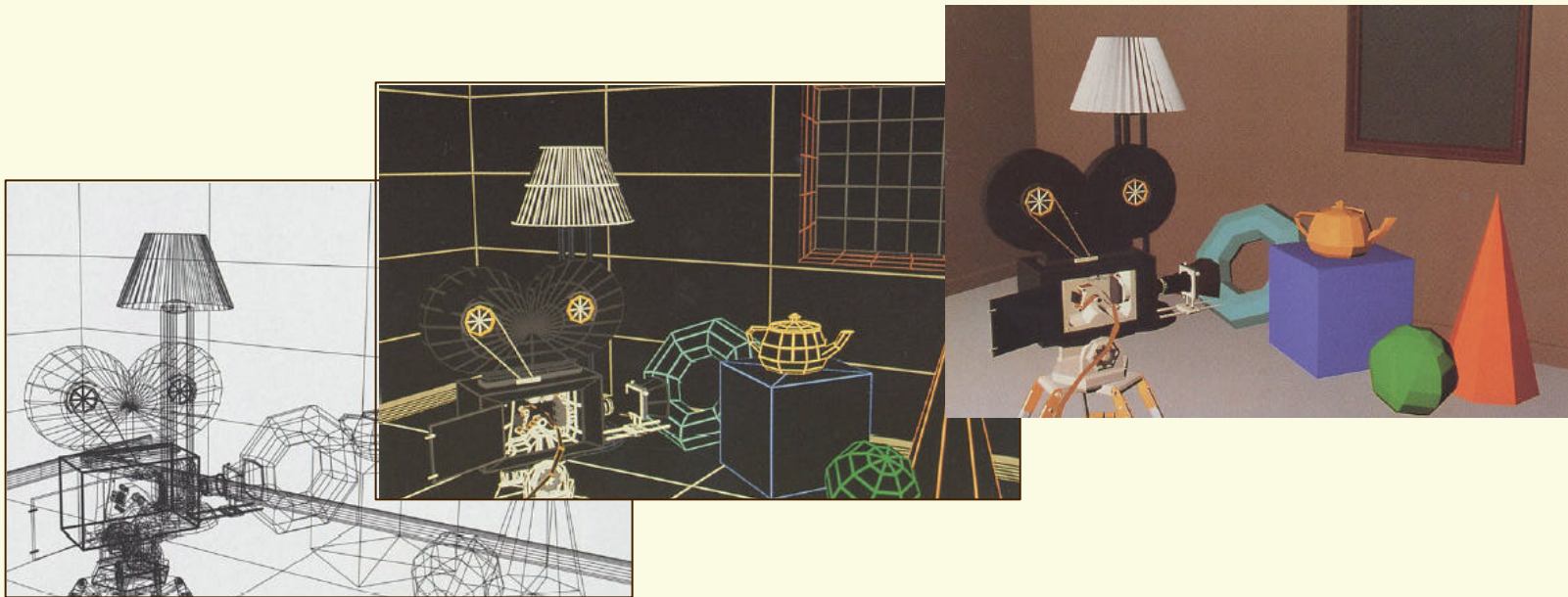3D

– 3D trackers
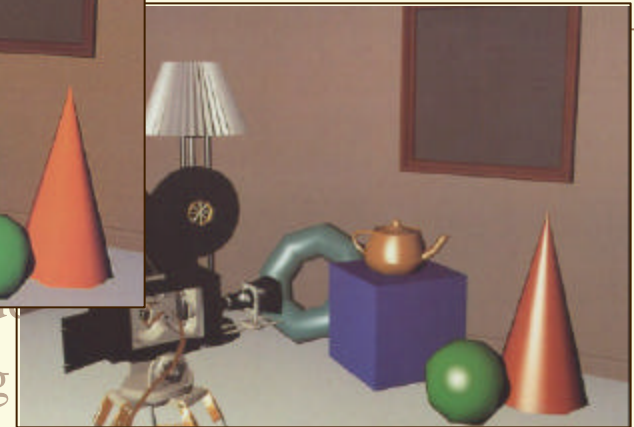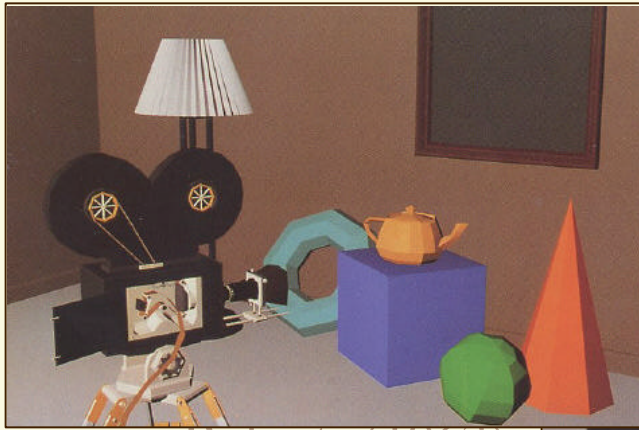
– multiple cameras

– active rangefinders

other

– data gloves

– voice

Rendering

1960s - the visibility problem

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

? ?????Marc Levoy

– Roberts (1963),
– Warnock (1969), Watkins (1970) - hidden
– 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
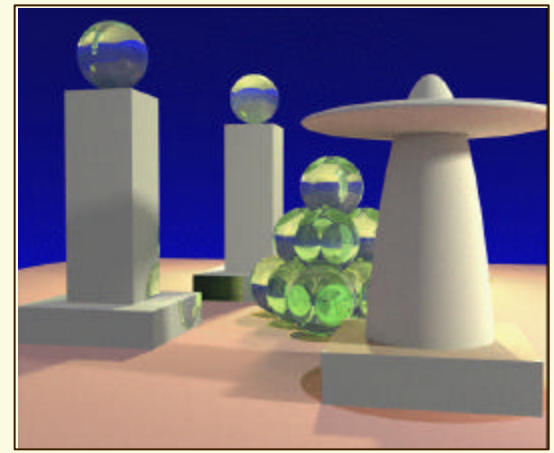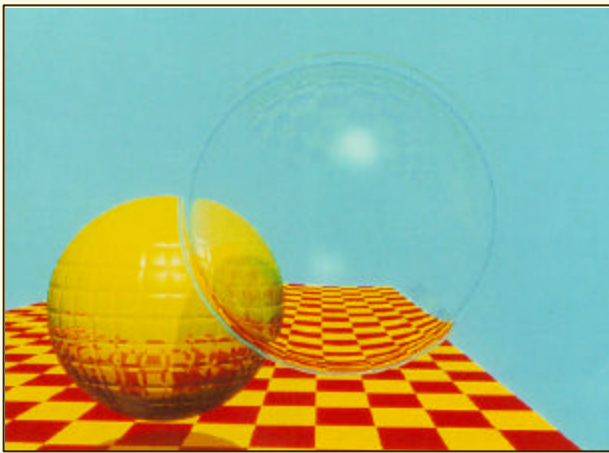
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– Sutherland (...

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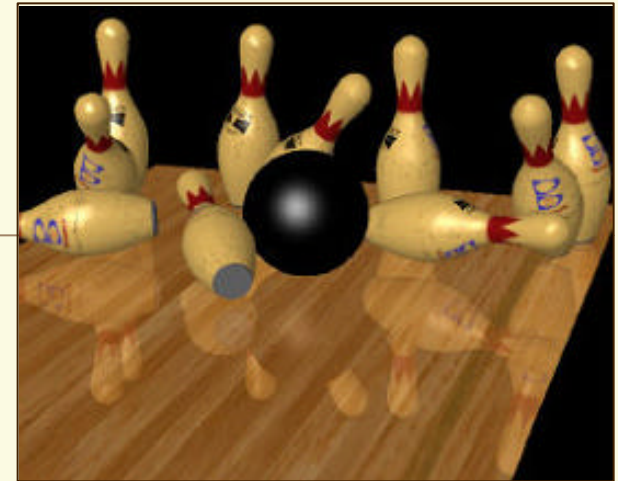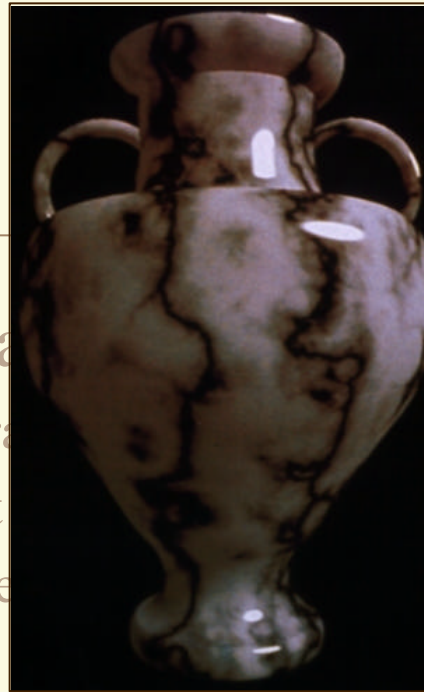
– Crow (1977) - anti-aliasing

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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– Goral, Torrance et 985) - radiosity

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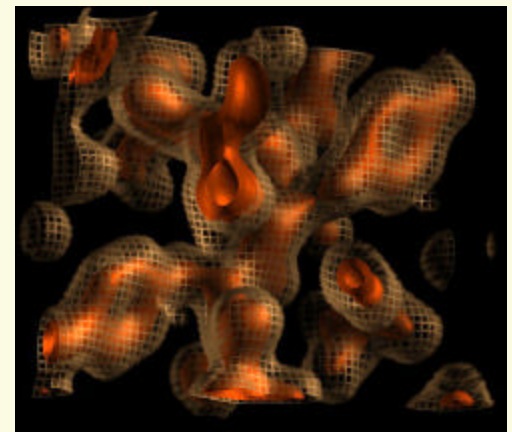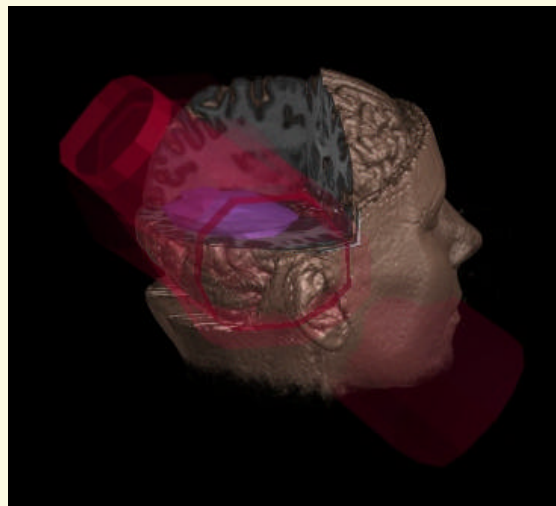# late 1980s - photorealism

– Cook (1984) - shade trees

– Perlin (1985) - shading languages

– Hanrahan and Lawson (1990) - RenderMan

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
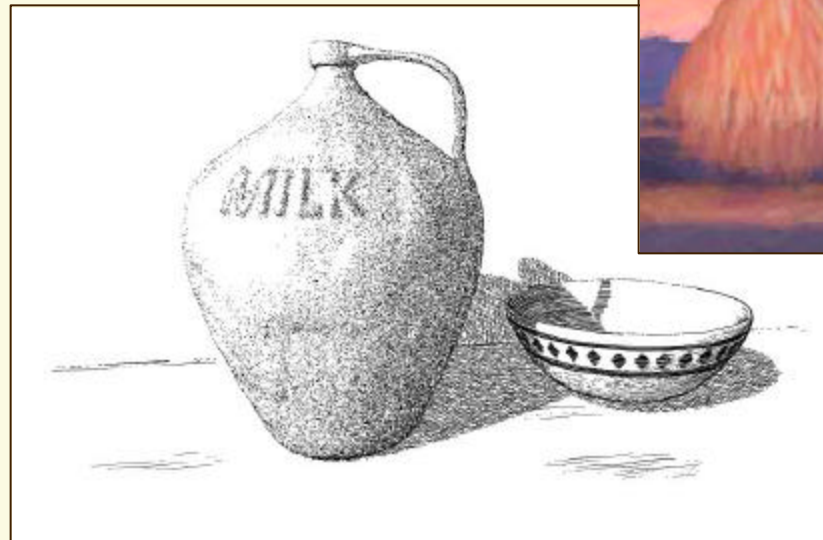
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The graphics pipeline

modeling	→	animation	→	rendering

Modeling

polygons

constructive solid geometry

parametric surfaces

implicit surfaces

subdivision surfaces

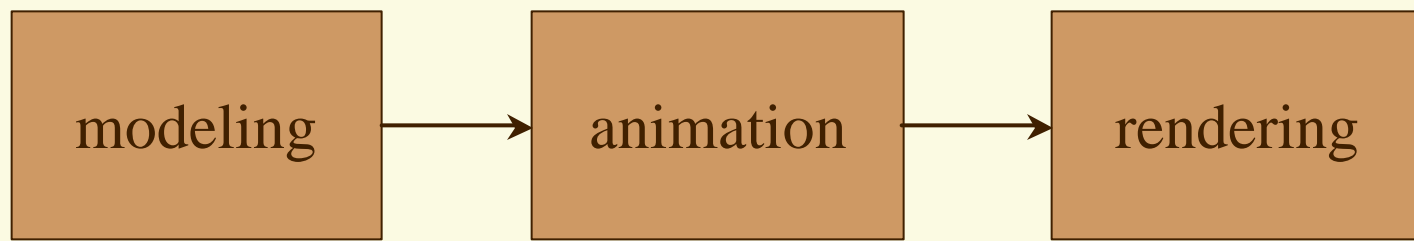particle systems

volumes

Animation
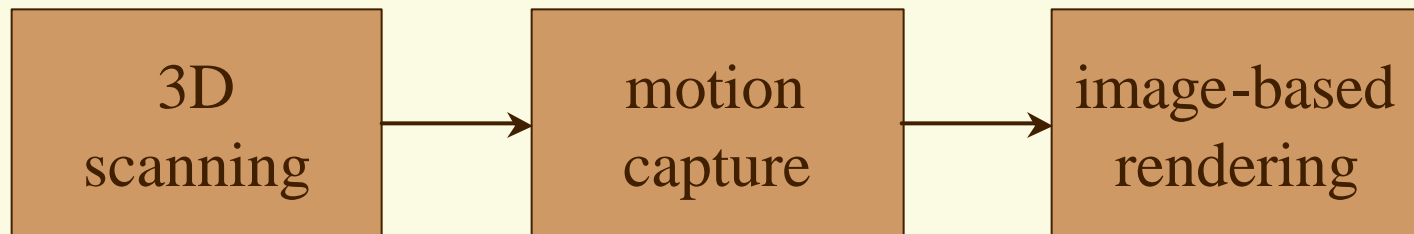
scripted

key-frame interpolation

inverse kinematics

dynamics

The graphics pipeline

the traditional pipeline

modeling	→ animation →	rendering

the new pipeline?

3D scanning	→ motion capture →	image-based rendering

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– Salesin et al. (1994-) - automatic pen-and-ink illustration

– 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