

HY416 ΓΡΑΦΙΚΑ ΥΠΟΛΟΓΙΣΤΩΝ

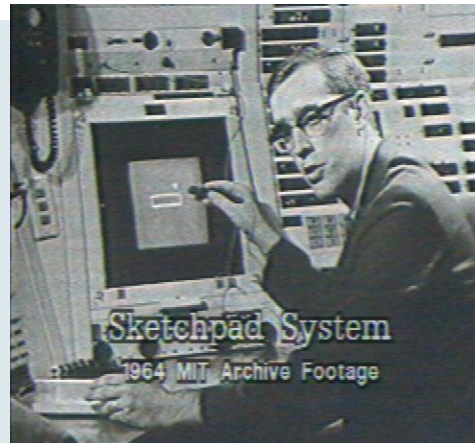
Ιστορία Γραφικών ΗΥ

Π. ΤΣΟΜΠΑΝΟΠΟΥΛΟΥ

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

ΤΜΗΜΑ ΗΛΕΚΤΡΟΛΟΓΩΝ ΜΗΧΑΝΙΚΩΝ & ΜΗΧΑΝΙΚΩΝ ΥΠΟΛΟΓΙΣΤΩΝ

Ivan Sutherland (1963) - SKETCHPAD



- ▶ pop-up menus
- ▶ constraint-based drawing
- ▶ hierarchical modeling

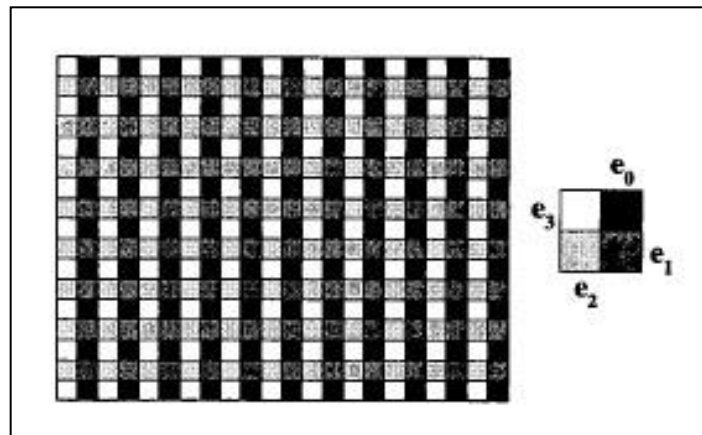
Display hardware

- ▶ **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

Input hardware

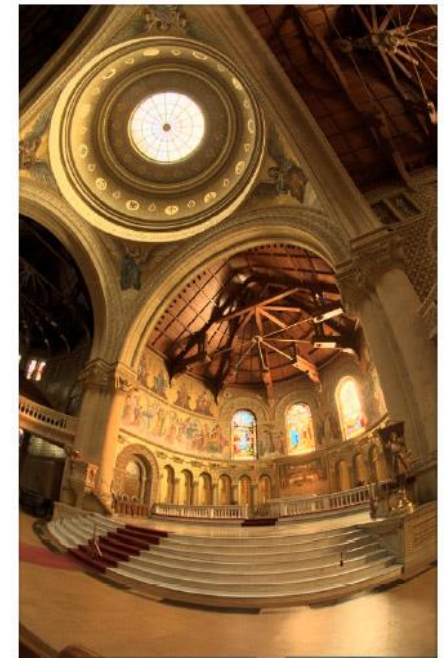
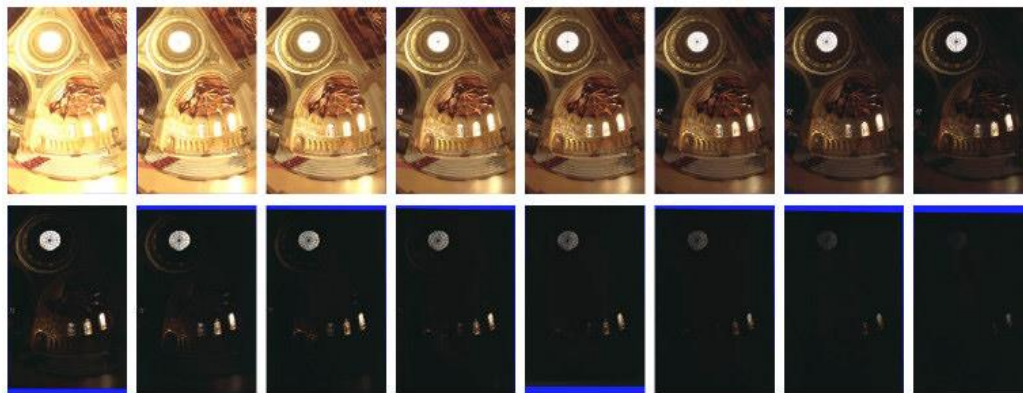
► 2D

- 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)



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▶ 3D

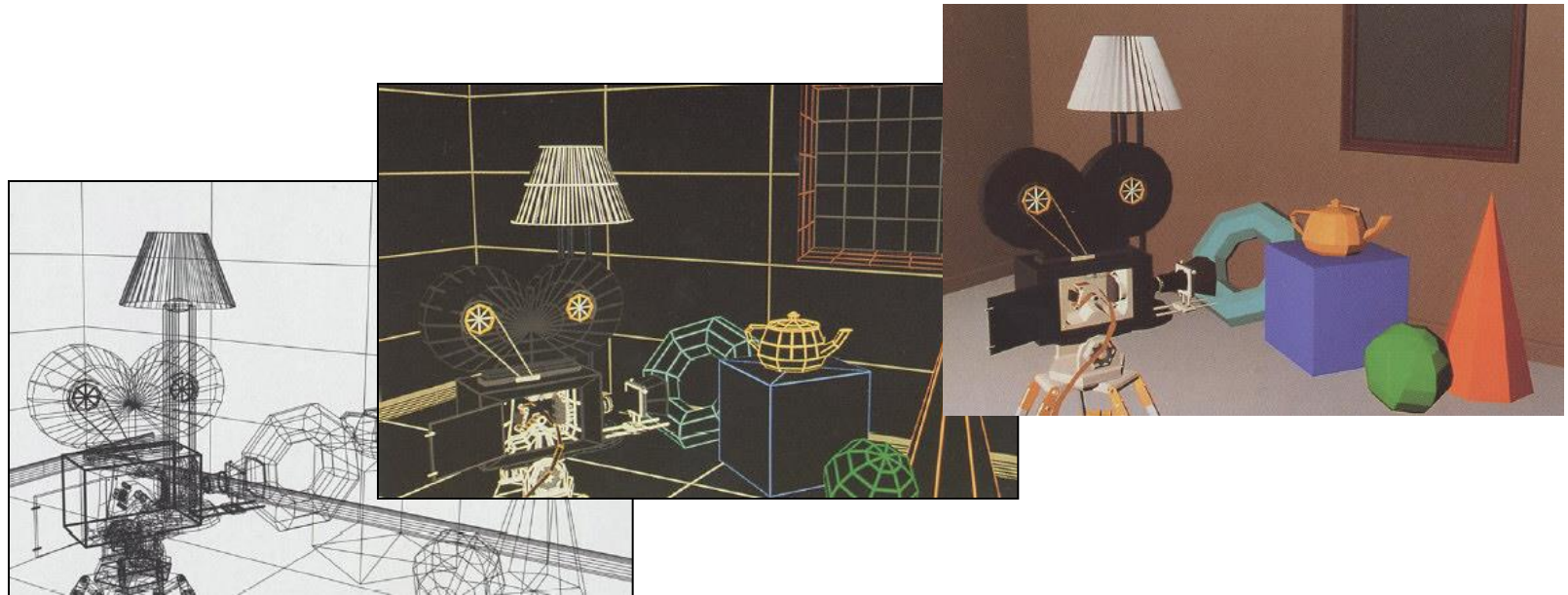
- ▶ 3D trackers
- ▶ multiple cameras
- ▶ active rangefinders

▶ other

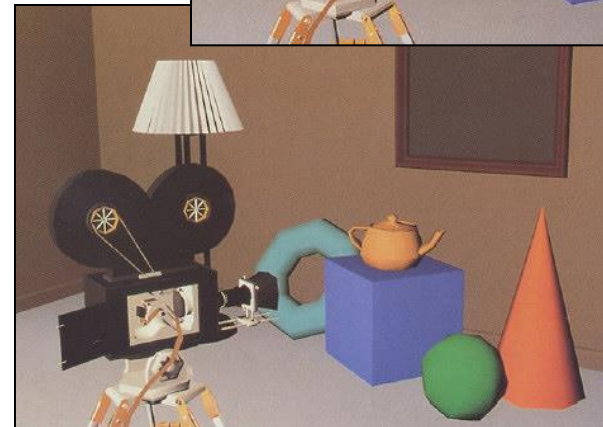
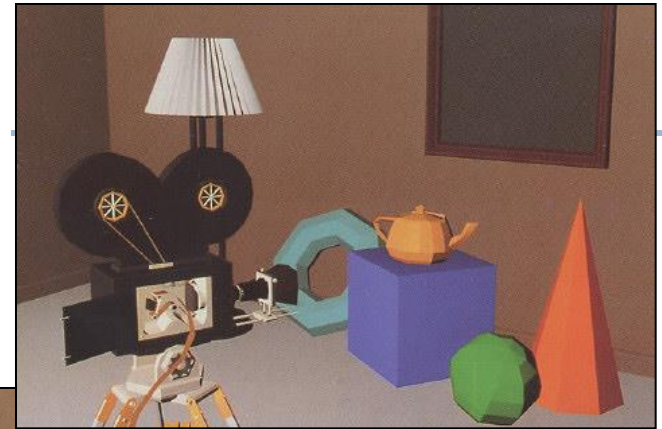
- ▶ data gloves
- ▶ voice

Rendering

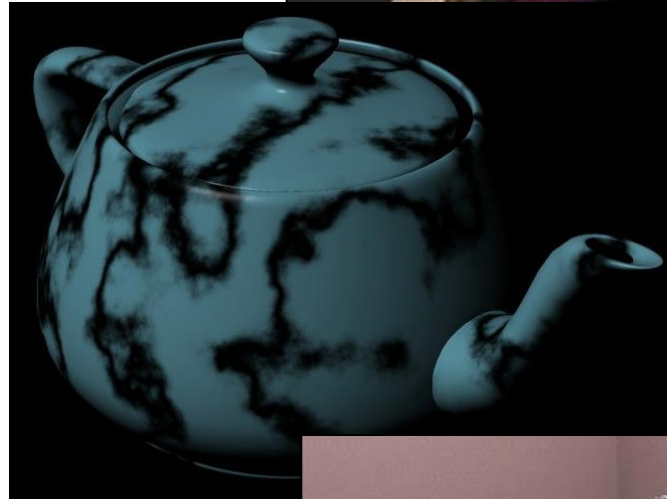
- ▶ 1960s - the visibility problem
 - ▶ Roberts (1963), Appel (1967) - hidden-line algorithms
 - ▶ Warnock (1969), Watkins (1970) - hidden-surface algorithms
 - ▶ Sutherland (1974) - visibility = sorting



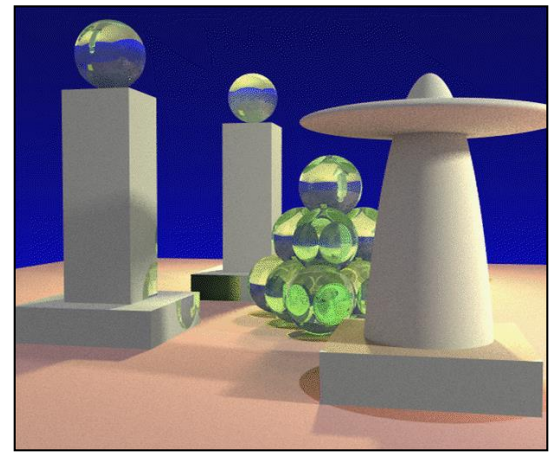
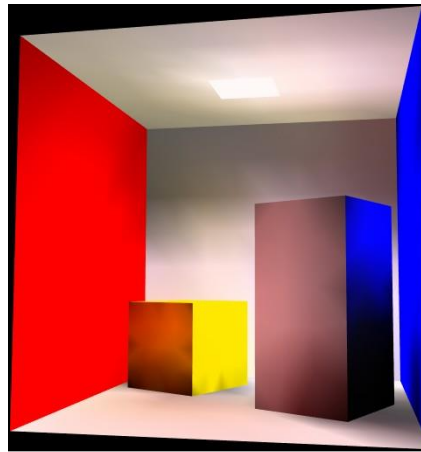
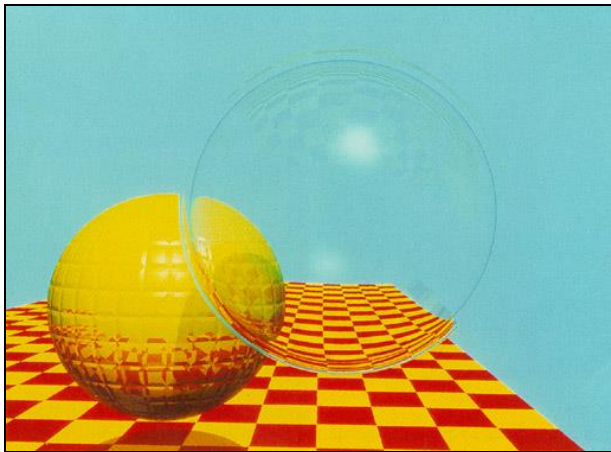
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- ▶ 1970s - raster graphics
 - ▶ Gouraud (1971) - diffuse lighting
 - ▶ Phong (1974) - specular lighting
 - ▶ Blinn (1974) - curved surfaces, texture
 - ▶ Crow (1977) - anti-aliasing



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 - ▶ Catmull (1974) - Z-buffer hidden-surface algorithm
 - ▶ Crow (1977) - anti-aliasing



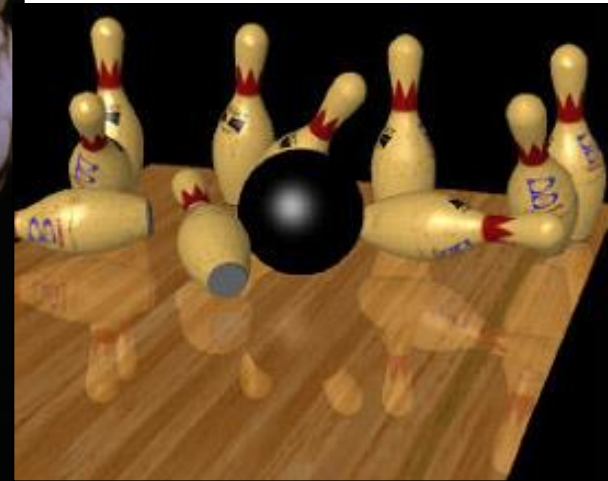
- ▶ early 1980s - global illumination
 - ▶ Whitted (1980) - ray tracing
 - ▶ Goral, Torrance et al. (1984), Cohen (1985) - radiosity
 - ▶ Kajiya (1986) - the rendering equation



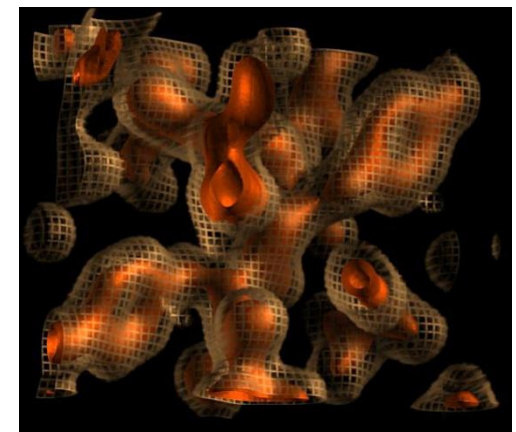
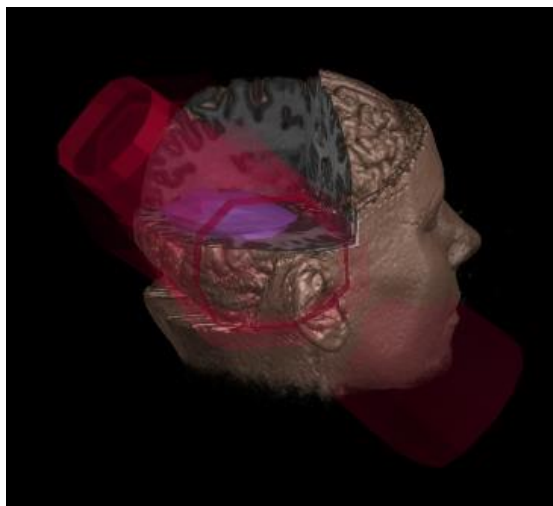
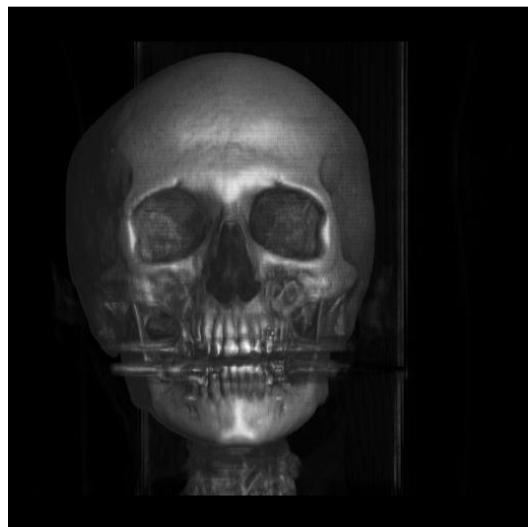
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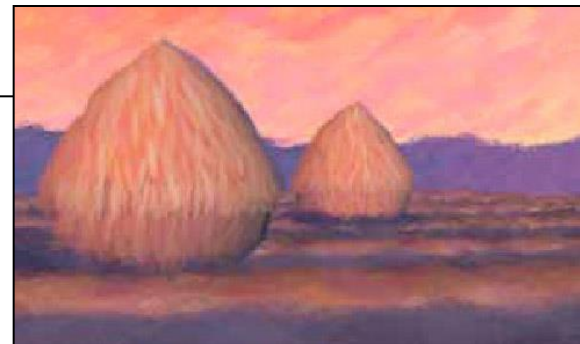
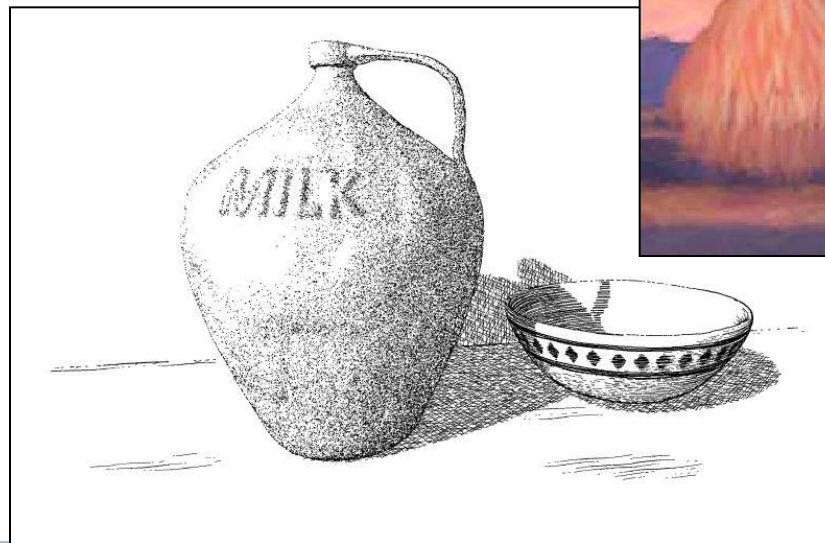
- ▶ late 1980s - photorealism
 - ▶ Cook (1984) - shade trees
 - ▶ Perlin (1985) - shading languages
 - ▶ Hanrahan and Lawson (1990) - RenderMan



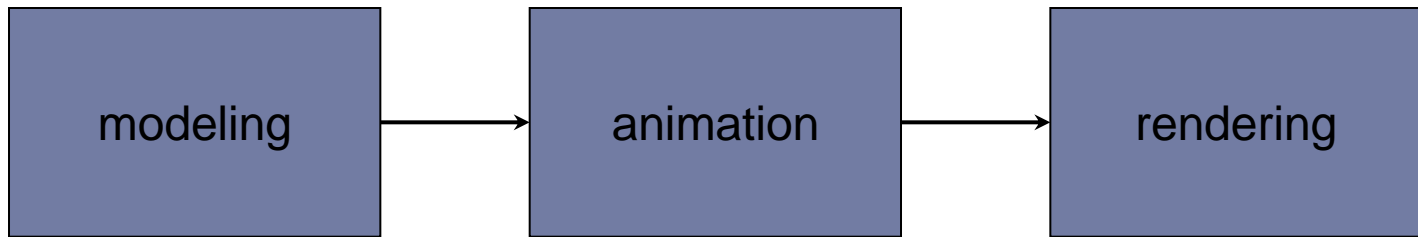
-
- ▶ early 1990s - non-photorealistic rendering
 - ▶ Drebin et al. (1988), Levoy (1988) - volume rendering
 - ▶ Haeberli (1990) - impressionistic paint programs
 - ▶ Salesin et al. (1994-) - automatic pen-and-ink illustration
 - ▶ Meier (1996) - painterly rendering



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The graphics pipeline



Modeling

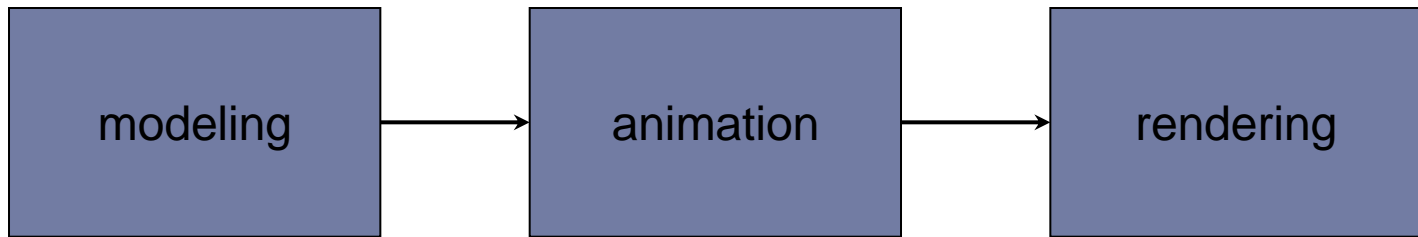
- ▶ polygons
- ▶ constructive solid geometry
- ▶ parametric surfaces
- ▶ implicit surfaces
- ▶ subdivision surfaces
- ▶ particle systems
- ▶ volumes

Animation

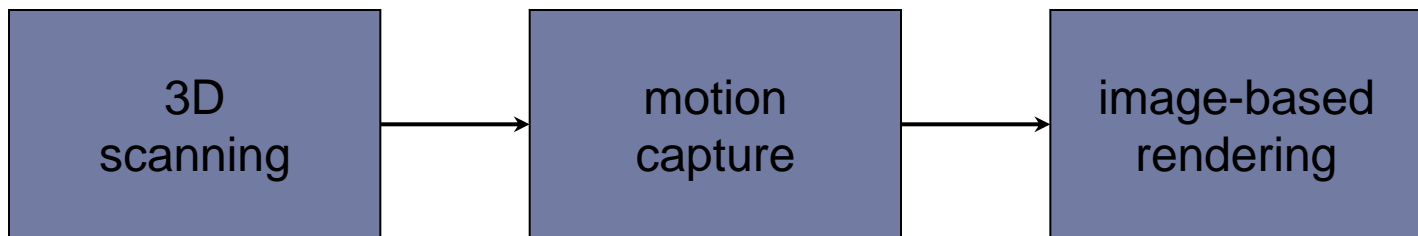
- ▶ scripted
- ▶ key-frame interpolation
- ▶ inverse kinematics
- ▶ dynamics

The graphics pipeline

the traditional pipeline



the new pipeline?



-
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 - ▶ Haeberli (1990) - impressionistic paint programs
 - ▶ 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

Ερωτήσεις

- ▶ Ιστοσελίδα μαθήματος (ενεργοποιημένη) :
<http://support.inf.uth.gr/courses/CE416/>
<http://eclass.uth.gr/eclass/MHX101/>
- ▶ E-mail λίστα του μαθήματος:
ce416@inf-server.inf.uth.gr
...και μέσω eclass...
- ▶ Π. Τσομπανοπούλου, Ε3-12, yota@uth.gr