Graphics and animation

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2-D graphics

Image creation based on two-dimensional geometric models

Typography, cartography, technical drawing, advertising

Small file size and presentation flexibility

- **Geometric models**
- **Digital images**
- **Typeset**
  (font style, size, position, orientation)
- **Mathematical expressions**

Geometric transforms (translation, rotation, scaling)

Layering

Vector graphics

Primary geometric shapes
- **points, lines, curves, polygons, arcs**
- **fonts**
- **mathematical expressions**

- **Concise information**
- **Magnification**
- **Appearance transforms**
- **Geometric transforms**

HTML5 canvas

Container for graphics

A canvas is a rectangular area on an HTML page

```
<canvas id="myCanvas" width="500" height="200" style="border:1px solid #03d333;">
```

Draw graphics on a web page via Javascript

Shapes / Images

- **Line (poly)**
- **Circle (arc)**
- **Rectangle**
- **Text**
- **Algebraic (Bezier) curve**
- **Static image**
- **Animated image**
- **Rotation (clock)**
- **Planet (2-D) motion**
- **Interactivity**

Scalar Vector Graphics

SVG defines vector-based graphics in XML format
Animation and interactivity

Shapes
- **Lines**
- **Rectangle**
- **Circle and ellipse**
- **Polygons and algebraic curves**
- **Circle over image**
- **Circles in motion**
- **Planet motion**
- **Static wave**

Filters
- **Blend**
- **Coloring**
- **Illumination**
- **Morphology**
- **Fading**
- **Grading**

2-D animation

Rapid succession of sequential images

Object motion, with/without background change

Lighting / Color change

Key-frames

Frame interpolation (in-betweens)

Procedural animation

- **describes the motion algorithmically**
- **function of small number of parameters**

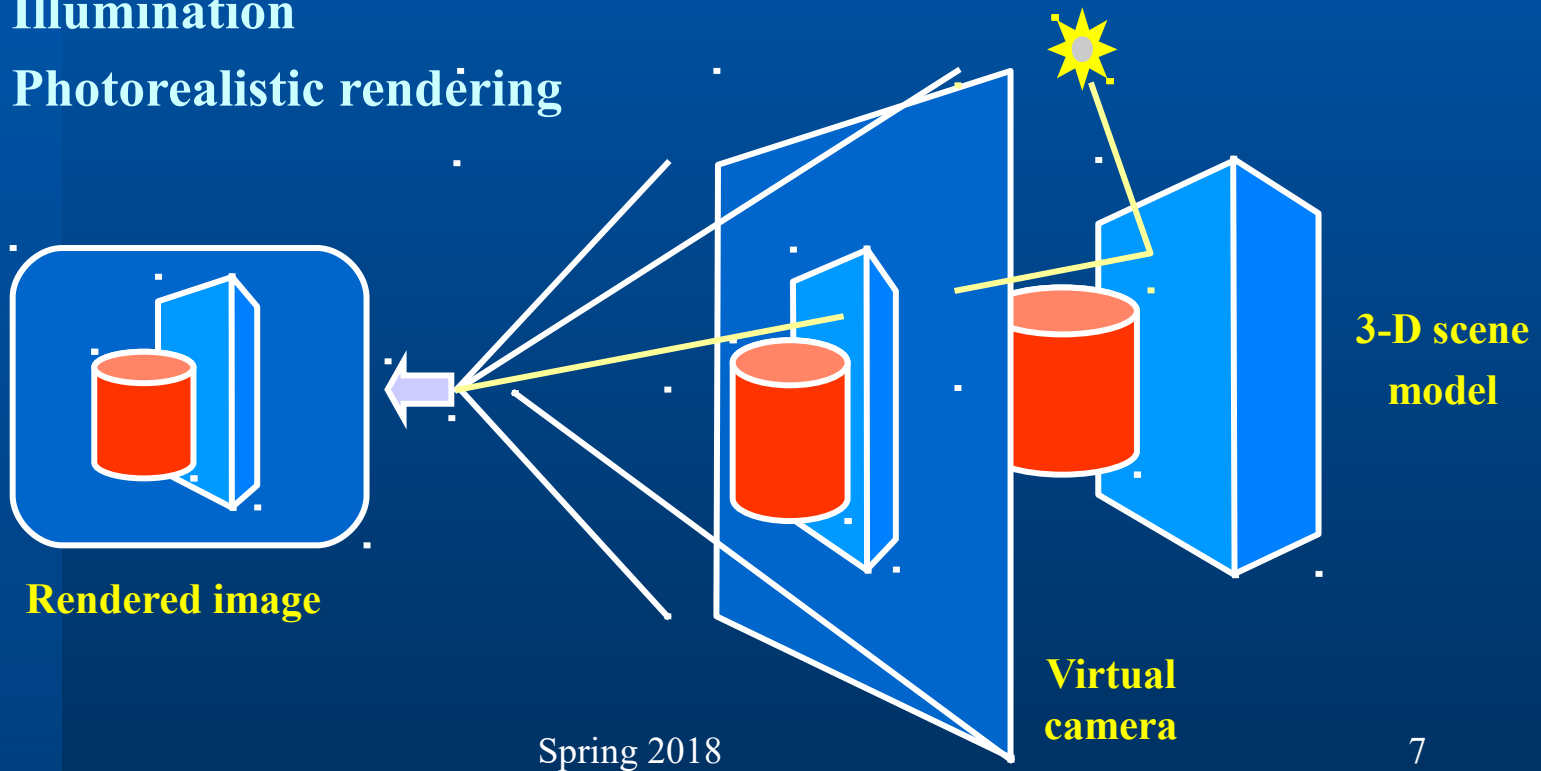
3-D graphics

3-D geometric model

Scene composition

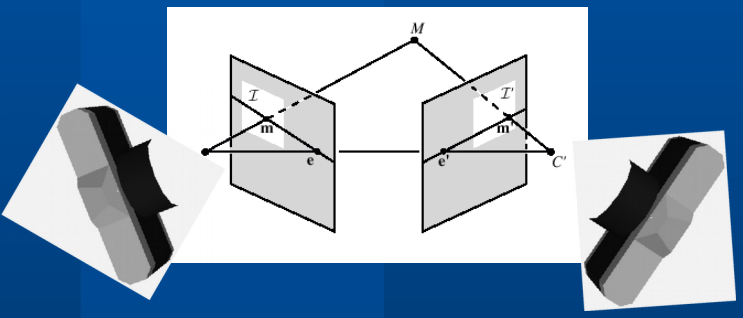
Illumination

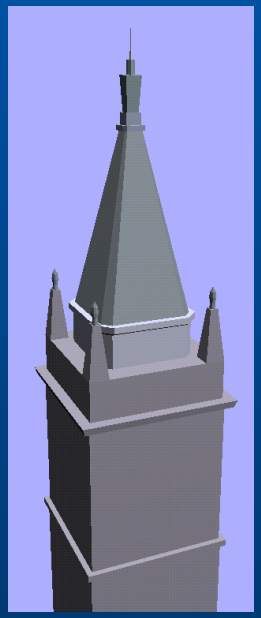
Photorealistic rendering

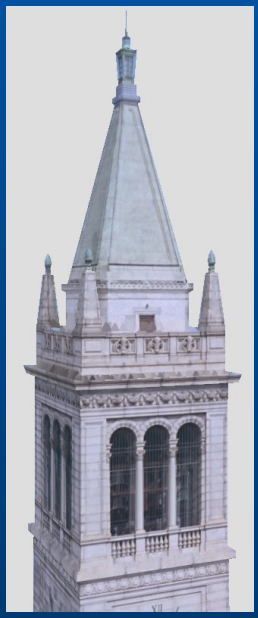


3-D graphics

- 3-D geometric shapes
- 3-D scanning
- 3-D reconstruction





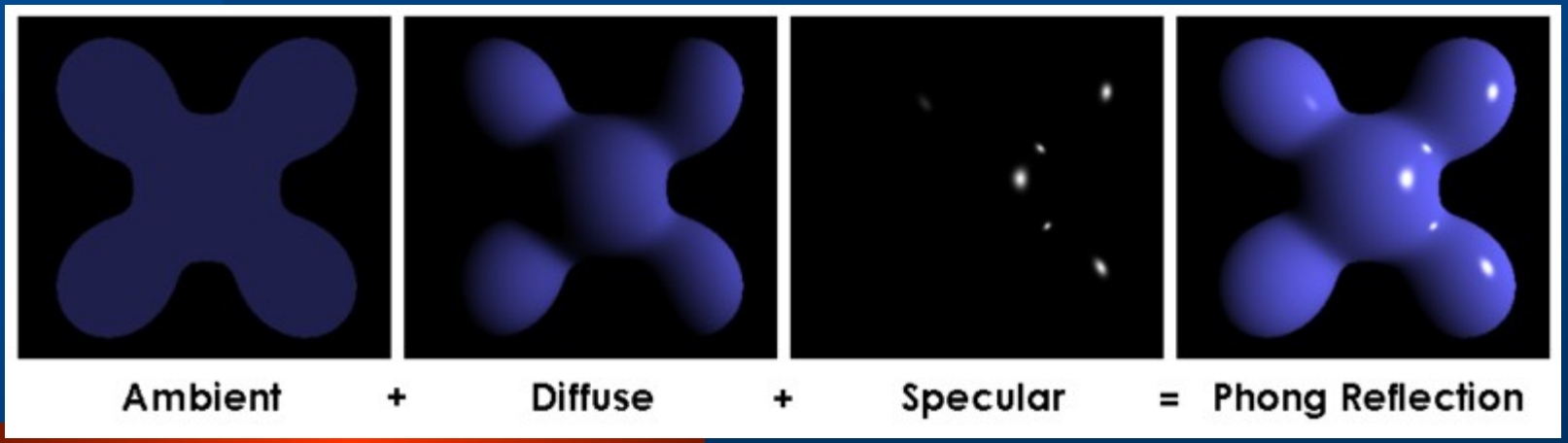


Φωτογραφία **Model** **Projection** **Composition**

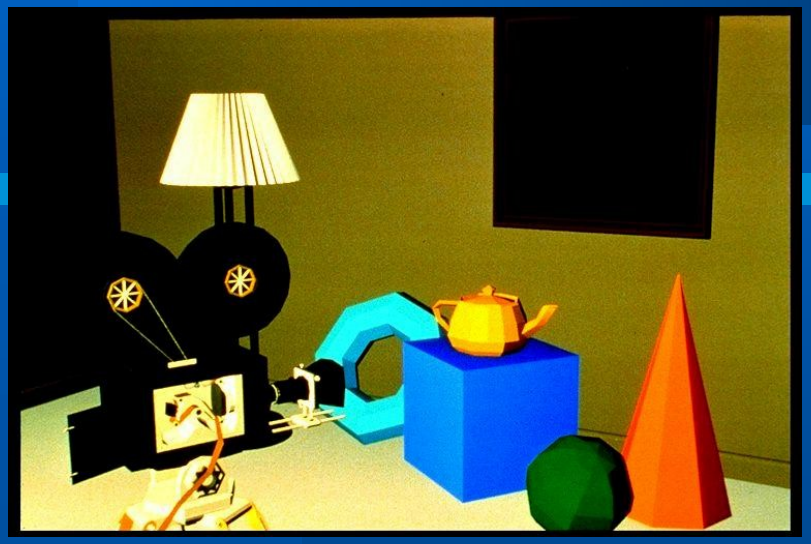
Illumination

- Homogeneous lighting
- Diffuse reflection (Lambertian)

  $L(a,b,\alpha,\beta) = L(a,b) = \rho \langle I, N(a,b) \rangle$
- Attenuation with distance
- Combination of ambient, diffuse and specular lighting
- Color components

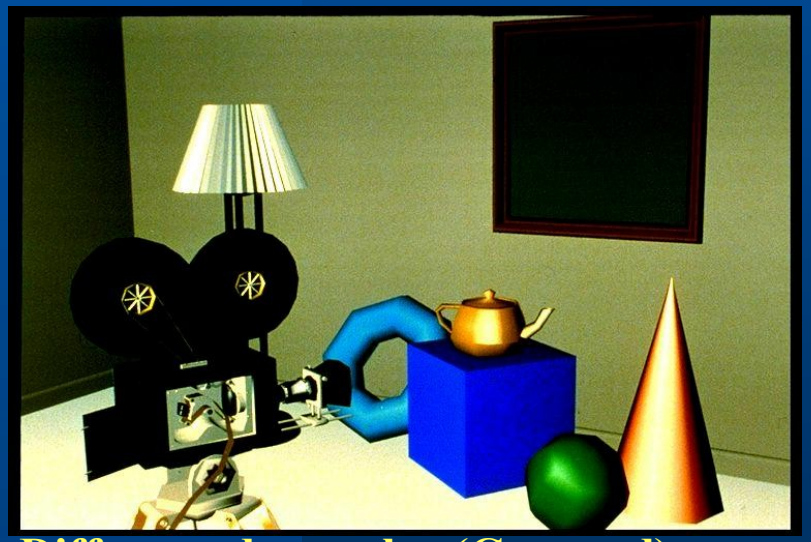


Photorealistic rendering



Polygon-wise constant

Diffuse (Gouraud)



Diffuse and specular (Gouraud)

Diffuse and specular (Phong)

3-D animation

Model

scene description and motion model

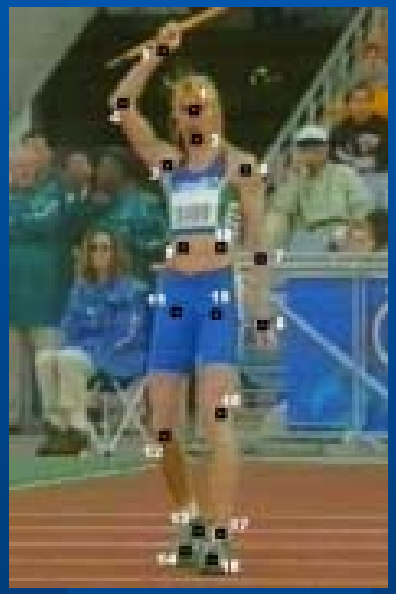
Rendering

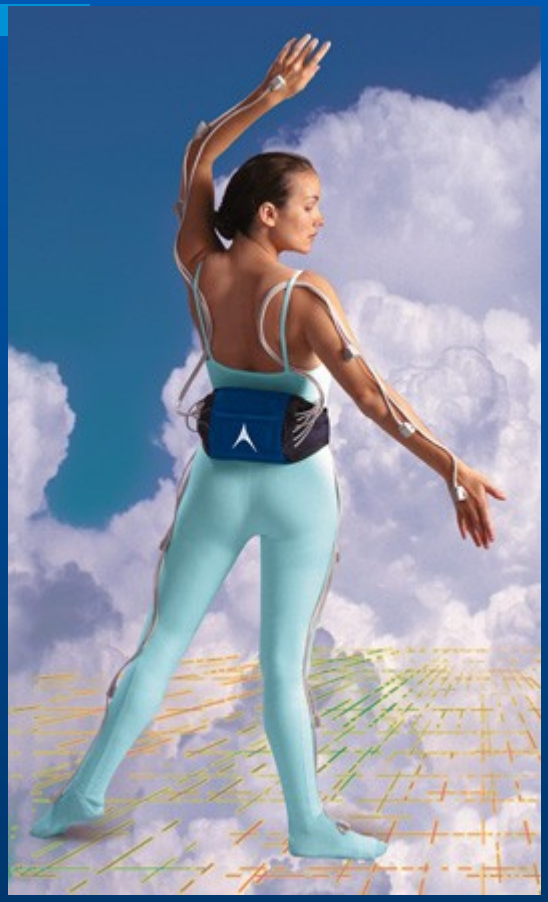
3-D rotation

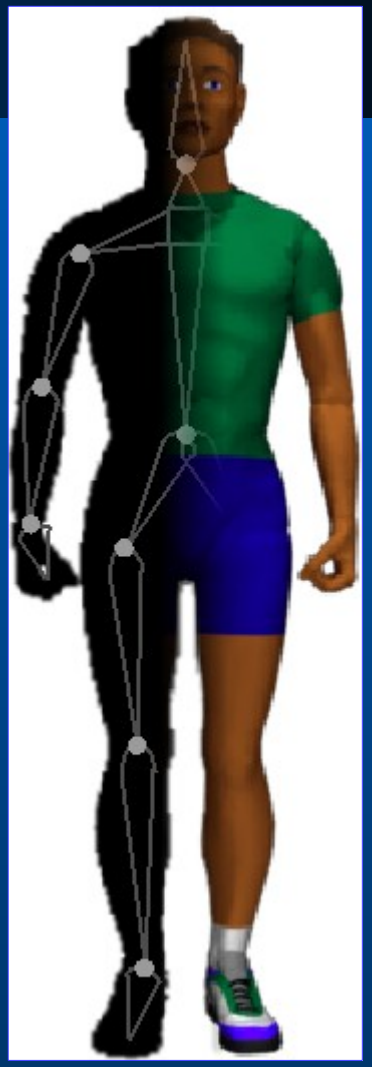
Photorealistic rendering

smooth movement perception (low-pass filter)

Articulated model







Articulated motion