3D Illustrative Effects for Animating Line Drawings

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Overview

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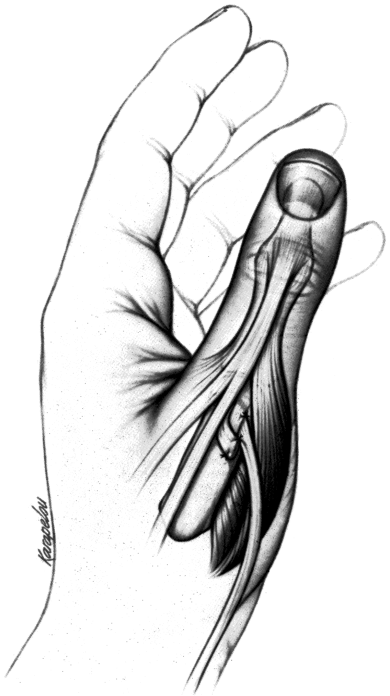
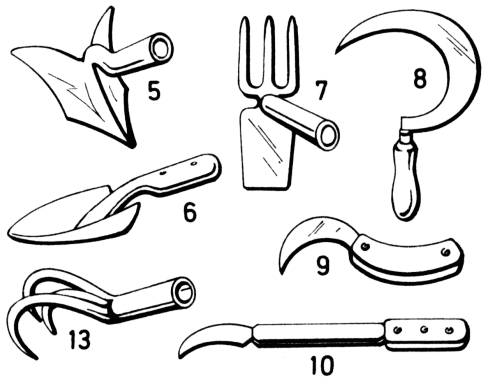
2. Illustrative Effects
3. Line Drawings
4. Line Drawing Animation System
5. Example Videos
6. Conclusion

Motivation and Goals

- traditional illustrations in print media
- examples: medical and technical illustrations
- visualization by changing the line attributes
  (line pressure and saturation)



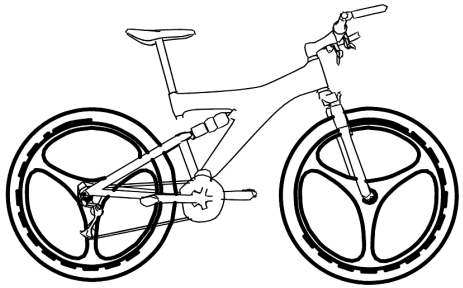


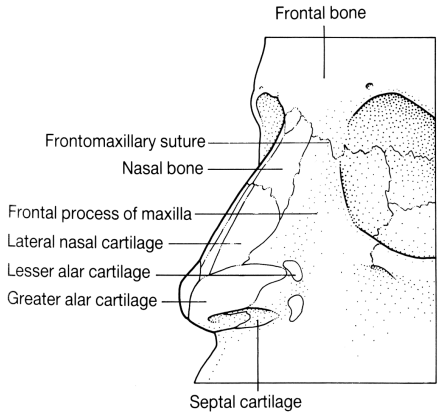
Spatial Manipulation—Illustrative Effects

- photorealism: simulation of physics
  $\Rightarrow f_{PR}(x, y, z)$
- non-photorealism: combination of depth, illumination, and style
  $\Rightarrow f_D(x, y, z) \circ f_I(x, y, z) \circ f_S(object)$

- instead: general spatial function to describe any *illustrative effect*
  $\Rightarrow f_E(x, y, z) \circ f_S(object)$

Advantages of Illustrative Effects





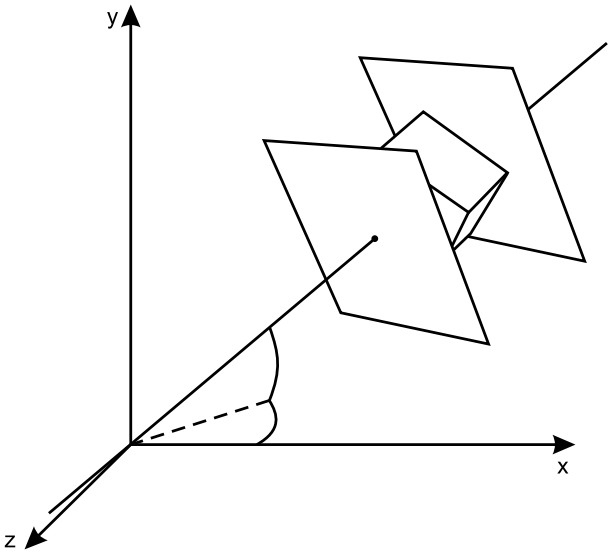
- object independence (e. g. organic models)
- direct specification of intended visualizational effect
- enforcement of clear separation between model and visualization
- broader spectrum of effects possible

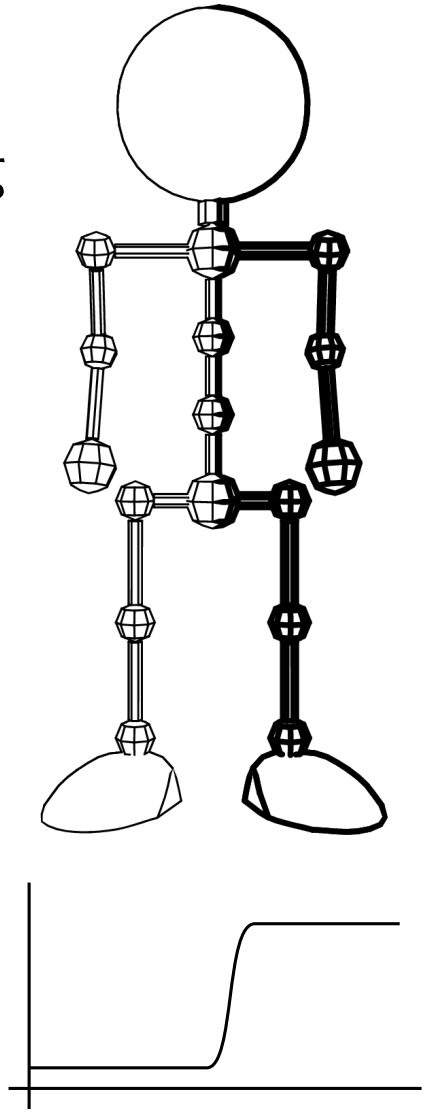
Illustrative Effects in Line Drawings

- analytic line rendering process
- parametric effect function for easier control:
  $f_P(t), t \in [0; 1]$
- $f_E(x, y, z) = f_P(t) \circ f'_E(x, y, z)$
- two example effects

Plane-Sweep-Effect

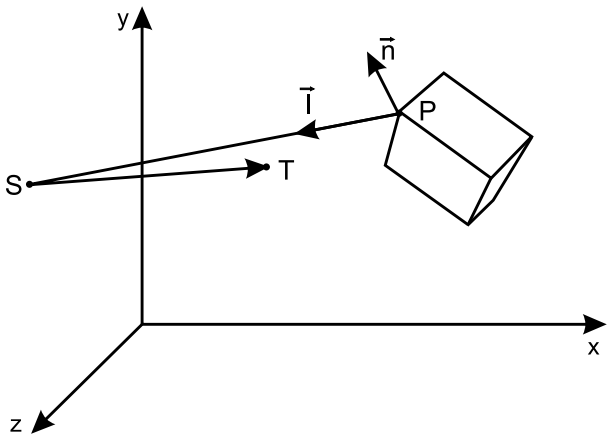
- parametric effect function computed according
  - a certain direction within the scene
  - active segment defined by a sweeping plane
- one-dimensional effect

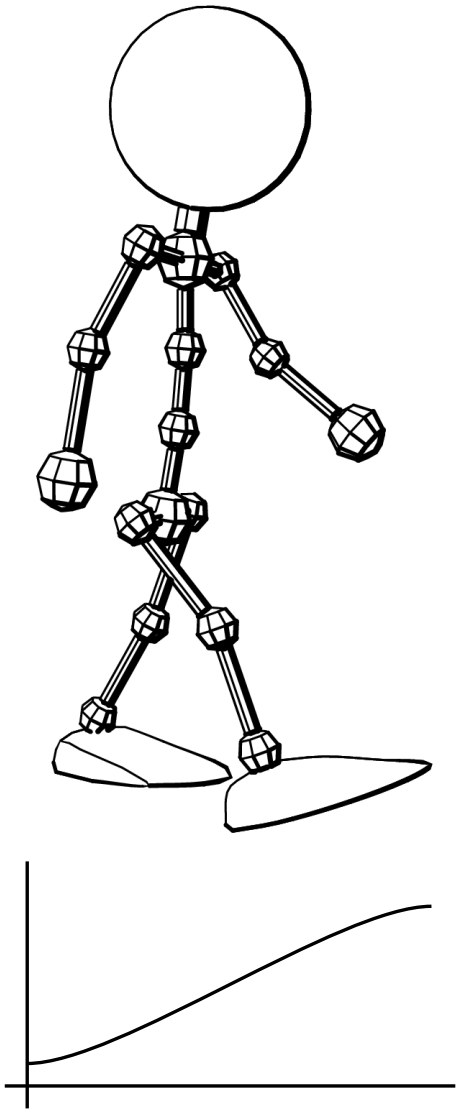




Lit-Volume-Effect

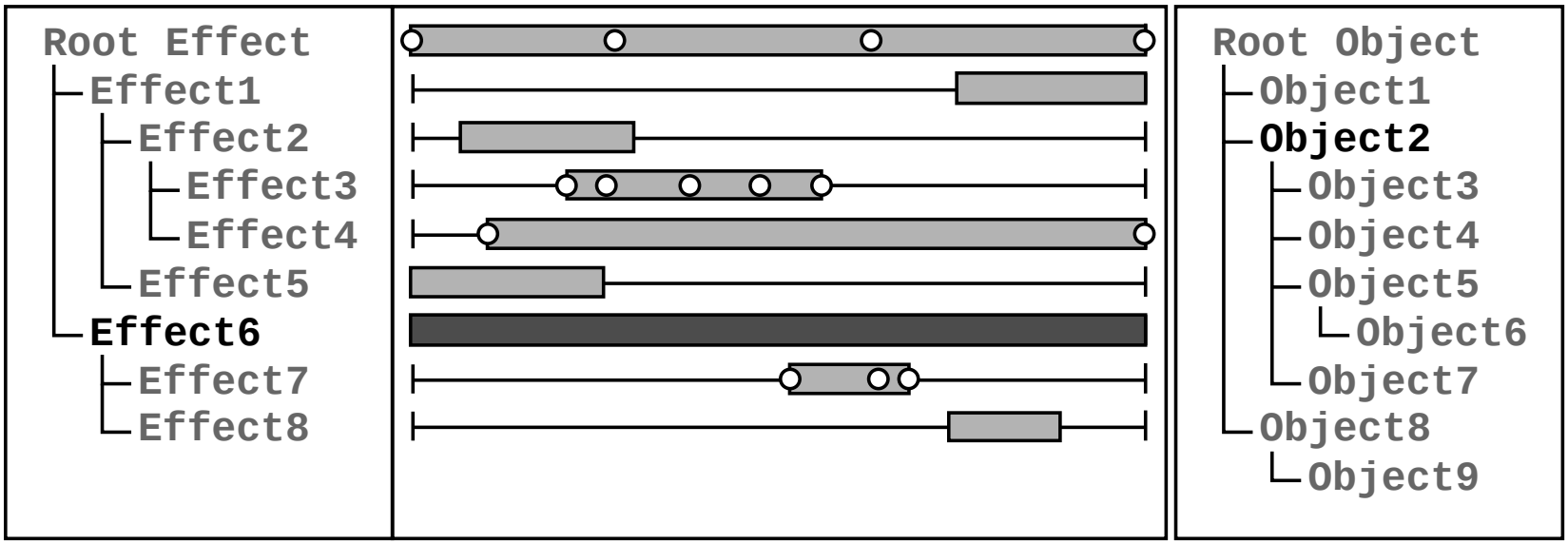
- $f'_E(x, y, z)$: diffuse part of PHONG model
  $\Rightarrow f_P(t)$ computed from illumination intensity
- three-dimensional effect





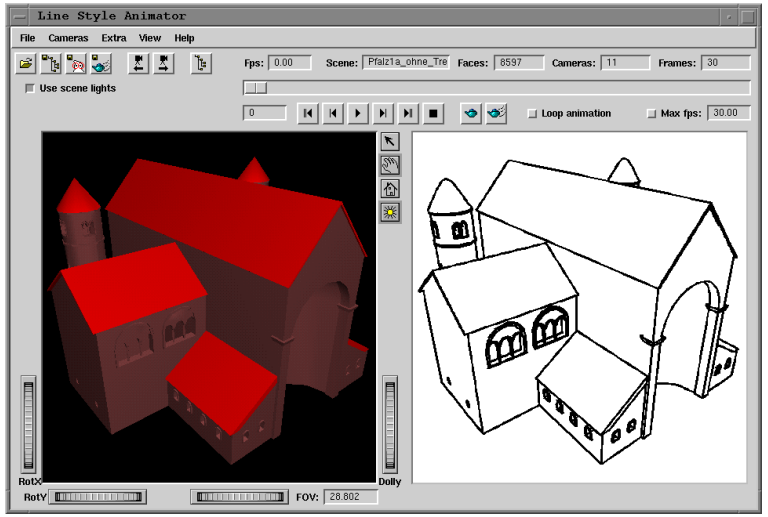
Combination of Effects

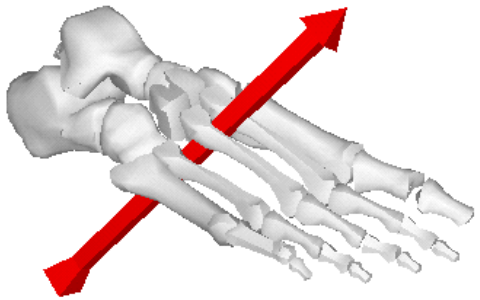
- object hierarchy & effect hierarchy
- animation of parameters
- independence of effects



Line Drawing Animation System

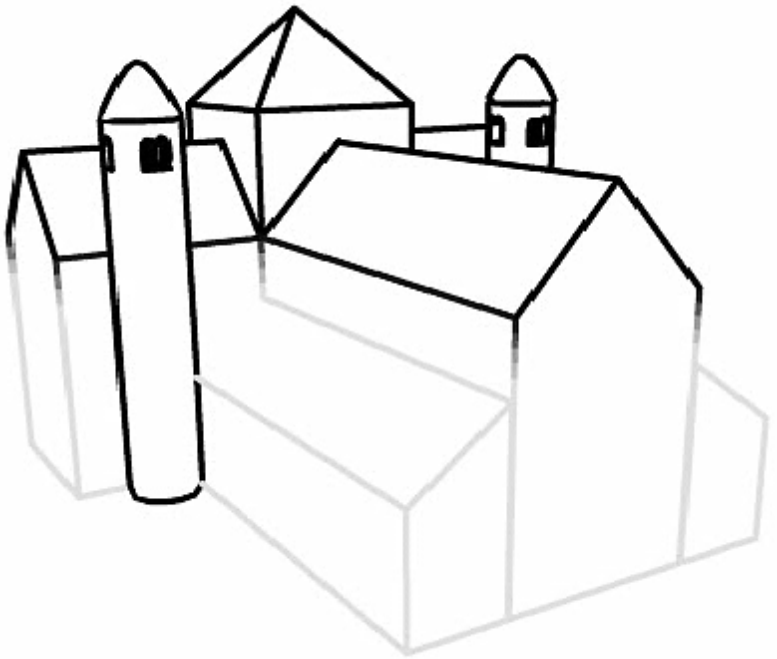
- implementation in Smalltalk
- 2 views: OpenGL
  and line drawing
- interaction problems
  - visualization elements
  - speedup by caching





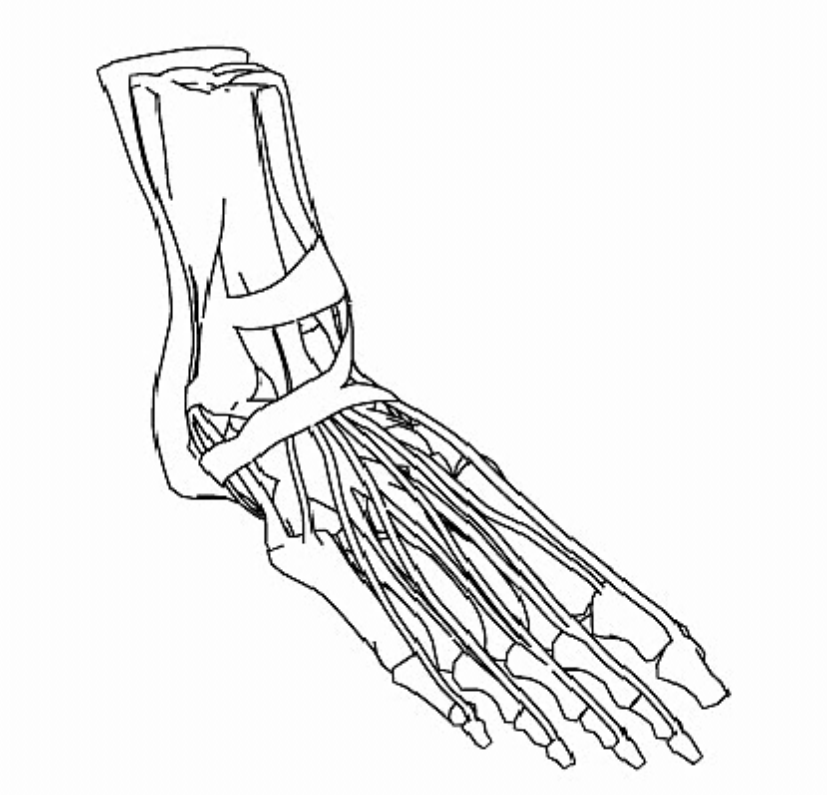
Example 1: Plane-Sweep-Effect

- visualizing the reasoning in a virtual reconstruction
- findings: remains of tower
- reasoning: tower $\Rightarrow$ second floor $\Rightarrow$ approximate height of the building



Example 2: Plane-Sweep-Effect

- visualizing the position of muscles of a human foot
- continuously emphasizing the lines depicting the muscles from back to front



Example 3: Lit-Volume-Effect

- visualizing the
  effect of a light source

Example 4: Camera-Effect

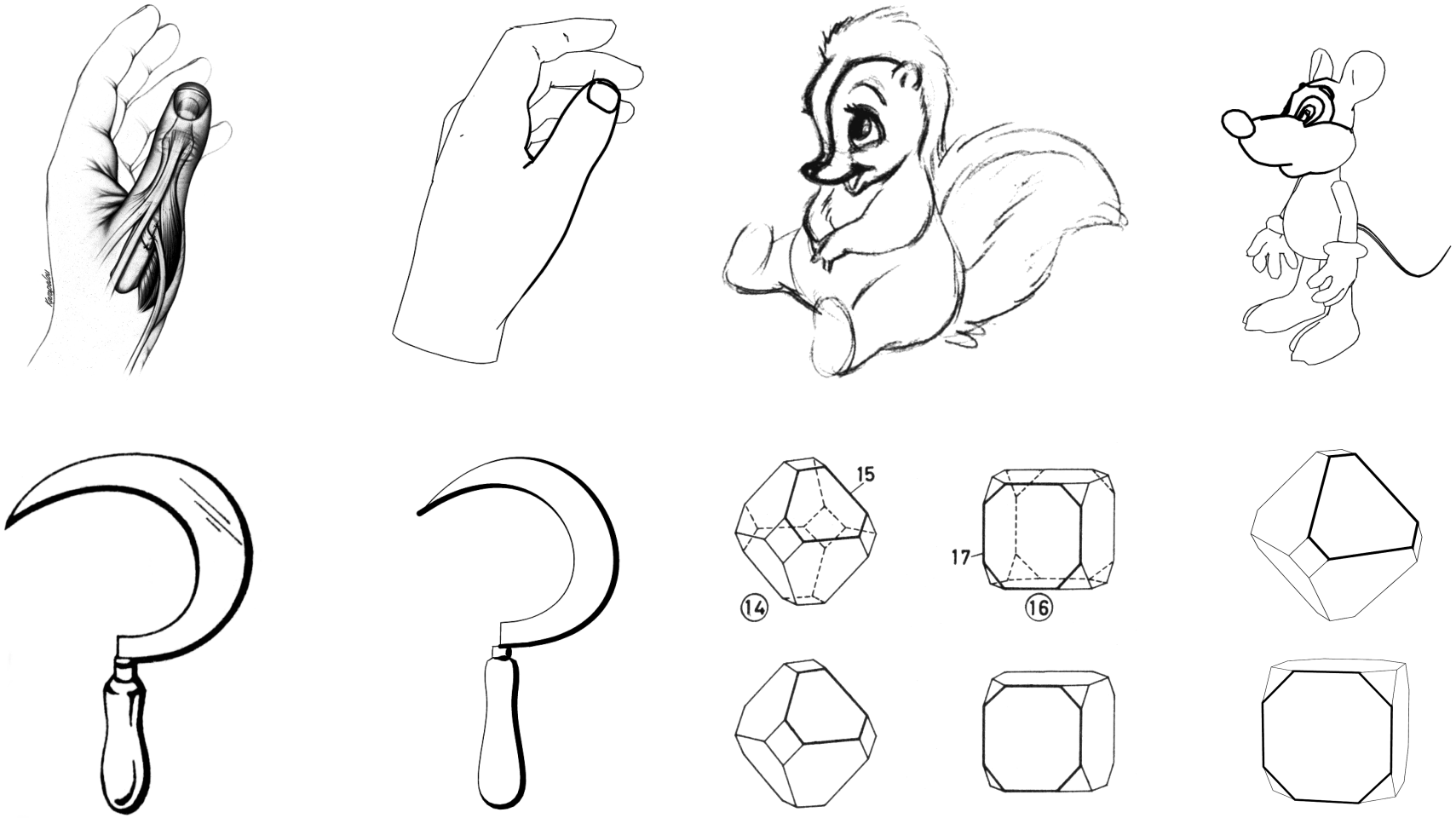
- visualizing the
  view frustrum of a camera

- application e. g. in
  animation planning

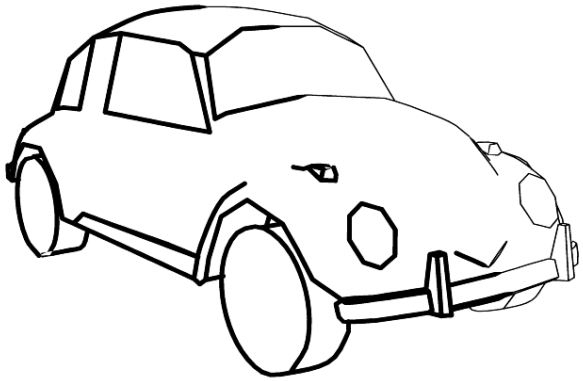
Conclusion

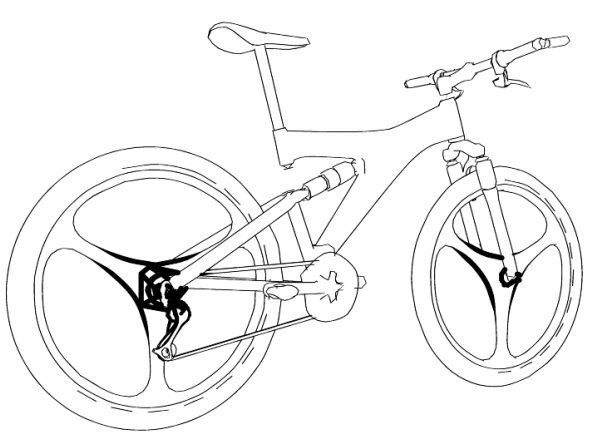
- illustrative effects: spatial approach
- object independence
- separation between model and visualization
- example application: line drawings
- animation by using local keyframing

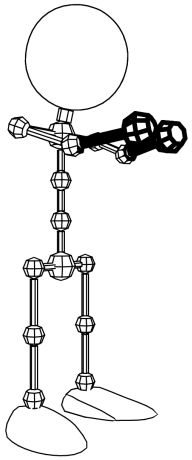
Comparison

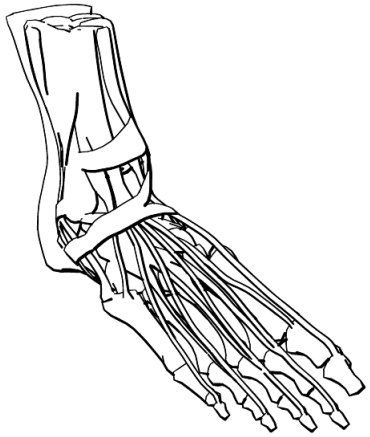


Examples

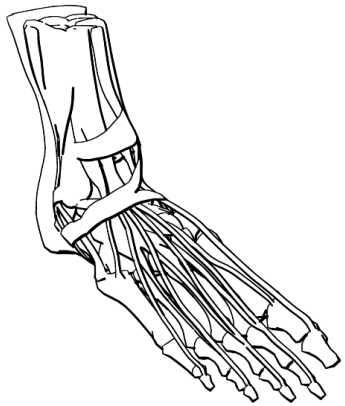


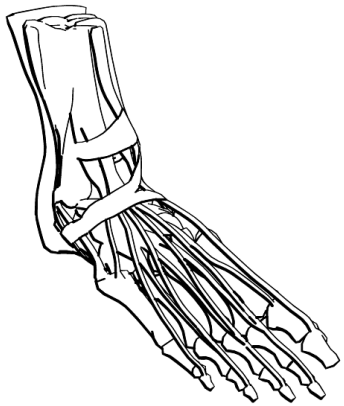


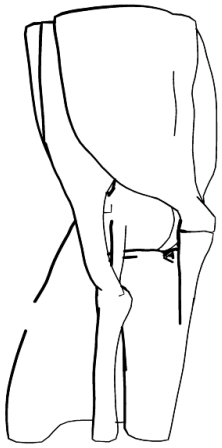




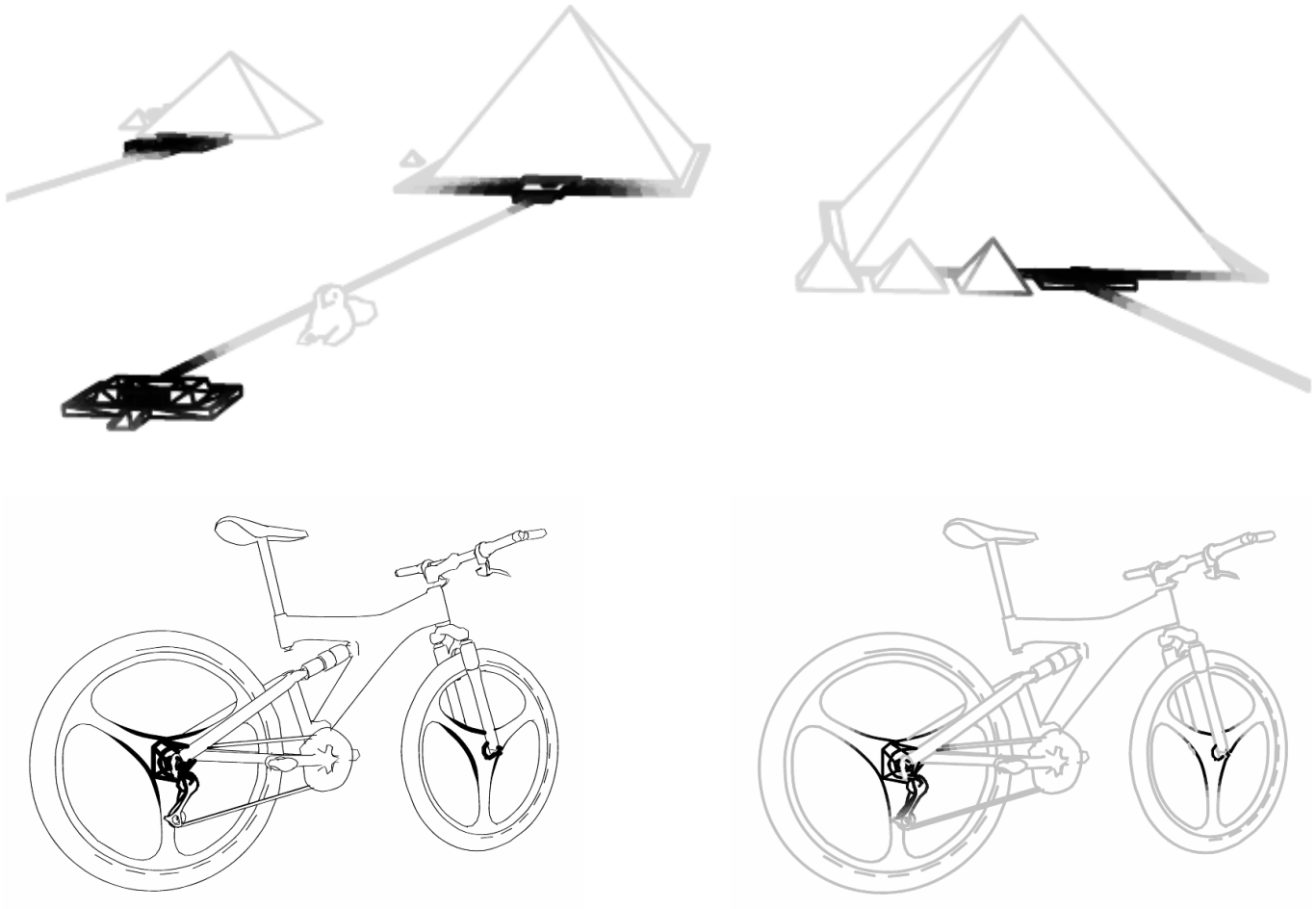
Illumination





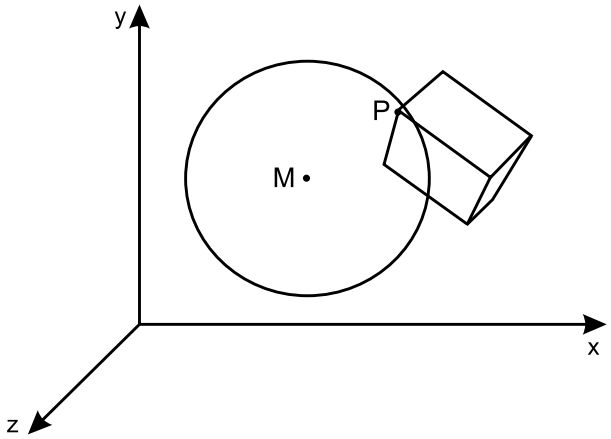


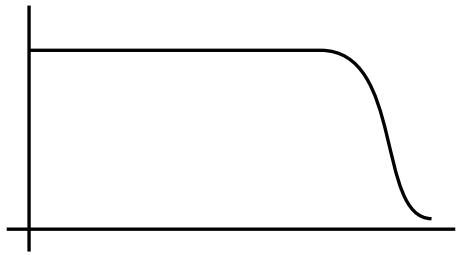
Line Saturation



Volume-of-Interest-Effect

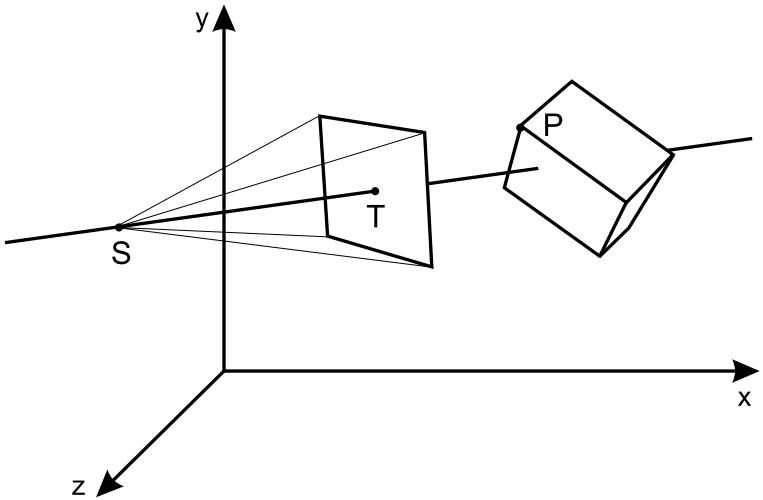
- parametric function $f_P(t)$ computed along the radius of the sphere
- three-dimensional effect

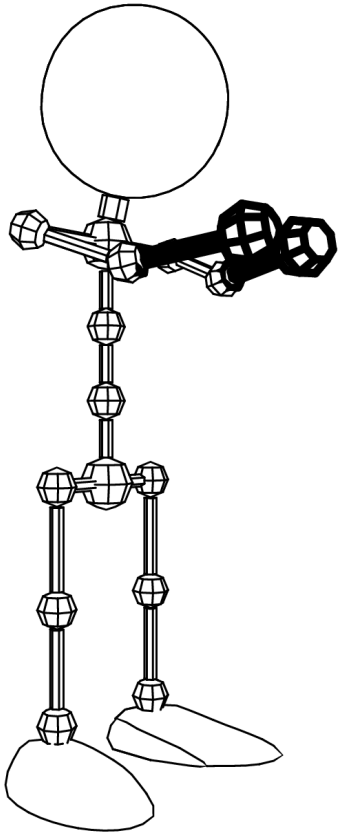


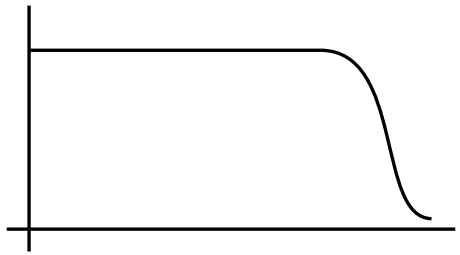


Camera-Effect

- $f_P(t)$ computed parallel to the view plane
- two-dimensional effect







Combination Functions