Non-Photorealistic Rendering

- Motivation: Much of the graphical imagery created is not photographic in nature
- Particularly in some domains:
  - Art
  - Animation
  - Technical illustration
  - Medical textbooks
  - Architecture
- In 1990, computer graphics research was almost entirely focused on realism

Element Based Approaches

- Layer elements of some type to cover the image
  - Paint with a brush
  - Sketch with a pen
  - Etch with a carving tool
- Can work with photographs, 3d models, or interactively

Elemental Issues

- What do the elements look like?
- Image space or object space?
- How are the elements laid out?
- How are the elements drawn?
- How is animation incorporated?

Shading Approach

- Define a new shading model that shades objects in a non-realistic manner
  - Emphasize outlines
  - Manipulate color across surfaces
- Only works with 3d models
- Aimed primarily at illustrating for understanding
- Animation? Real-time?

Common Operations

- Find silhouettes and contours
  - Where surface normal is perpendicular to the view direction
  - Edge detection for images
- Find image gradient and principle directions
  - Maximal and minimal directions from 3d models
  - Standard methods for photos
- Find highlights
- Randomly distribute points
- Clip lines or regions to edges

Outstanding Problems

- Better use of stylized rendering for visualization
- What, if anything, to do about animation?
  - Animation of painterly rendering has no historical counterpart
  - What are the “styles”?
- Non-Physically-Based simulation for animation