Non-Photorealistic Rendering (NPR)

Last Time?
• Texture Mapping
• Solid Texture
• Procedural Textures
  – Perlin Noise
• Procedural Modeling
  – L-Systems

Today: Non Photorealistic Rendering
• Architectural Rendering
• Reading for Today
• Line Drawing
• Pen & Ink / Hatching
• Technical Illustration
• Painterly Rendering

Frank Lloyd Wright’s Fallingwater

Frank Lloyd Wright’s Fallingwater

Plan & Section Drawings
Digital Models

Photorealistic Rendering

http://www.etereausstudios.com/docs_html/fallingwater_htm/fall_still_03.htm

Non Photorealistic Rendering

Goals for NPR?

• Exaggerate - or - de-emphasize lighting, texture, contrast, perspective, etc.
• May use limited palette of colors, or precision/resolution
• Allow vagueness about material & geometry
• Varying level of detail – draw attention to particular aspects of imagery
• More detail than a single traditional image can show (cross section, transparency, exploded view, multi-viewpoint rendering, etc.)

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Reading for Tuesday:

• “Artistic Thresholding” 
Xu & Kaplan,
NPAR 2008
Halftoning

“Digital Facial Engraving”, Ostromoukhov, SIGGRAPH 1999

Real-time NPR

• (Before programmable pixel shaders)
  – Create 1D texture map of shading tones
  – Local lighting (normal, view, & light directions)
    turned into texture coordinate
  – Texture lookup is final color

• Concerns about spatial & temporal coherence
  – popping
  – “Shower door” effect

Dynamic Solid Textures for Real-Time Coherent Stylization
Bénard, Bousseau, and Thollot, I3D 2009

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Where Do People Draw Lines?

Types of Edges in Line Drawings

- Silhouettes/Contours: where normal is perpendicular to the view direction
- Suggestive Contour: inflection points of the surface normal
- Ridges & Valleys: extremum of curvature
- Apparent Ridges: based on view dependent curvature

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Real-Time Hatching

Prana, Hoppe, Webb & Finkelstein
SIGGRAPH 2001

Smoothed minimum & maximum curvature
(image from Alliez et al. '03)

Pen & Ink Illustration

Figure & indicating terms. The left house is drawn using "indications"; the right house is not.
Computer-generated pen-and-ink illustration
Winkenbach & Salesin 1996

Interactive Pen-and-Ink Illustration
Salisbury et al., SIGGRAPH 1994

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Technical Illustration

A non-photorealistic lighting model for automatic technical illustration
Gooch, Gooch, Shirley, & Cohen SIGGRAPH 1998

Technical Illustration

Rendering Effective Route Maps: Improving Usability Through Generalization
Agrawala & Stolte, SIGGRAPH 2001

Technical Illustration

Designing Effective Step-By-Step Assembly Instructions
Agrawala et al. SIGGRAPH 2003

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Painterly Rendering

Painterly rendering with curved brush strokes of multiple sizes
Hertzmann SIGGRAPH 1998

Reading for Friday:

"PatchMatch: A Randomized Correspondence Algorithm for Structural Image Editing",
Barnes, Shechtman, Finkelstein, & Goldman, SIGGRAPH 2009