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
- Artistic Styles and Painterly Rendering

Frank Lloyd Wright’s Fallingwater

Frank Lloyd Wright’s Fallingwater

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Frank Lloyd Wright’s Fallingwater

Frank Lloyd Wright’s *Fallingwater*

Plan & Section Drawings

Digital Models


http://lvlworld.com/t.php/Frank+Lloyd+Wright's+-+Falling+Water
Photorealistic Rendering

http://www.etereaestudios.com/docs_html/fallingswater.htm/fall_still_03.htm

Miniatures

Wiley White
Architectural Models

http://www.architectural-models.com/galfallwat.html

Non-Photorealistic Miniatures

http://www.urbanbydesignonline.com/urbanbydesign/tag/fallingswater

Non-Photorealistic Miniatures

http://www.flickr.com/photos/matijagrguric/set/72157623778661188/

Non-Photorealistic Miniatures


http://twls.libsyn.com/index.php/post_id=35584

HGA Architects & Planners - Cantilevers: Inspired by Falling Water

http://www.flickr.com/photos/j_bussmann/4549613488/
Non-Photorealistic Rendering


http://www.fallingwater.org/

http://jjh1392.deviantart.com/art/Fallingwater-151791274?q=sort%3Atime+gallery%3Ajjh1392&qo=1


Brian Bent
http://www.dirtgallleryla.com/bb_falling.html
Non Photorealistic Rendering

Frank Lloyd Wright’s Fallingwater

http://www.historichollywood.biz/drawings-pennsylvania/fallingwater.htm

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 Today:

• “Artistic Tessellations by Growing Curves”, Li & Mould, Non-Photorealistic Animation and Rendering (NPAR) 2011

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Where Do People Draw Lines?

![Diagram of line drawings](image1)


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

![Types of Edges in Line Drawings](image2)

Suggestive Contours for Conveying Shape, DeCarlo et al., SIGGRAPH 2005

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![Today: Non Photorealistic Rendering](image3)

Halftoning

![Halftoning](image4)

“Digital Facial Engraving”, Ostromoukhov, SIGGRAPH 1999
Pen & Ink Illustration

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

Real-Time Hatching

Real-Time Hatching
Praun, Hoppe, Webb & Finkelstein
SIGGRAPH 2001

Computer-generated pen-and-ink illustration
Winzenbach & Salesin 1996

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

http://artis.imag.fr/Publications/2009/BBT09/DynSolidTextures.mov

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Technical Illustration

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

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Painterly Rendering

“Towards Artistic Minimal Rendering”,
Rosin & Lai, NPAR 2010

Artistic Thresholding

- Xu & Kaplan, NPAR 2008

Reading for Friday:
“Fragment-based image completion”,
Drori, Cohen-Or, Yeshunan, SIGGRAPH 2003