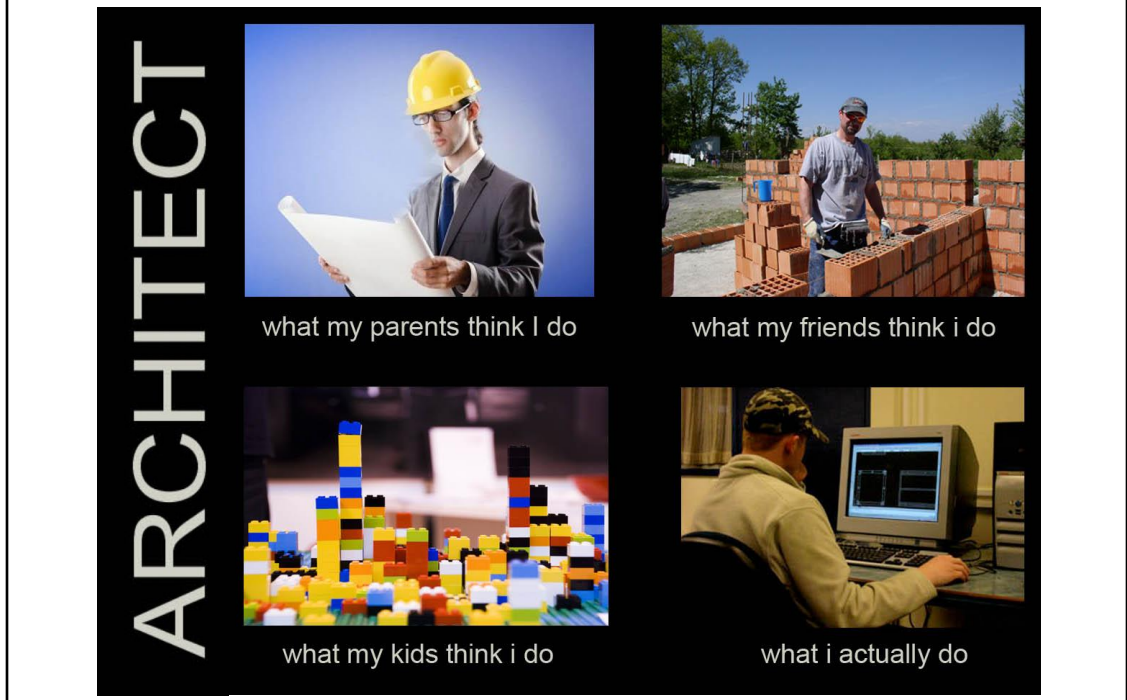
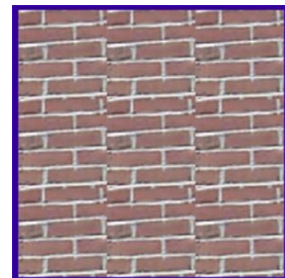
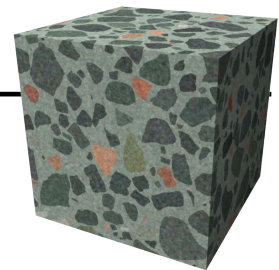
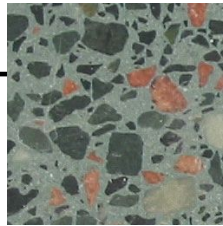


Non-Photorealistic Rendering

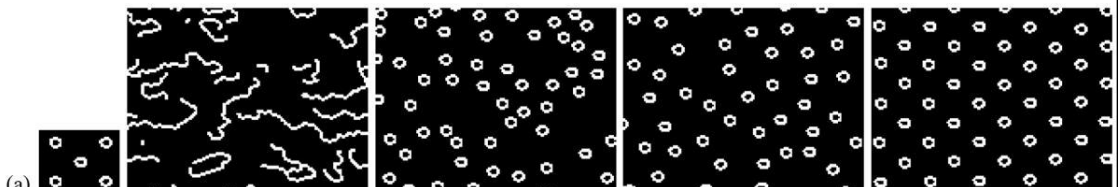


Last Time?

- Texture Synthesis
- Markov Model
- Image Completion
- Volumetric Texture Synthesis



"I spent an interesting evening recently with a grain of salt."



Fishing, PDI, Siggraph 1999



Brush, Lei Chen, Siggraph 2006



Today: Non Photorealistic Rendering

- Worksheet
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- Pen & Ink / Hatching
- Technical Illustration
- Artistic Styles and Painterly Rendering
- Papers for Next Time

Frank Lloyd Wright's *Fallingwater*



Frank Lloyd Wright's *Fallingwater*



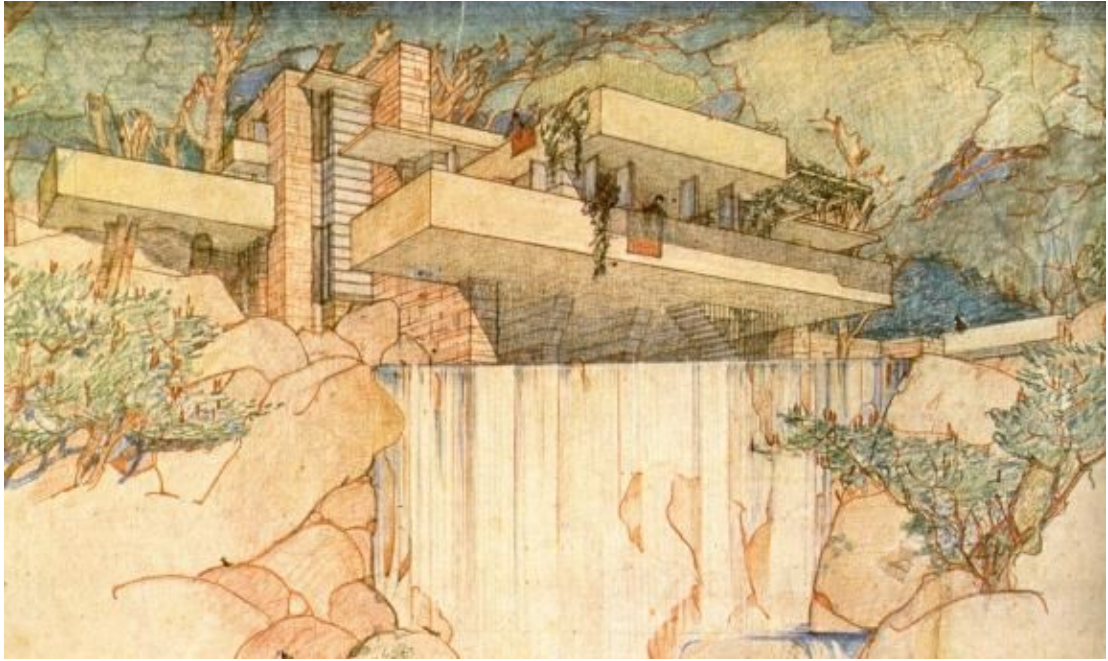
<http://www.thetimesnewroman.com/2011/07/luxe-living-fallingwater.html>

Frank Lloyd Wright's *Fallingwater*

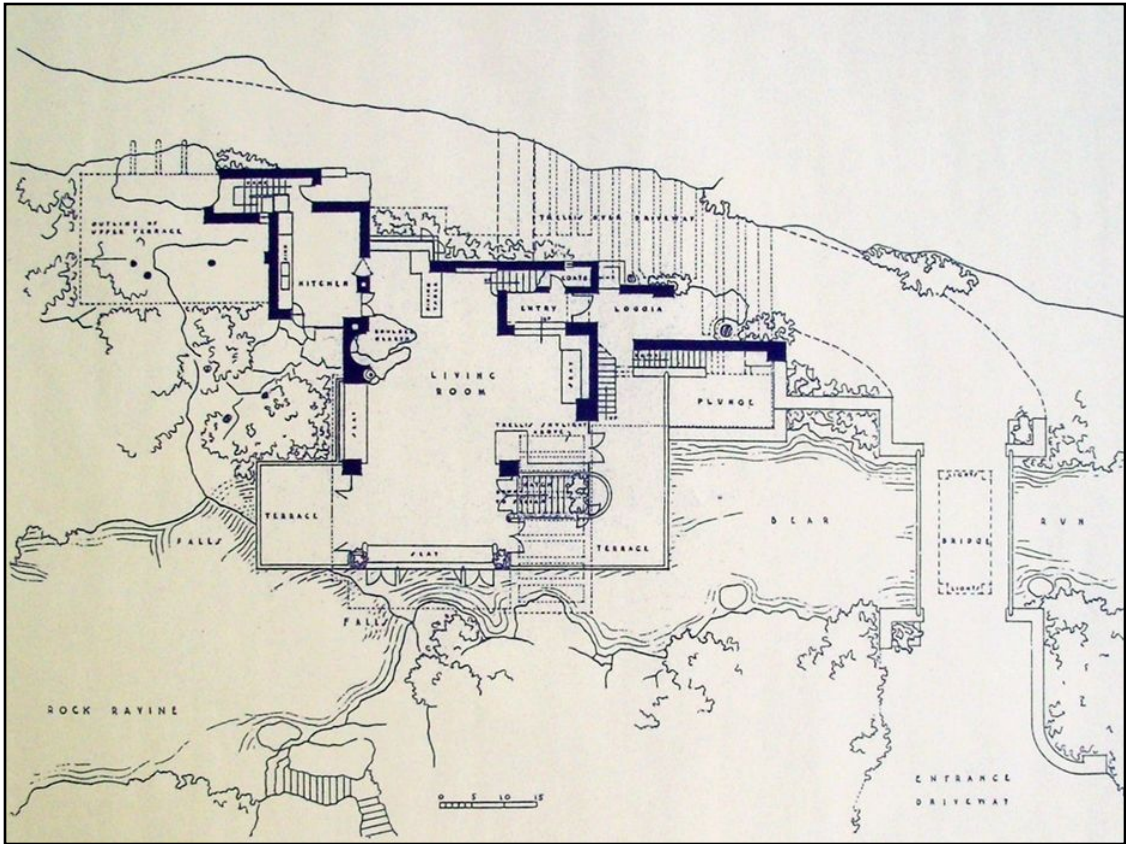


<http://www.thetimesnewroman.com/2011/07/luxe-living-fallingwater.html>

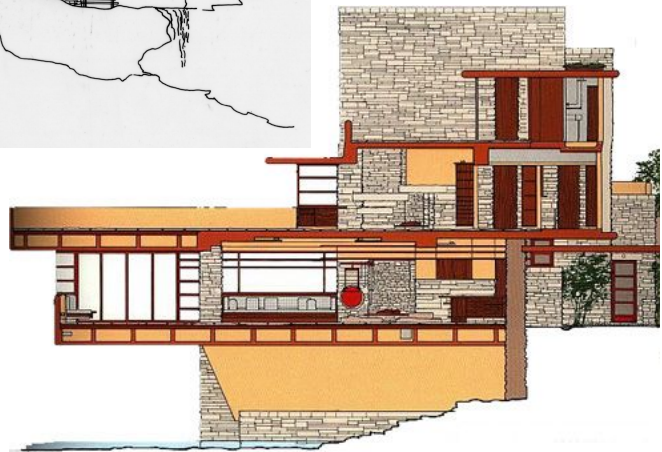
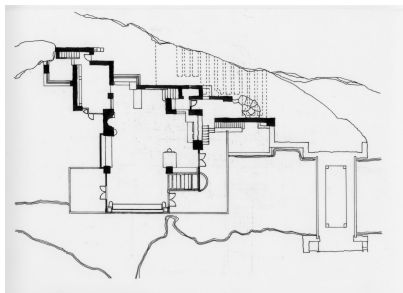
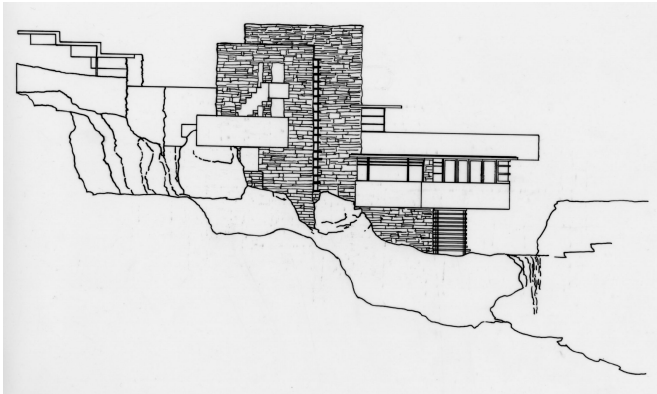
Frank Lloyd Wright's *Fallingwater*



https://si.wsj.net/public/resources/images/OD-AG561_FALLIN_G_20110506021738.jpg



Plan, Section, & Elevation Drawings





http://www.architecturelist.com/wp-content/uploads/2007/10/fallingwater_4.jpg

Digital Models





http://www.minecraftforum.net/topic/9148-falling-water-by-frank-lloyd-wright/page__st__20



<https://www.youtube.com/watch?v=MbCL4WJmcgg>



<https://3dwarehouse.sketchup.com/model/5b9851979897e7e3a03c22556407e748/Falling-Water>



TURBOSQUID Search Stock 3D Cart My Files Support Login/Join

Falling Water House by MillieModels \$75.00 Add to Cart

Product File Downloads

3ds Max 7 (.max)	119 KB
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Live Chat Now 24/7
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File format conversions

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3D Model Specifications

Product ID:	266247
Published:	Jun 6, 2005
Geometry:	Polygonal
Polygons:	17,864
Vertices:	9,653
Textures:	Yes
Materials:	Yes
Rigged:	No
Animated:	No
UV Mapped:	Unknown
Unwrapped UVs:	Unknown

Product Rating

In rated

<http://www.turbosquid.com/3d-models/water-house-3d-x/266247>



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

Digital Models

From Half Life 2



Photorealistic Rendering



<https://vimeo.com/802540>



<http://luftwerk.net/projects/fallingwater/>
<https://www.youtube.com/watch?v=6RJbnA7ESKk>



<https://www.6sqft.com/a-kooky-1970s-fallingwater-lookalike-in-greenwich-is-asking-3-5m/>

Miniatures

Wiley White
Architectural Models



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

Non-Photorealistic Miniatures



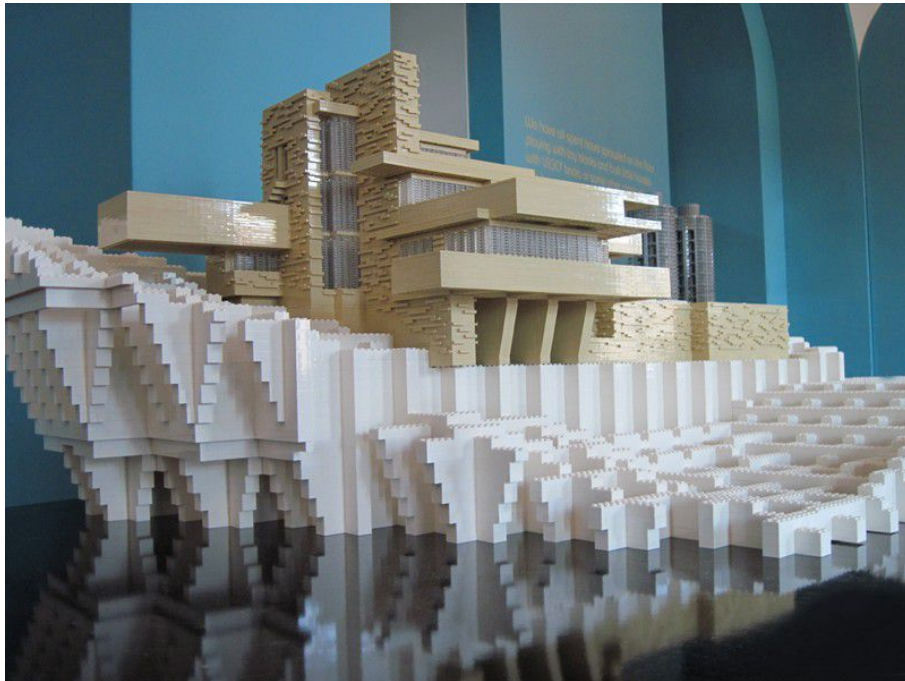
<http://shop.lego.com/ByTheme/Product.aspx?p=21005&cn=52>
<http://www.urbanbydesignonline.com/urbanbydesign/tag/fallingwater>

Non-Photorealistic Miniatures



<http://www.flickr.com/photos/matijagrguric/sets/72157623778661188/>

Non-Photorealistic Miniatures



Adam Reed Tucker <http://www.mocpages.com/moc.php/220533>

Non-Photorealistic Miniatures



<http://gardenmelodies.blogspot.com/2010/11/falling-water-gingerbread-house.html>



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/



<http://www.fallingwater.org/>

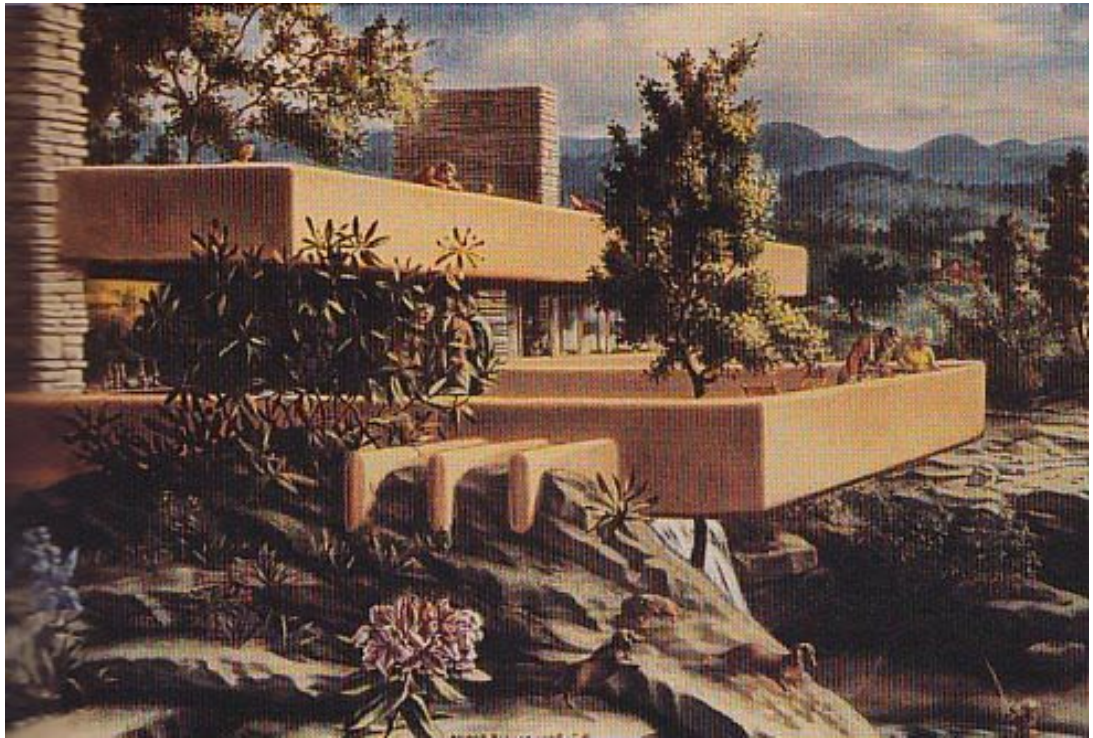
Non-Photorealistic Rendering



<http://www.studio360.org/2009/may/29/fallingwater/>

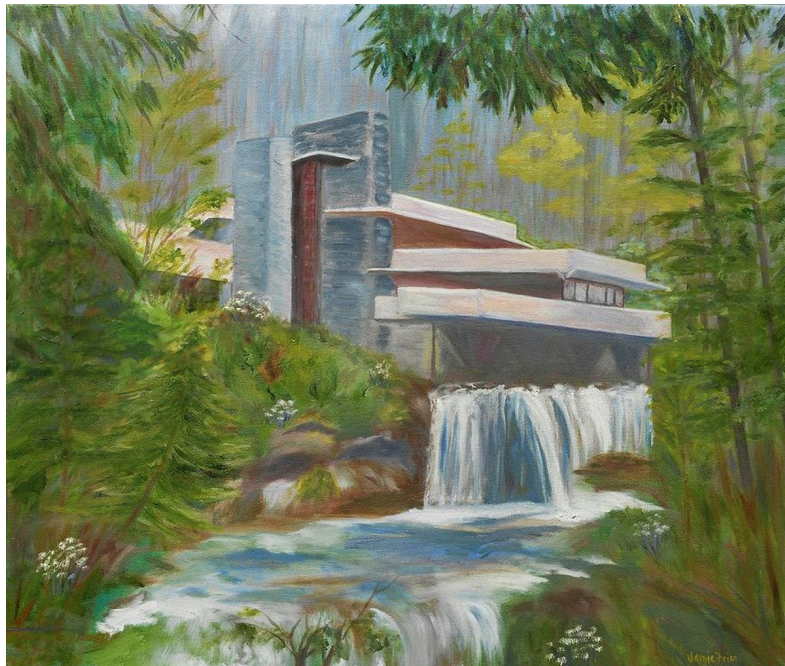


<http://www.funnyfishdesign.com/casestudies/craft-lights/?ckattempt=1>



“House At Falling Water”, Peter Blume, 1938-1968.
First painting of Fallingwater. Commissioned by the owners.

Painting / Painterly Rendering



<http://fineartamerica.com/featured/falling-water-jamie-frier.html/>

Painting / Painterly Rendering



<http://disney.go.com/create/art/2gs11k6UcUbS000010040000-g-bce863>

Painting / Painterly Rendering



<http://www.ivonneimagines.com/487/falling-water/>



<http://kempersmith.com/fallingwater.html>

Non Photorealistic Rendering



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



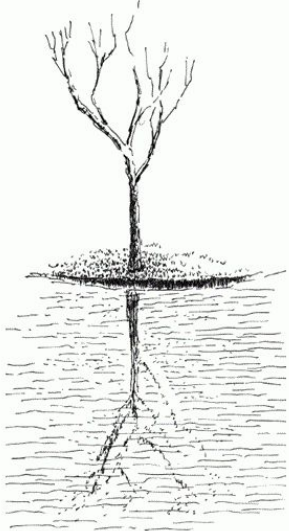
Brian Bent

http://www.dirtgalleryla.com/bb_falling.html



<http://www.anopensketchbook.com/2009/02/monticello-fallingwater.html>

How to Draw Water with Pen and Ink

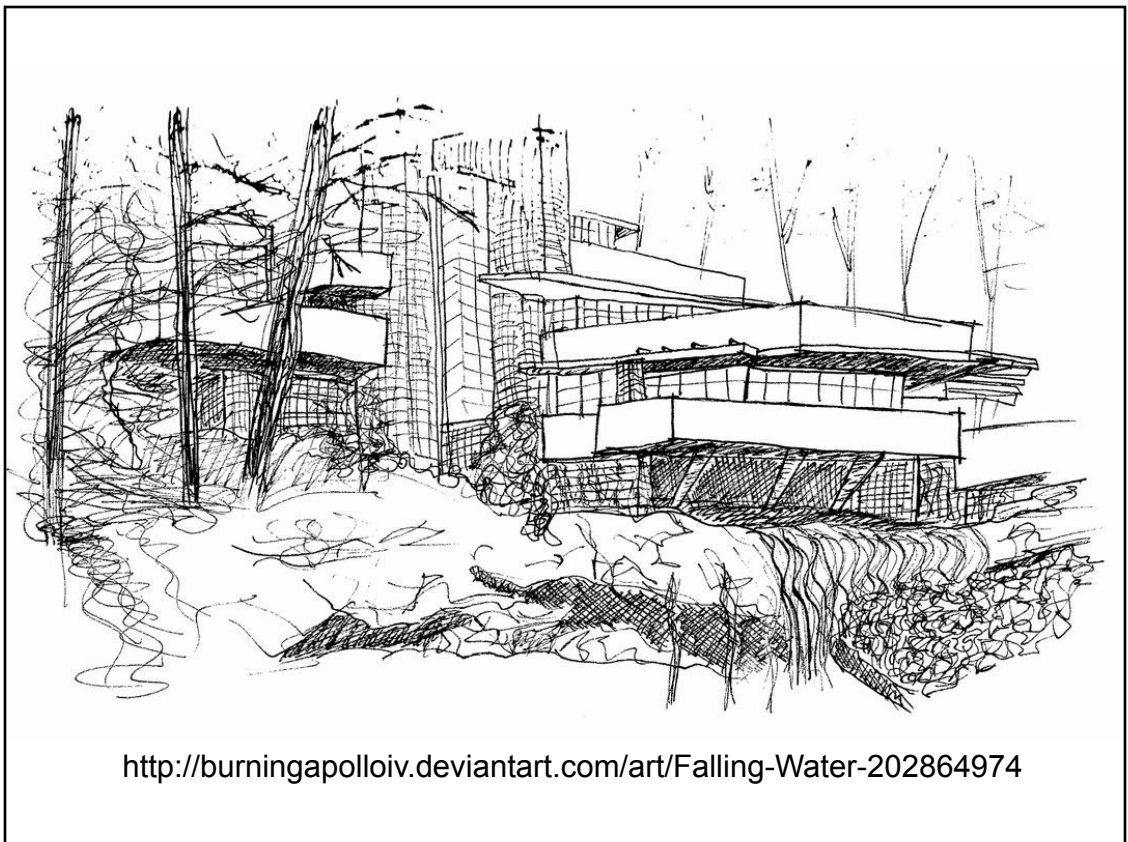
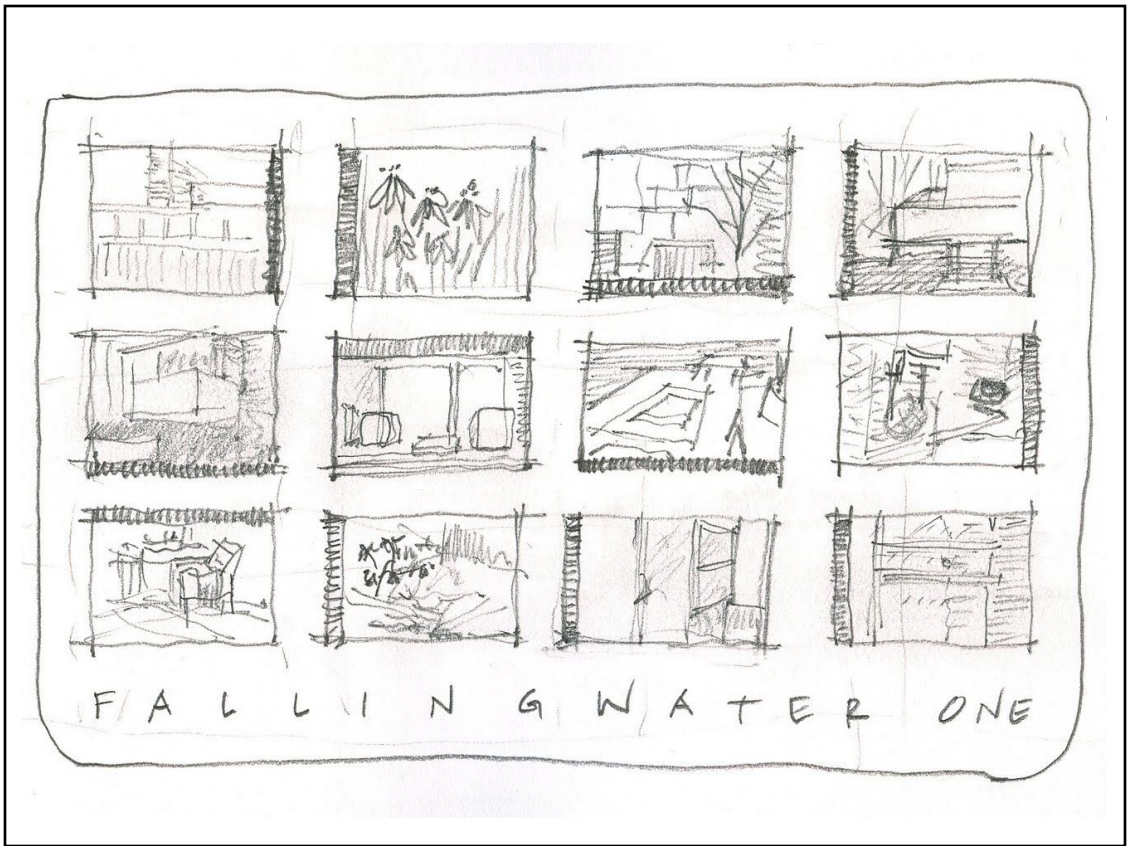


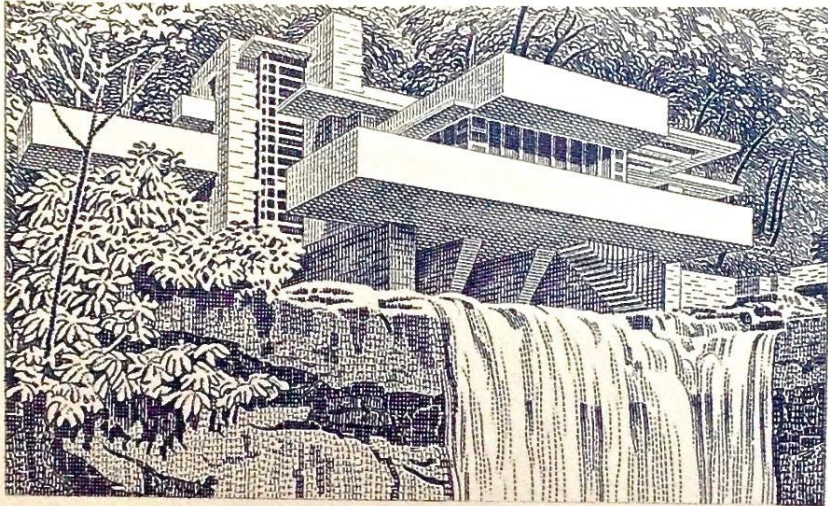
Rahul Jain <https://pendrawings.me/2016/01/04/draw-water/>



Jul 20 09

<http://www.gibson-design.com/images/Slides/fallingwater-entry-100dpi.jpg>



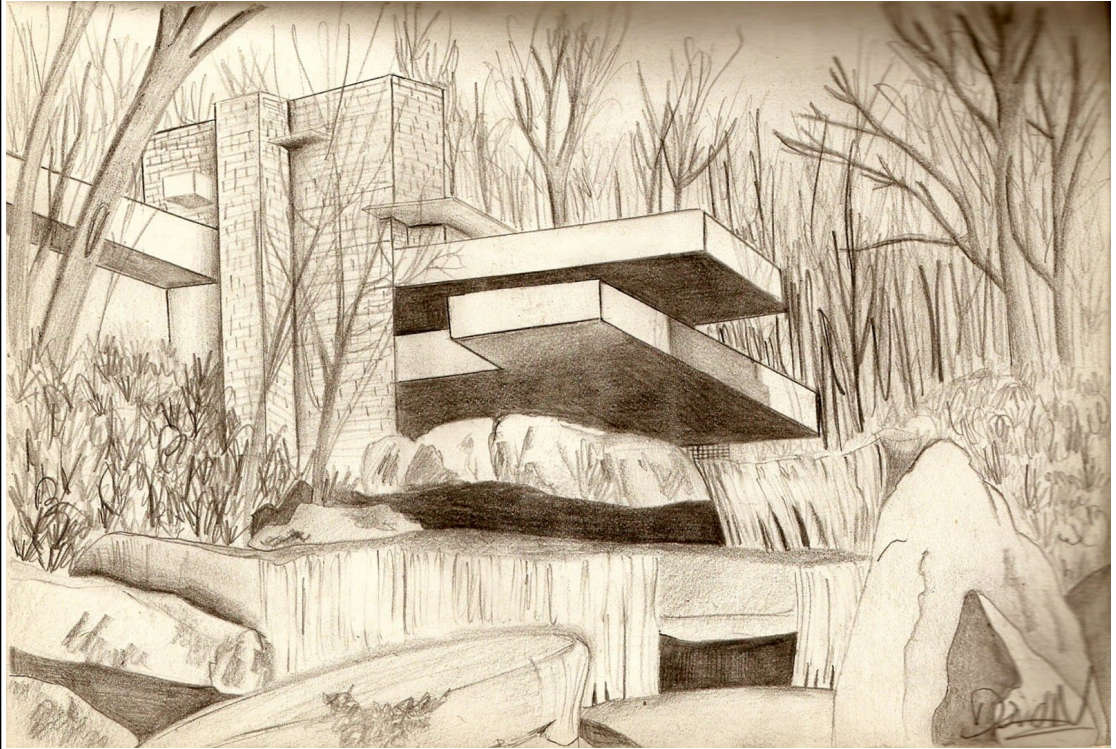


Frank Lloyd Wright 1867-1959 Fallingwater Mill Run PA
Architecture USA 20c

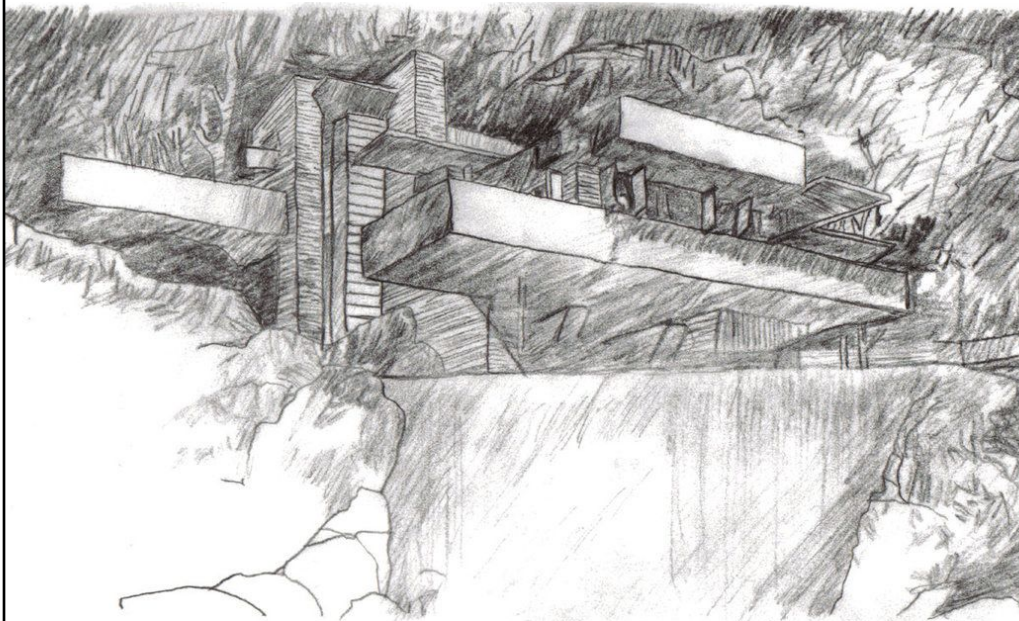
<https://edelweisspost.com/products/10-vintage-frank-lloyd-wright-architecture-stamps-fallingwater-house-unused-postage-stamps-for-mailing>



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



<http://obrasdearteacarvao.blogspot.com/>



<http://rocket-204.deviantart.com/art/Falling-Water-Sketch-61337019>

Frank Lloyd Wright's *Fallingwater*



Goals for NPR?

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

Today: Non Photorealistic Rendering

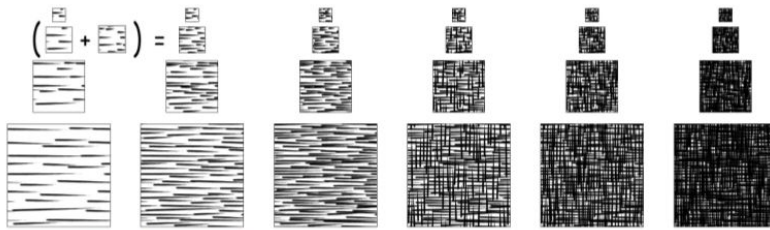
- Worksheet
- Architectural Rendering
- **Papers for Today**
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- Technical Illustration
- Artistic Styles and Painterly Rendering
- Papers for Next Time

Reading for Today: *(pick one)*



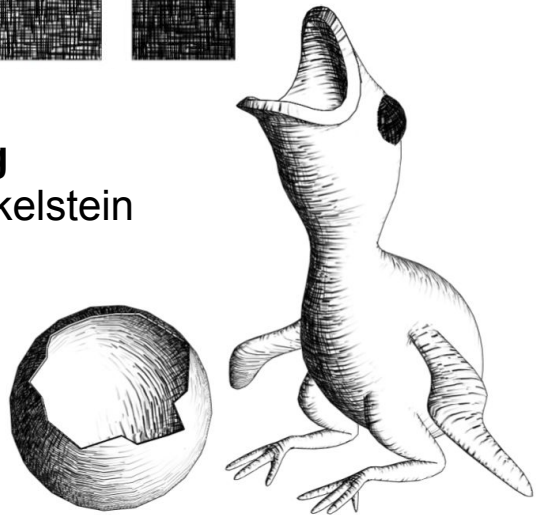
Painterly rendering with curved brush strokes of multiple sizes
Hertzmann SIGGRAPH 1998

Reading for Today: *(pick one)*

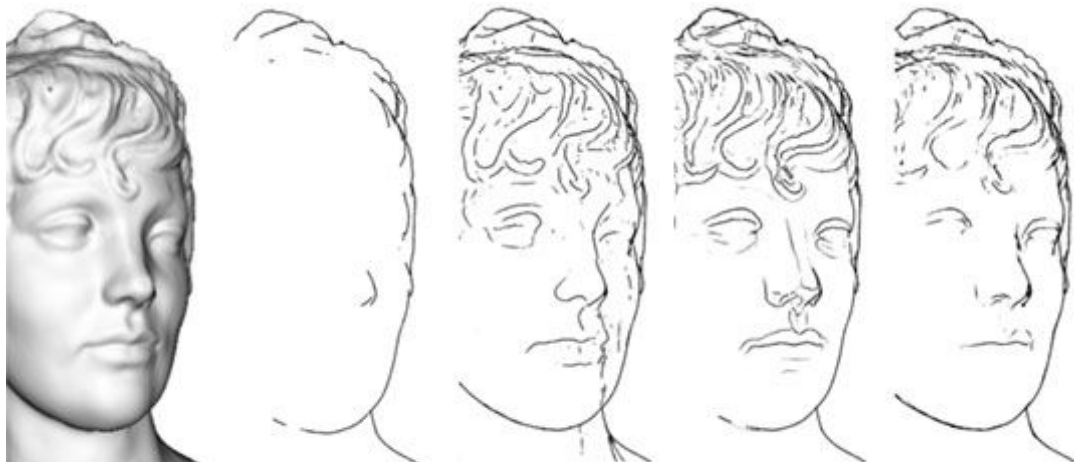


Real-Time Hatching

Praun, Hoppe, Webb & Finkelstein
SIGGRAPH 2001



Reading for Today: *(pick one)*



Shaded View

Contours

Suggestive Contours

Ridges & Valleys

Apparent Ridges

Apparent Ridges for Line Drawings

Judd, Durand & Adelson, SIGGRAPH 2007

Reading for Today: *(pick one)*

“Example-Based Brushes for Coherent Stylized Renderings”

Zheng, Milliez, Gross, and Sumner, NPAR 2017

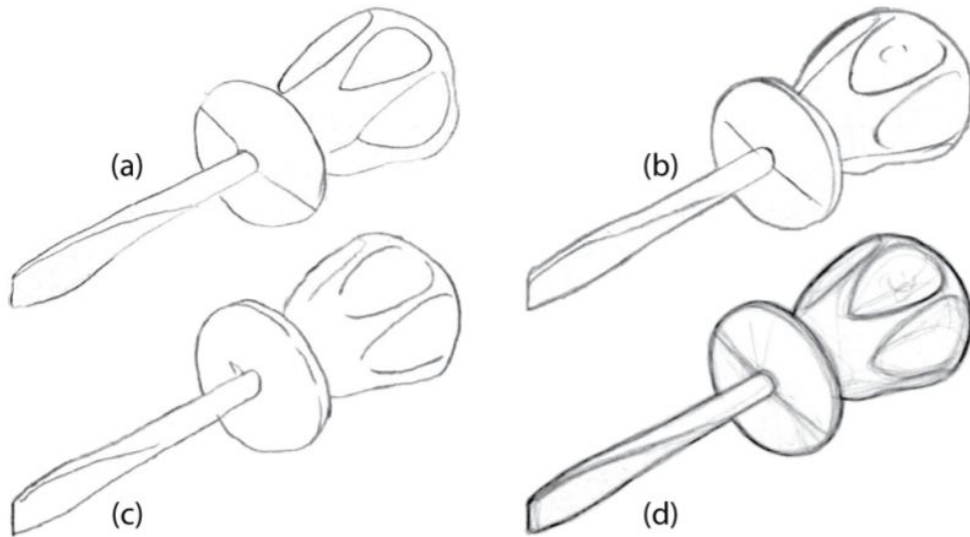


Figure 1: These 3D paintings are rendered in screen space using our method with calligraphy and watercolor styles. The paint stroke rendering is temporally coherent as the characters and camera are animated.

Today: Non Photorealistic Rendering

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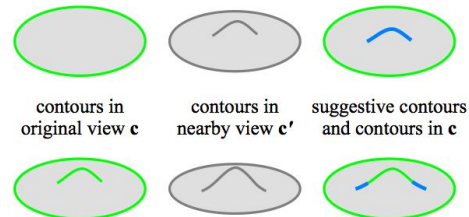
Where Do People Draw Lines?



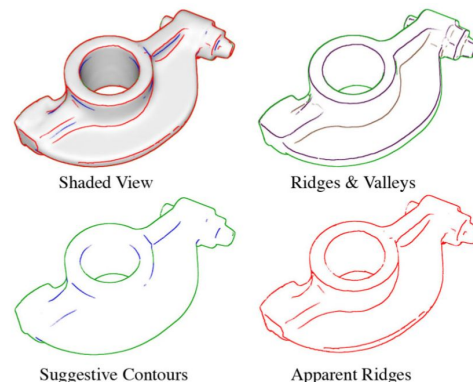
Cole, Golovinskiy, Limpaecher, Stoddart Barros, Finkelstein, Funkhouser, & Rusinkiewicz, SIGGRAPH 2008

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



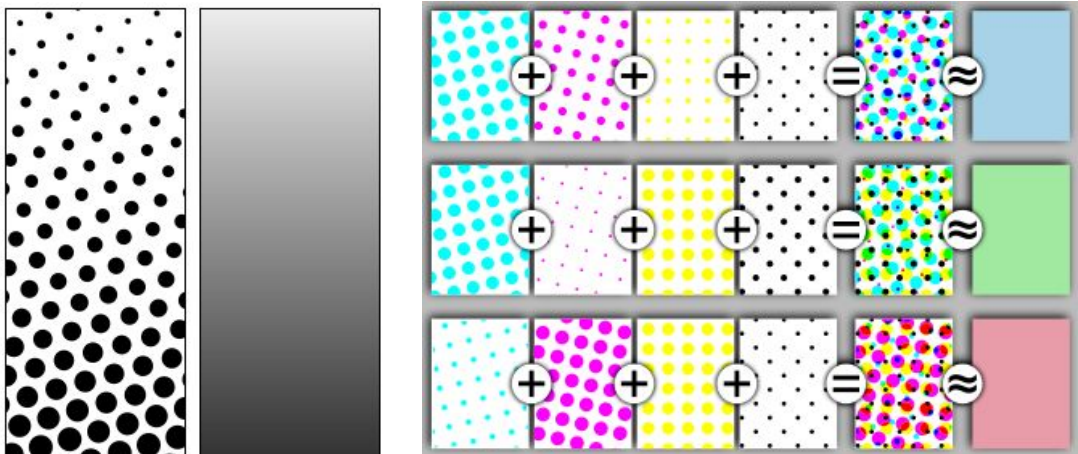
Suggestive Contours for Conveying Shape, DeCarlo et al., SIGGRAPH 2003



Today: Non Photorealistic Rendering

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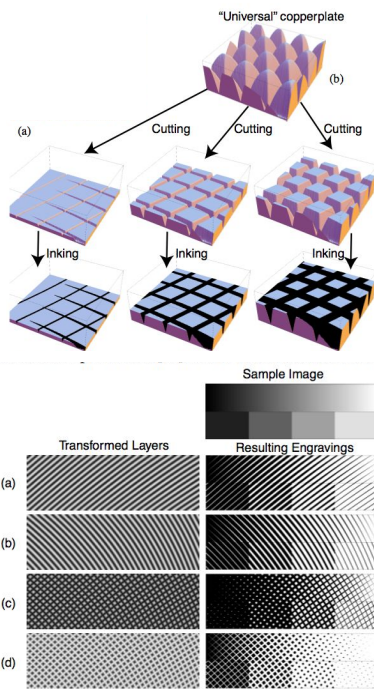
Halftoning



http://en.wikipedia.org/wiki/File:Halftoning_introduction.svg

<http://en.wikipedia.org/wiki/File:Halftoningcolor.svg>

“Digital Facial Engraving”, Ostromoukhov, SIGGRAPH 1999



Pen & Ink Illustration

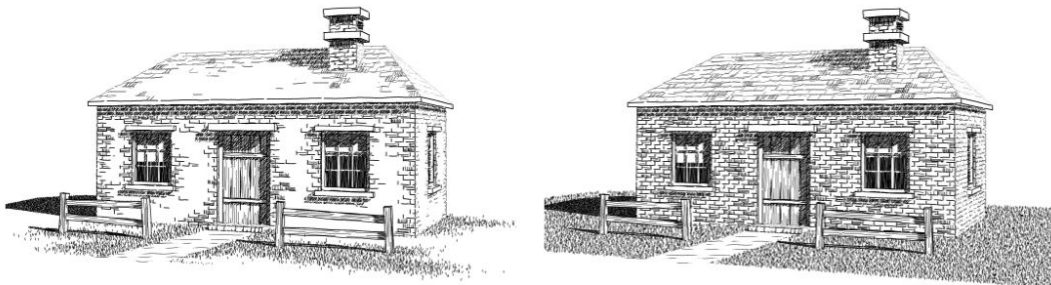
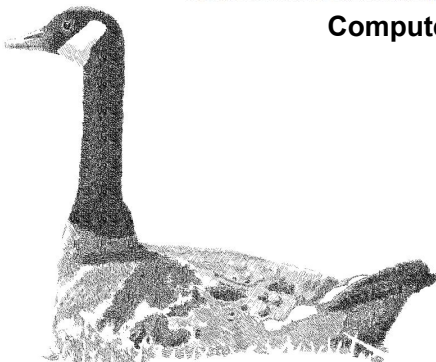


Figure 6: Indicating texture. The left house is drawn using "indication"; the right house is not.

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



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

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

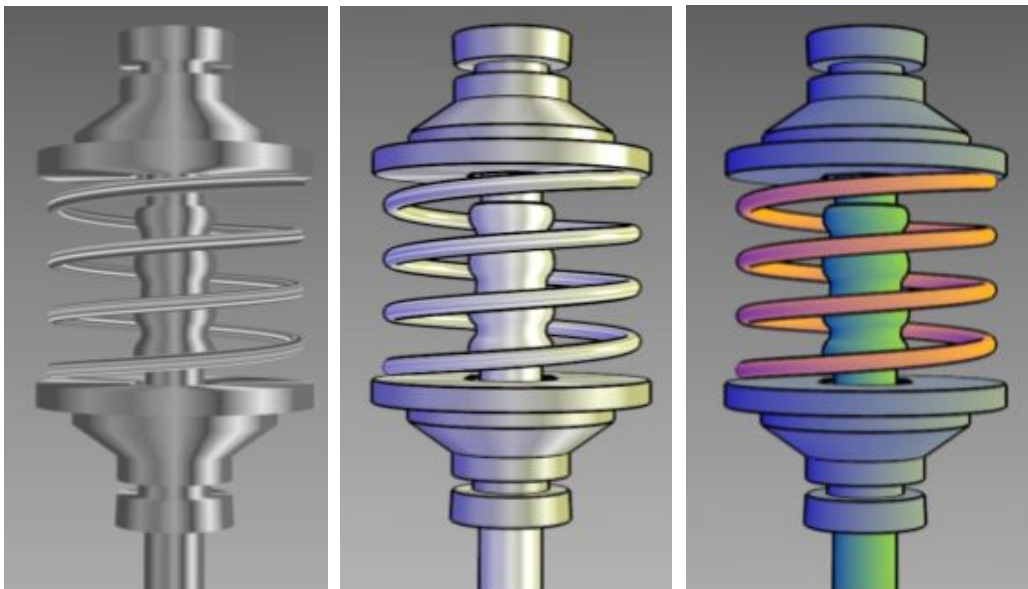


<http://artis.imag.fr/Publications/2009/BBT09/DynSolidTextures.mov>

Today: Non Photorealistic Rendering

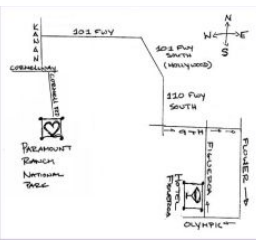
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Technical Illustration

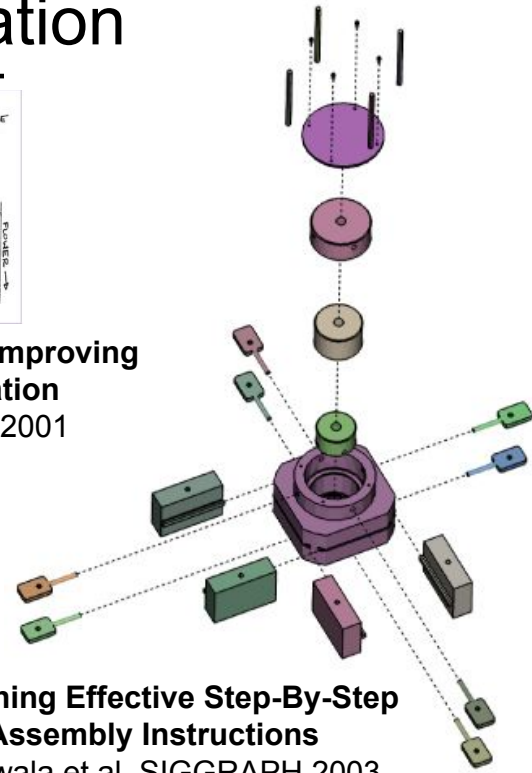


A non-photorealistic lighting model for automatic technical illustration
Gooch, Gooch, Shirley, & Cohen SIGGRAPH 1998

Technical Illustration



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



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

Today: Non Photorealistic Rendering

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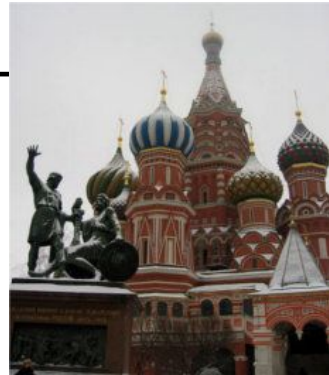
“Towards Artistic Minimal Rendering”, Rosin & Lai, NPAR 2010



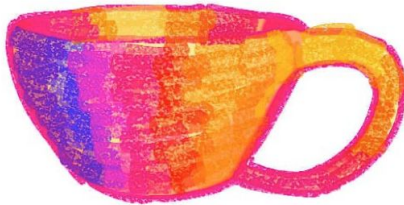
Figure 1: *Mona Lisa* rendered in different styles. (a) line drawing, (b) image abstraction, (c)(d)(e): three styles of the proposed approach in this paper (single level, texture and pyramid).

Artistic Thresholding

- Xu & Kaplan,
NPAR 2008



“WYSIWYG NPR: Drawing Strokes Directly on 3D Models”,
Kalnins, Markosian, Meier, Kowalski, Lee, Davidson, Webb,
Hughes, & Finkelstein, SIGGRAPH 2002



Today: Non Photorealistic Rendering

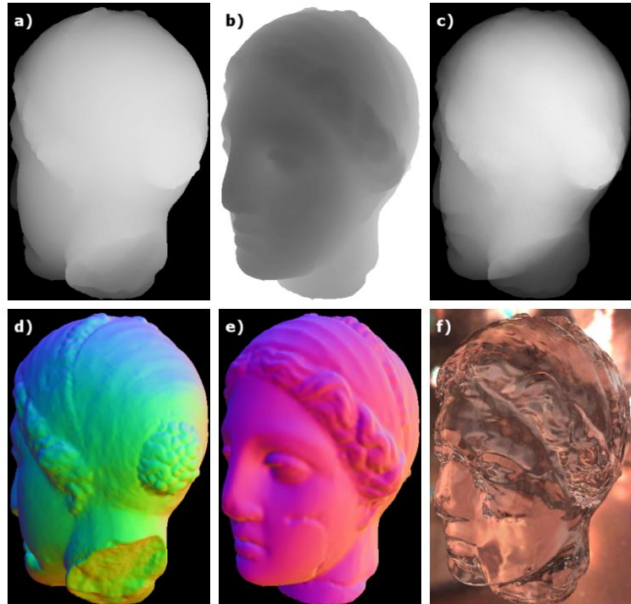
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Reading for Next Time: *(pick one)*

Chris Wyman,

"An Approximate
Image-Space
Approach for
Interactive
Refraction",

SIGGRAPH 2005



Reading for Next Time: *(pick one)*

"Environment Matting and Compositing"

Zongker, Werner, Curless, & Salesin, SIGGRAPH 1999



Reading for Next Time: *(pick one)*

“Video Matching”,
Sand & Teller, SIGGRAPH 2004

