CMSC 491A/691A
Artistic Rendering

Penny Rheingans
UMBC

Announcements

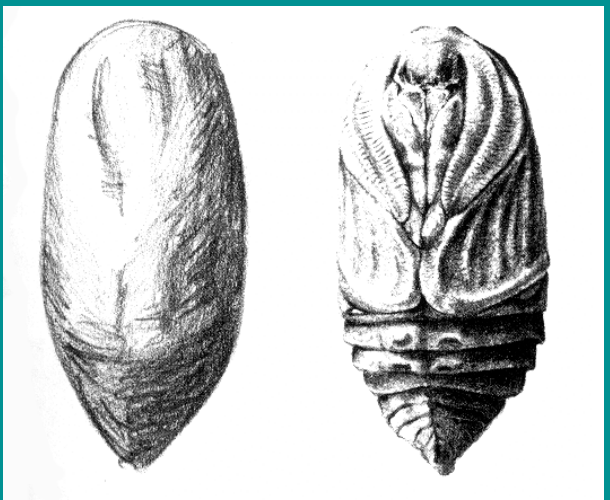
- Upcoming paper presentations:
  - Today: John
  - Thurs: JonB; Sean
  - Tues: Josh, JonD
- Upcoming deadlines
  - Alpha, biblio, revised prop: sept 21
  - Media spec: oct 3
- Class in ITE 346 on Sept 26

Conveying Shape

"A basic understanding of how light affects form is another of the essential elements in the production of a scientific illustration. A drawing, no matter how beatifully rendered, will not look convincing if the highlights and shadows are placed unnaturally."

Elaine Hodges, in Hodges89

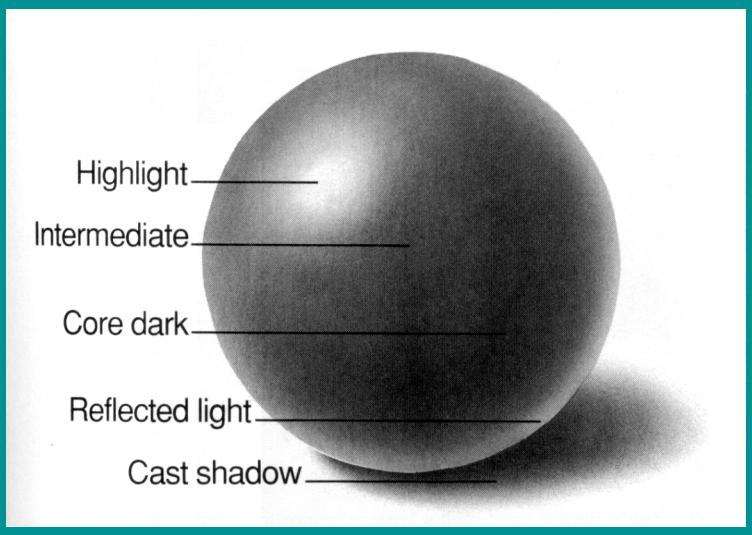
Shape Cues: Overall Shape



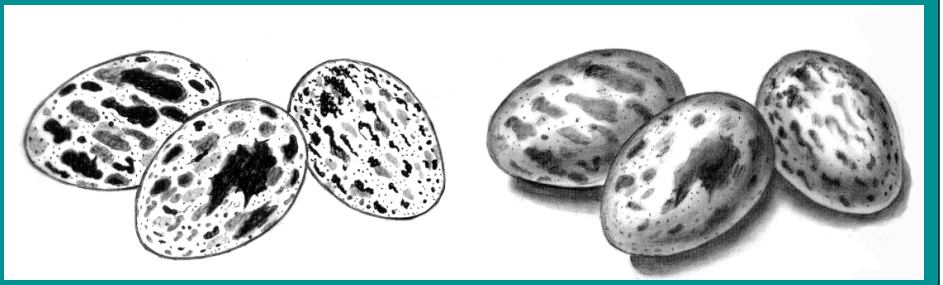
- Squint to isolate main contour shape

Noelle Congdon, in Wood94, pg 25

Shape Cues: Light and Shadow

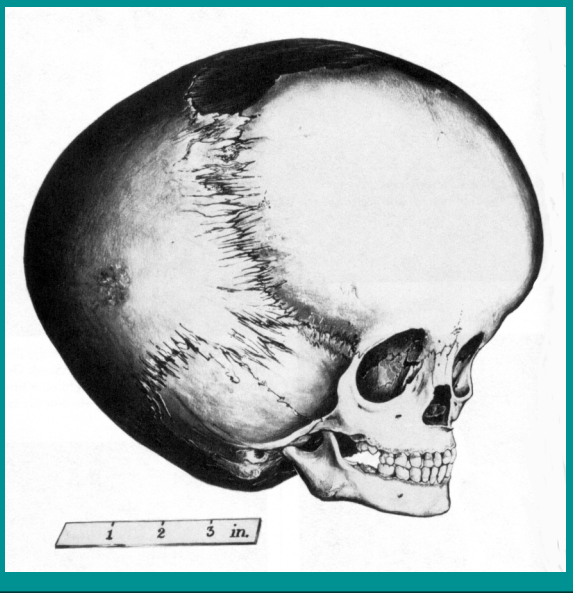


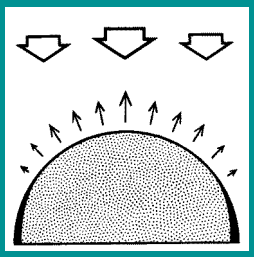
Shape Cues: Lighting and Shadow



Phyllis Wood, in Wood94, pg 22

Shape Cues: Rim Shadow

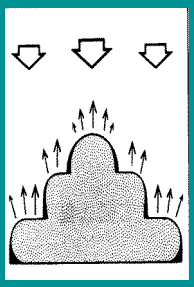


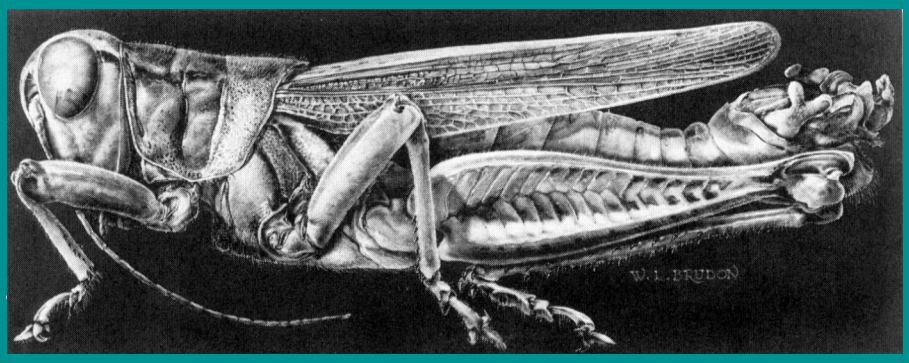


- Periphery in shadow
- Distant areas darkened
- Simulates beam of light from front
- William Brudon, in Hodges89, pg 86

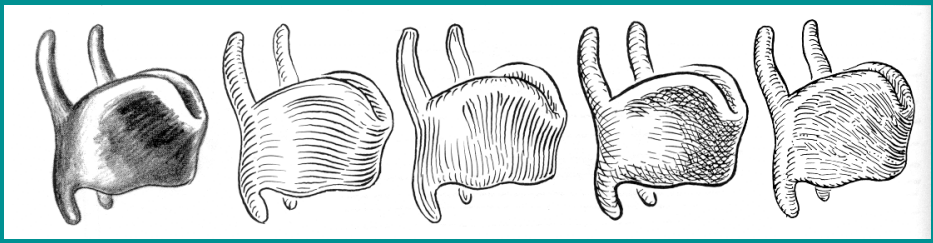
Shape Cues: Plateau Lighting

- Multiple levels of rim shadow





Shape Cues: Rendering Styles



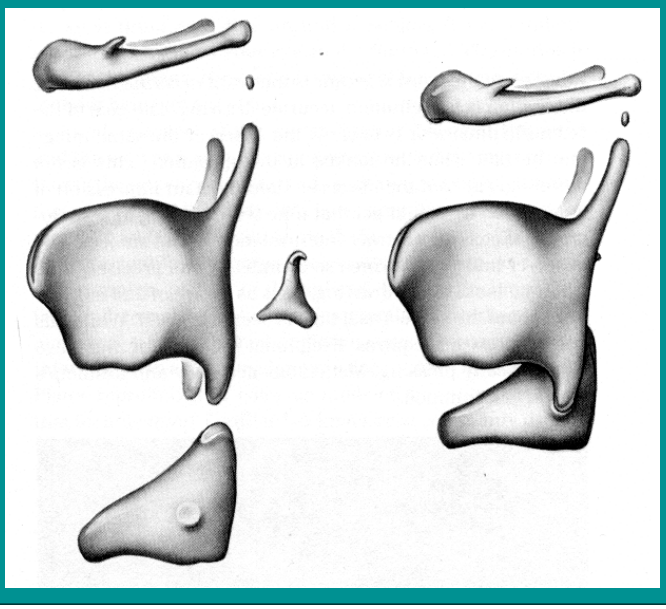
Phyllis Wood, in Wood94, pg 40

Conveying Depth

"In studying atmospheric perspective we learn that, as an object recedes from the eye, it becomes less clear, dimmer, softer, more hazy. … The part of the specimen that is further away from the eye is drawn with finer lines than is the part closer to the eye. This convention gives a three-dimensional quality to the subject."

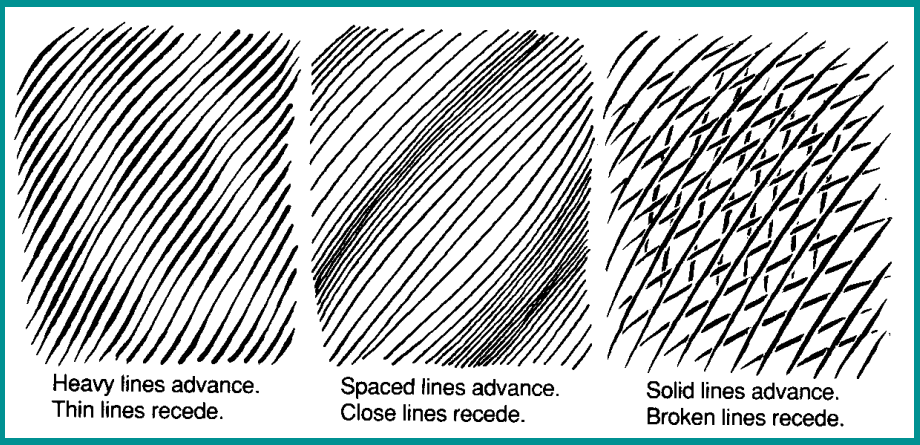
Phyllis Wood, in Wood94

Depth Cues: Atmospheric Perspective



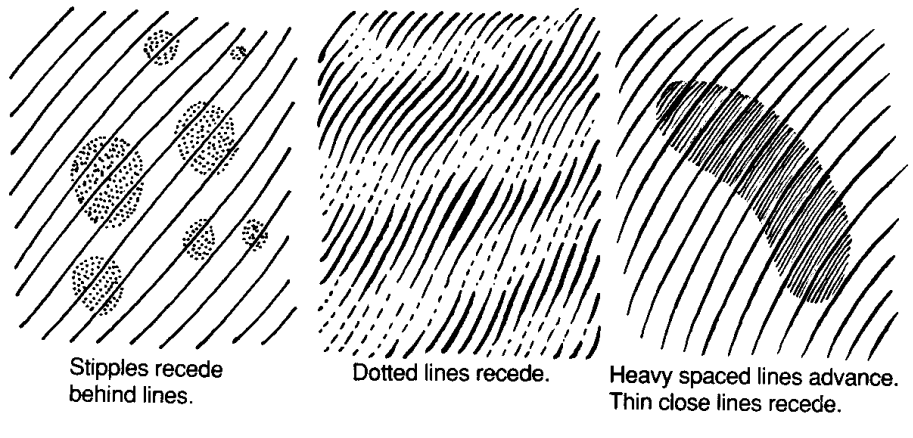
Robert Demarest, in Wood94, pg 7

Depth Cues: Line Attributes



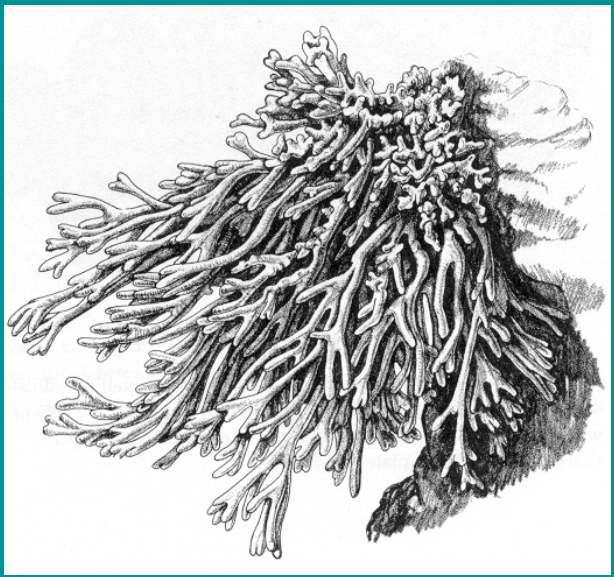
Wood94, pg 32

Depth Cues: Line Attributes



Wood94, pg 32

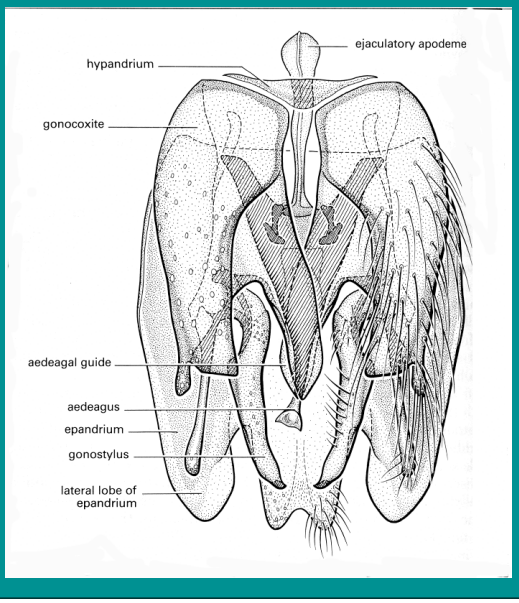
Depth Cues: Halos



- Leave halo behind foreground objects
- Greater space indicates greater distance

Janet McKenzie, in Wood94, pg 45

Depth Cues: Texture Changes

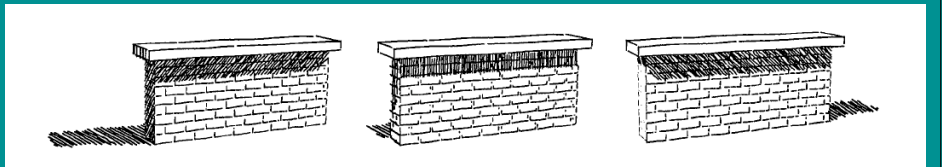


- Breaks in outline
- Line pattern changes

Ralph Idema, in Hodges89, pg 100

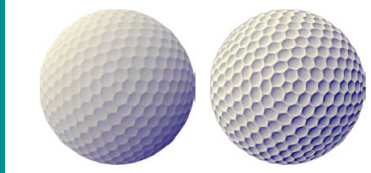
Shading and Texturing

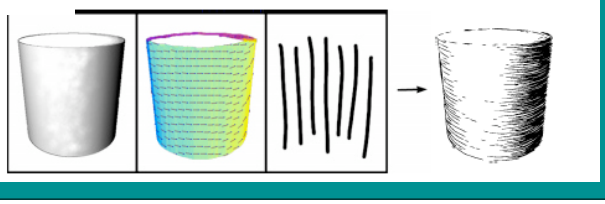
- Generating appropriate tone and texture
- Key issues:
  - Matching tone representing shaded surfaces
  - Using strokes appropriate to style
  - Matching desired textures
  - Using tone and texture to clarify shape



Shading and Texturing

- Papers
  - Winkenbach94
  - Meier96
  - Salisbury97
  - Rusinkiewicz06





Computer-Generated Pen-and-Ink Illustration

Georges Winkenbach, David Salesin

SIGGRAPH 94

Basic Approach

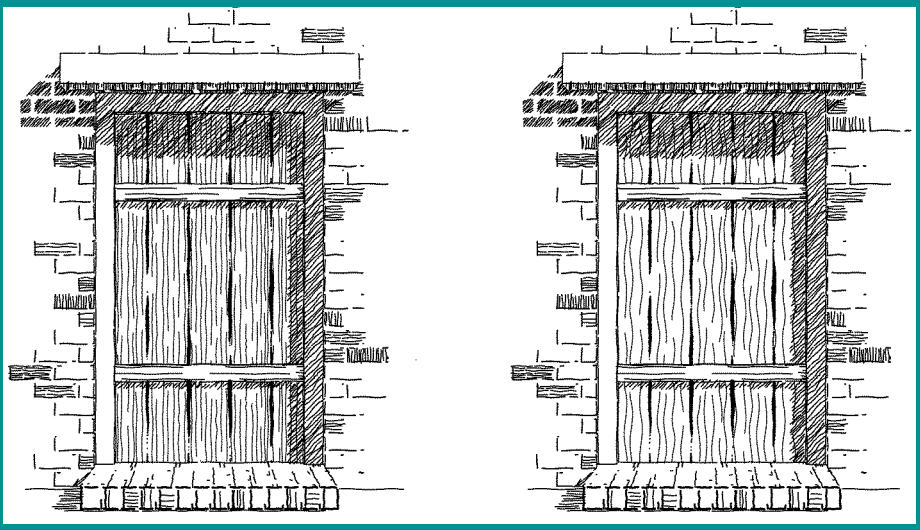
- Adapt techniques of traditional pen-and-ink illustration for automatic generation
- Major Topics:
  - strokes
  - tone and texture
  - outlines

NPR Graphics Pipeline

- Unique nature of process
  - strokes create both texture and tone
  - 2D/3D interactions
- Differences from standard pipeline
  - 2D spatial subdivision
  - rendering of tone and texture
  - stroke clipping
  - outlining

Stroke Principles

- Stroke thickness should correspond to level of detail
- Line thickness should vary over stroke length
- Wavy lines indicate schematic parts



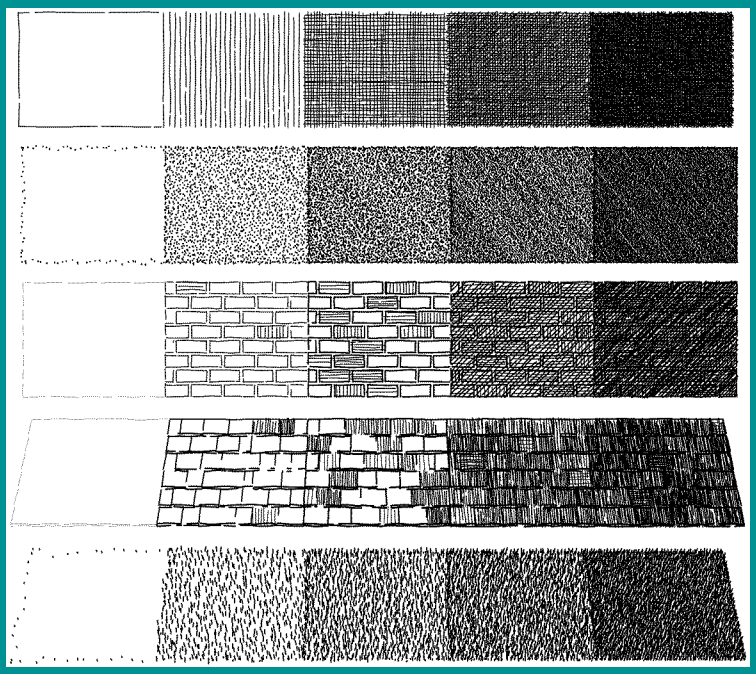
- Winkenbach and Salesin '94

Stroke Implementation

- Stroke specified with
  - path
  - nib: footprint as function of pressure
  - character function: waviness and pressure
- Strokes clipped to region
- Initial implementation
  - circular nibs
  - randomly perturbed sine wave character funcs

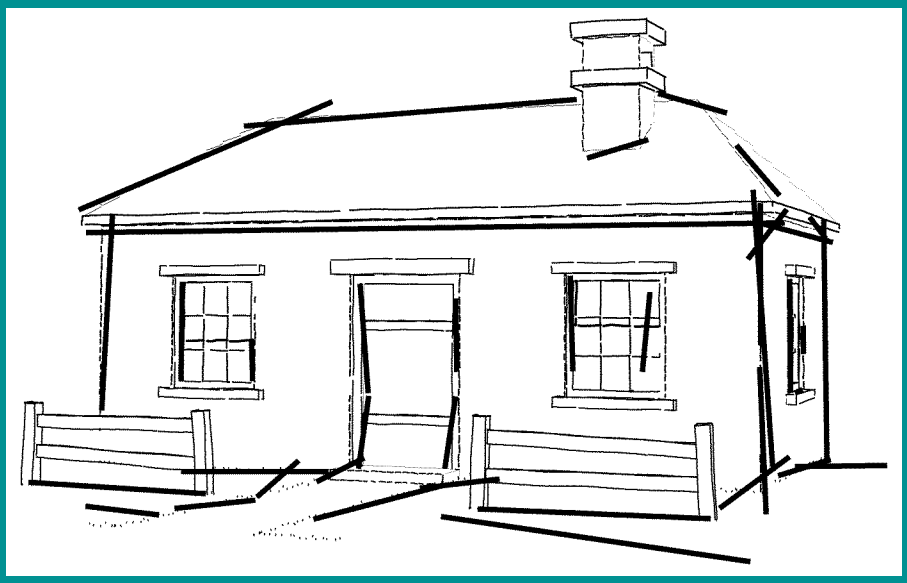
Tone and Texture Principles

- Tones should be created from lines of roughly equal weight and spacing
- Relative tones more important that absolute
- Textures convey material types
- Tone can be implied by “indication”



Texture Implementation

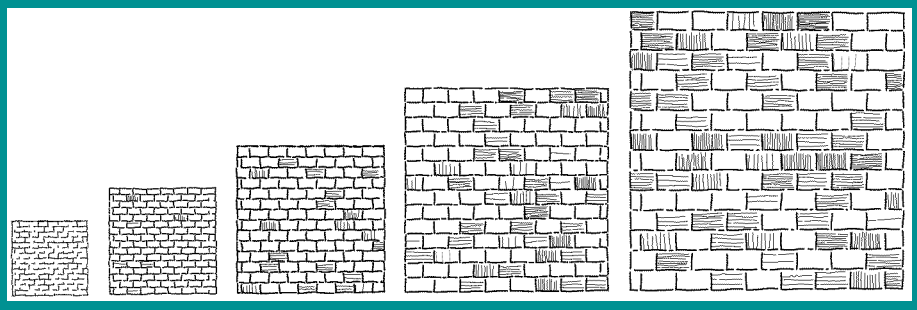
- Stroke texture
  - each stroke has a priority
  - strokes together achieve desired tone (computed from simple Phong lighting model)
  - procedural prioritize specification for texture
- Interactive indication specification
  - detail segments generate fields with small random perturbation



- Winkenbach and Salesin ‘94

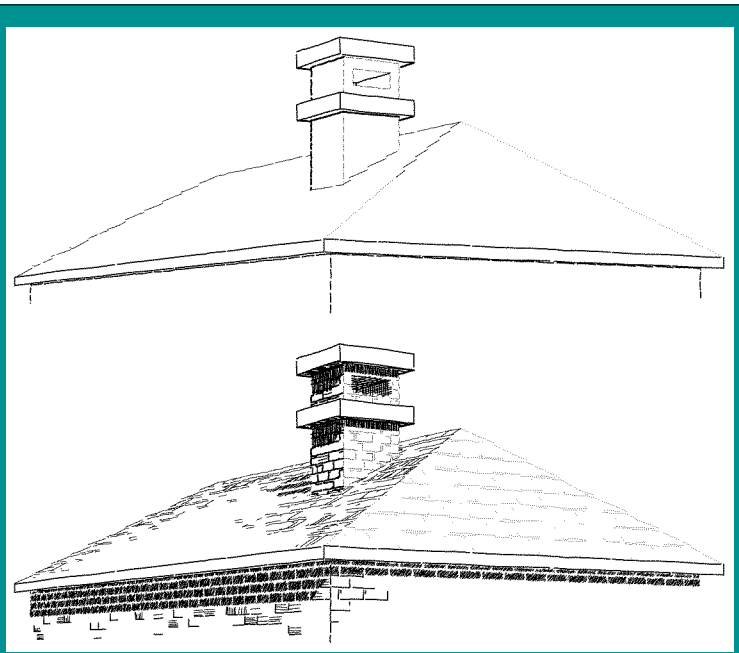
Outline Principles

- Quality of outline conveys texture
- Thick outlines suggest shadows
- Halos around outlines improve visibility
- Outlines must be present even when tones are not
- Outlines can be implied by “indication”

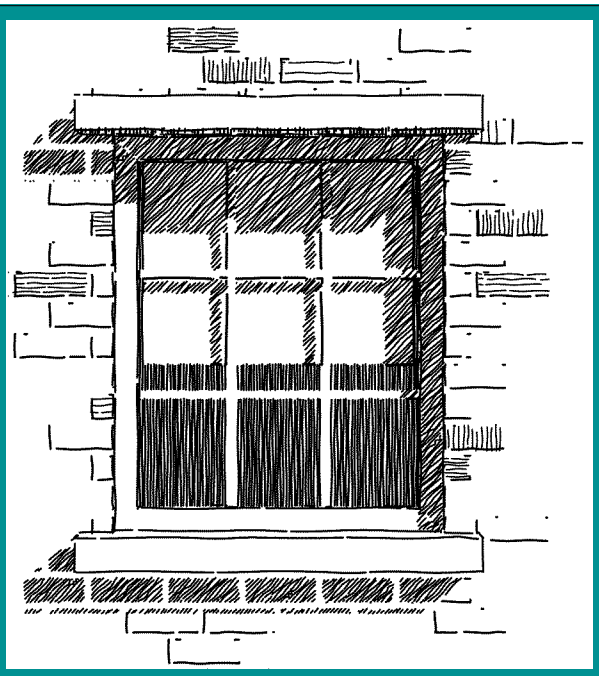


Outline Implementation

- Outline types:
  - boundary
  - interior
- Boundary outline as part of texture
- Only draw outlines where necessary
- Accent outlines for shadowing and relief
- Outlines are view dependent

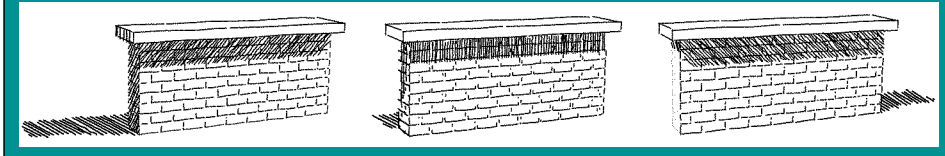


- Winkenbach and Salesin ‘94

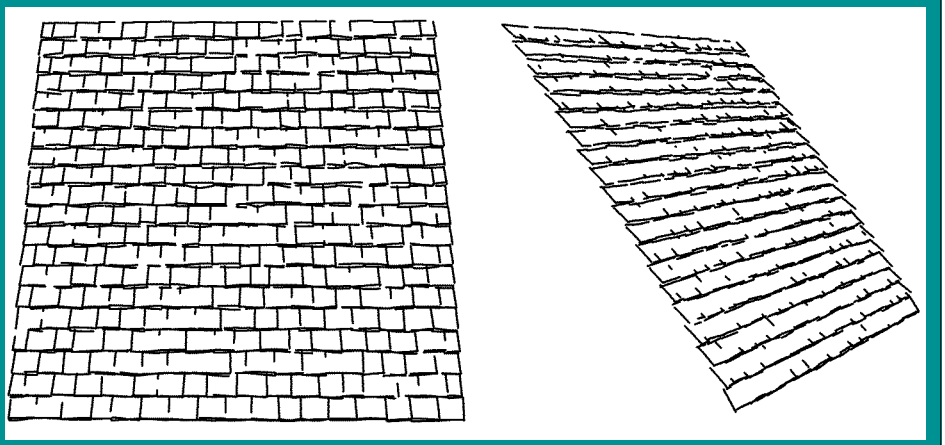


- Winkenbach and Salesin ‘94

Light Dependence



View Dependence



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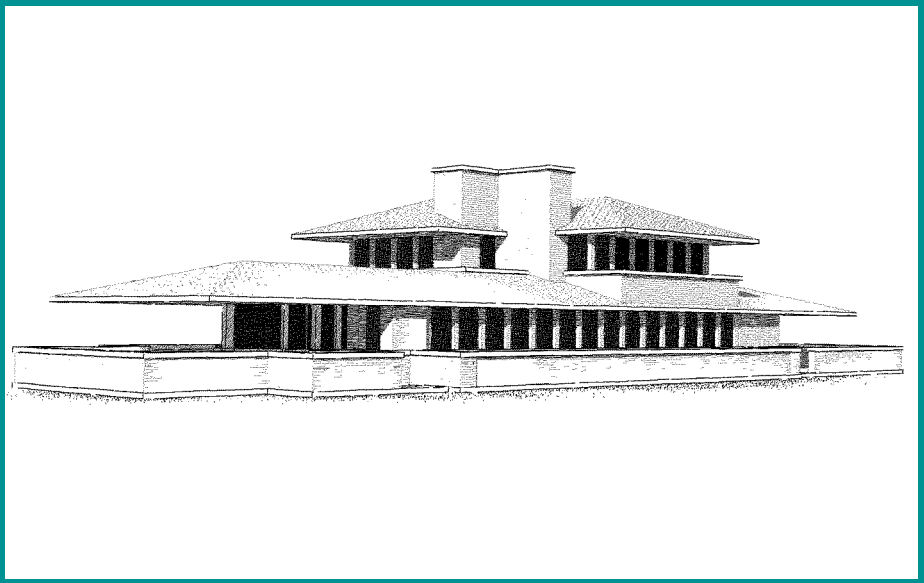

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