

# *Computer Graphics*

*by Ruen-Rone Lee*  
**ICL/ITRI**



# *Wrap up from last week*

- ◆ **Global Illumination**
  - **Radiosity**
  - **Ray tracing**

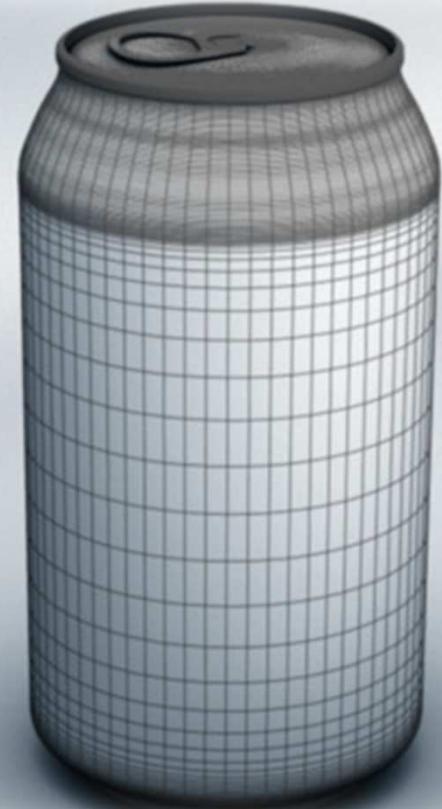


# *Non-Photorealistic Rendering (NPR)*

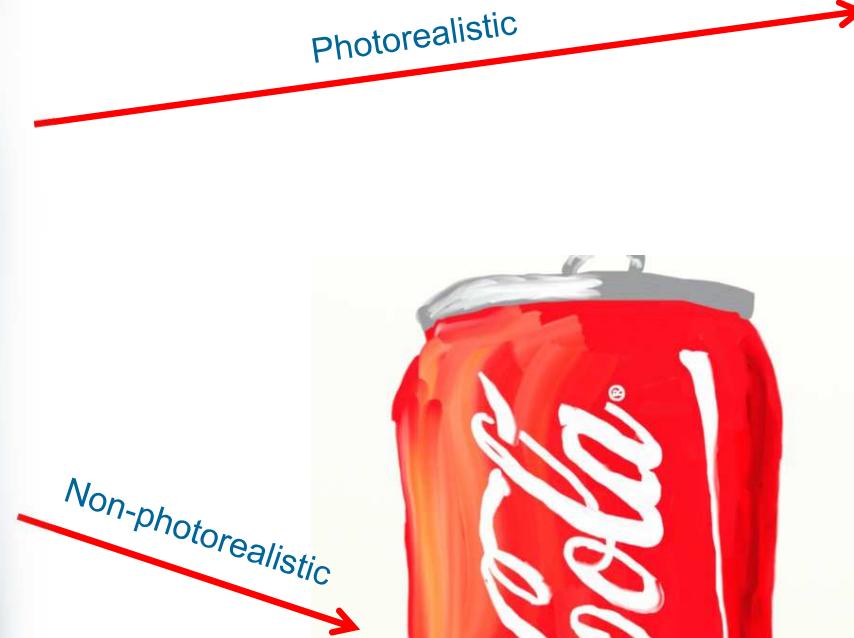
*Painting  
Drawing  
Illustration  
Art works*



# *Photorealistic vs Non-photorealistic*



3D model



Photorealistic

Non-photorealistic



# *Comparing and Contrasting*

	<b>Photorealism</b>	<b>NPR</b>
<i>Approach</i>	Simulation	Stylization
<i>Characteristic</i>	Objective	Subjective
<i>Influences</i>	Simulation of physical processes	Sympathies with artistic processes; perceptual-based
<i>Accuracy</i>	Precise	Approximate
<i>Deceptiveness</i>	Can be deceptive or regarded as 'dishonest'; viewers may be misled into believing that an image is 'real'	Honest – the observer sees an image as a <i>depiction</i> of a scene
<i>Level of detail</i>	Hard to avoid extraneous detail; too much information; constant level of detail	Can adapt level of detail across an image to focus the viewer's attention
<i>Completeness</i>	Complete	Incomplete
<i>Good for representing</i>	Rigid surfaces	Natural and organic phenomena

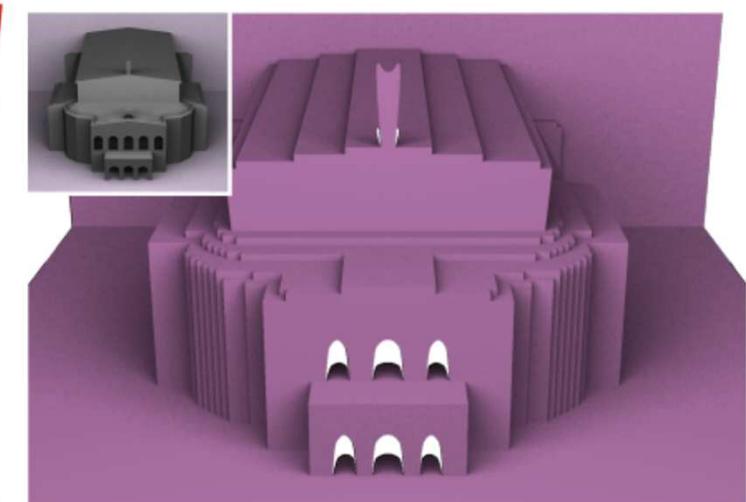
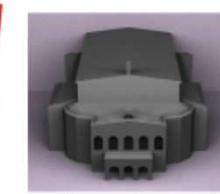
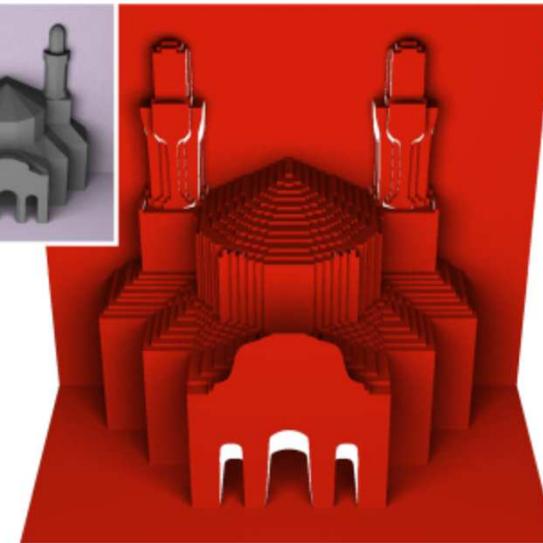
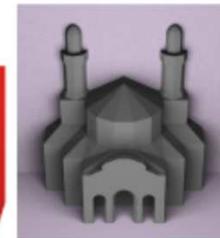
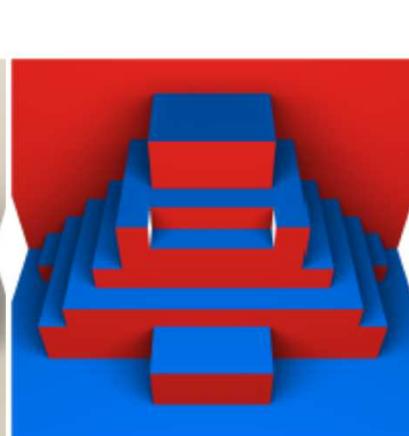
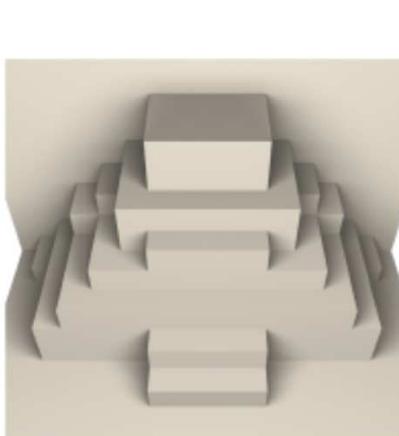
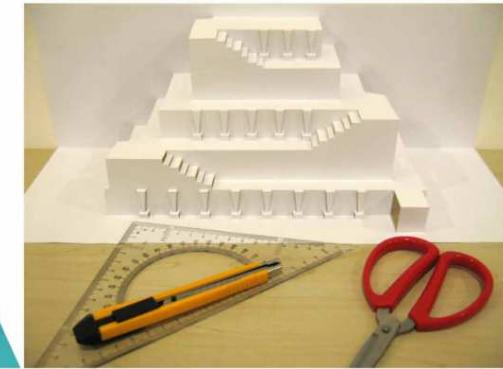
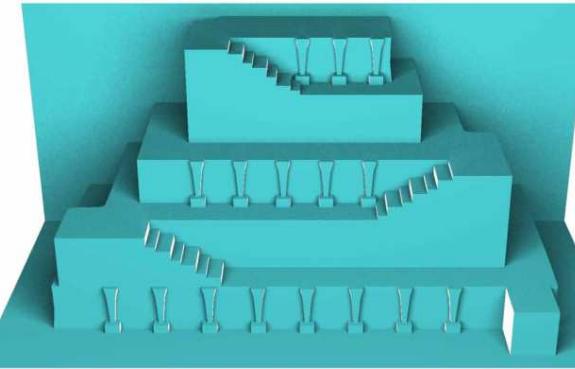
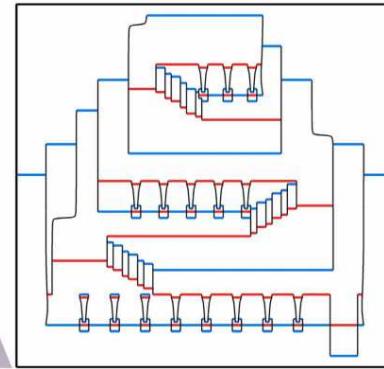
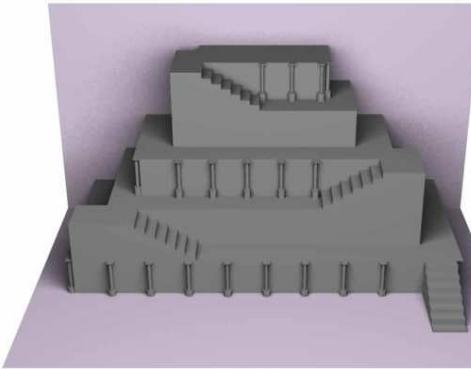
# *Non-Photorealistic Rendering*

- ◆ Approximation of artistic artworks with different stylizations



# *Popup book*

- ◆ Popup: Automatic Paper Architecture from 3D Models



# *Popup book*

Popup: Automatic

from 3D Models



(a) Amsterdam Central Station



(b) Statue of Liberty

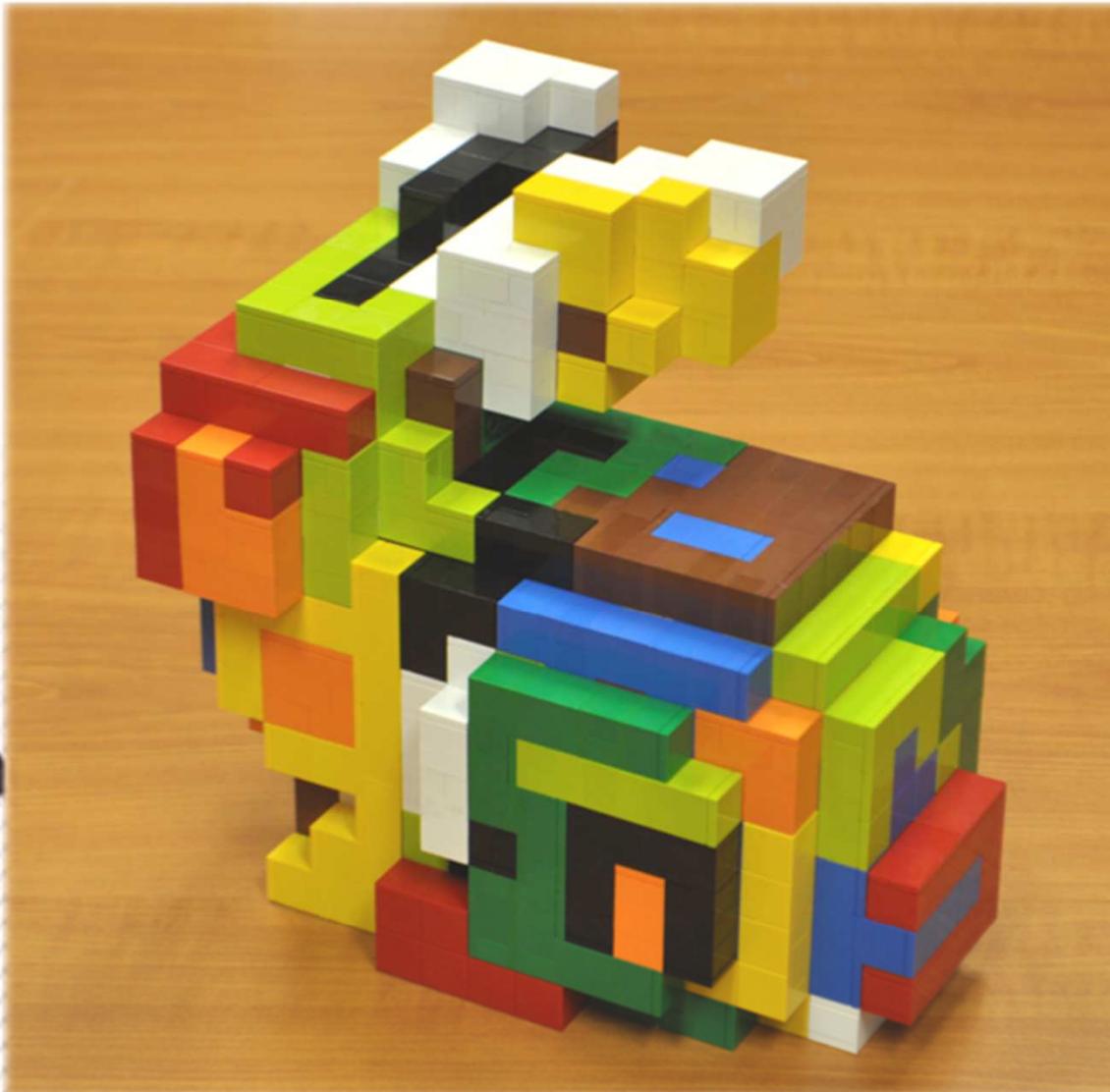


(c) Bellesguard Tower



(d) Himeji Castle

# Puzzles

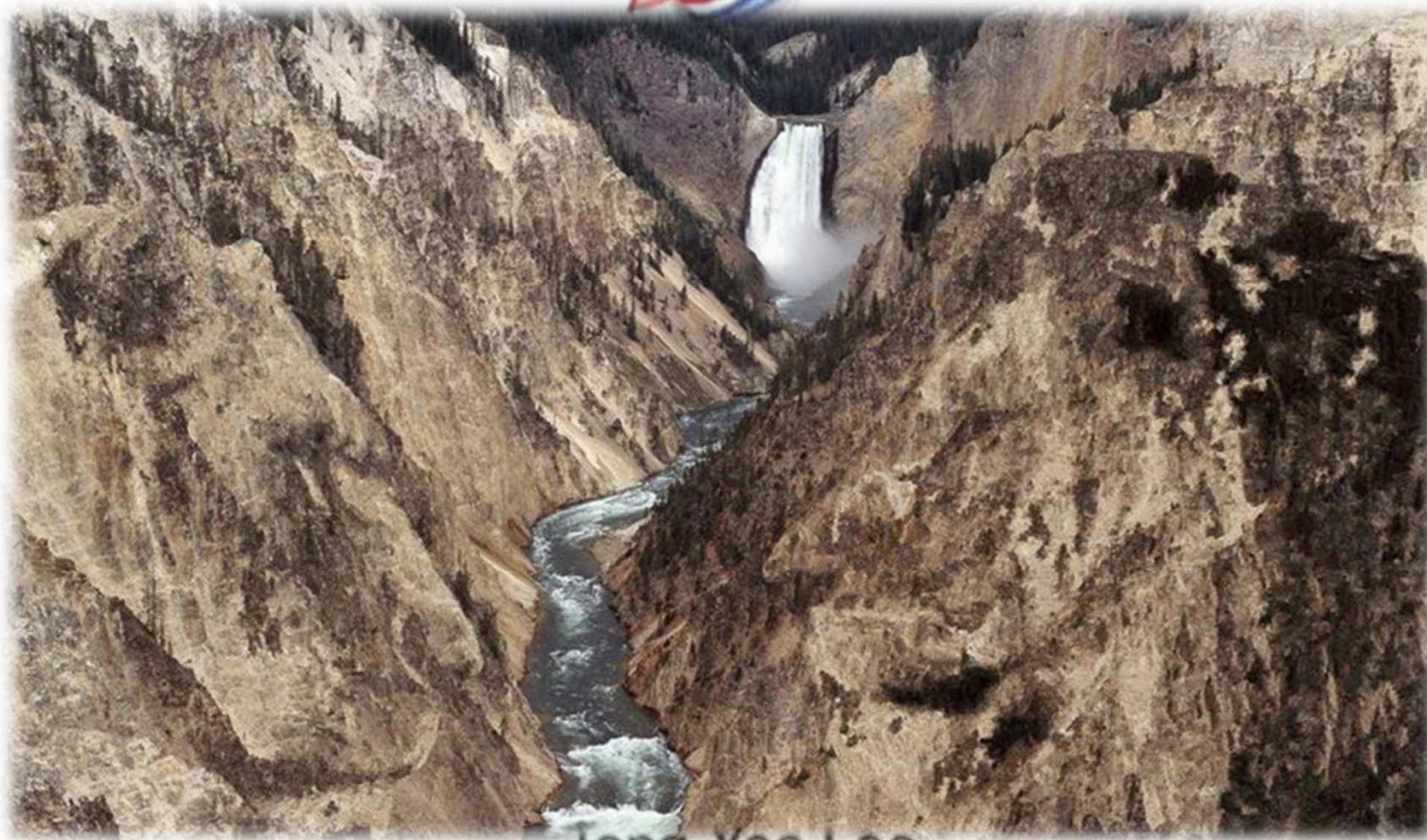


N-OR

# Puzzles



# *Camouflage Image*



Iong-Yee Lee

National Cheng Kung University, Taiwan



# *Halftone QR Codes*

## Halftone QR Codes



# *Painting Synthesis*

- ◆ Converting an image or 3D model to a specific painting style
  - Watercolor
  - Oil painting
  - Chinese painting
  - Pen-and-ink
  - Illustration
  - Sketching
  - ... any kinds of stylization



# *Painting Synthesis*

- ◆ Design stroke tools for user to create similar painting style with respect to user input drawing
  - Corel Painter
  - Photoshop
  - ...



# *Stroke Based Rendering*

- ◆ Synthesize artwork by compositing rendering marks (lines, strokes, tiles) on a digital canvas



Source Image

Layer 1

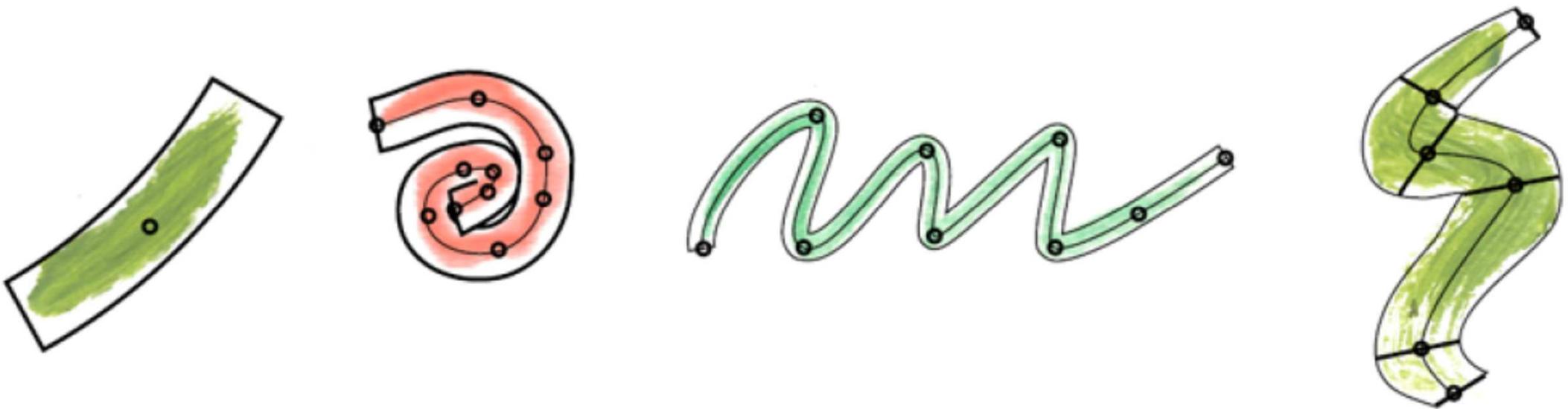
Layer 1+2

Layer 1+2+3

Layer 1+2+3+4

# *Strokes Synthesis*

## ◆ Texture Spline Strokes



# Watercolor

- ◆ Mimic the effects of all kinds of watercolor techniques

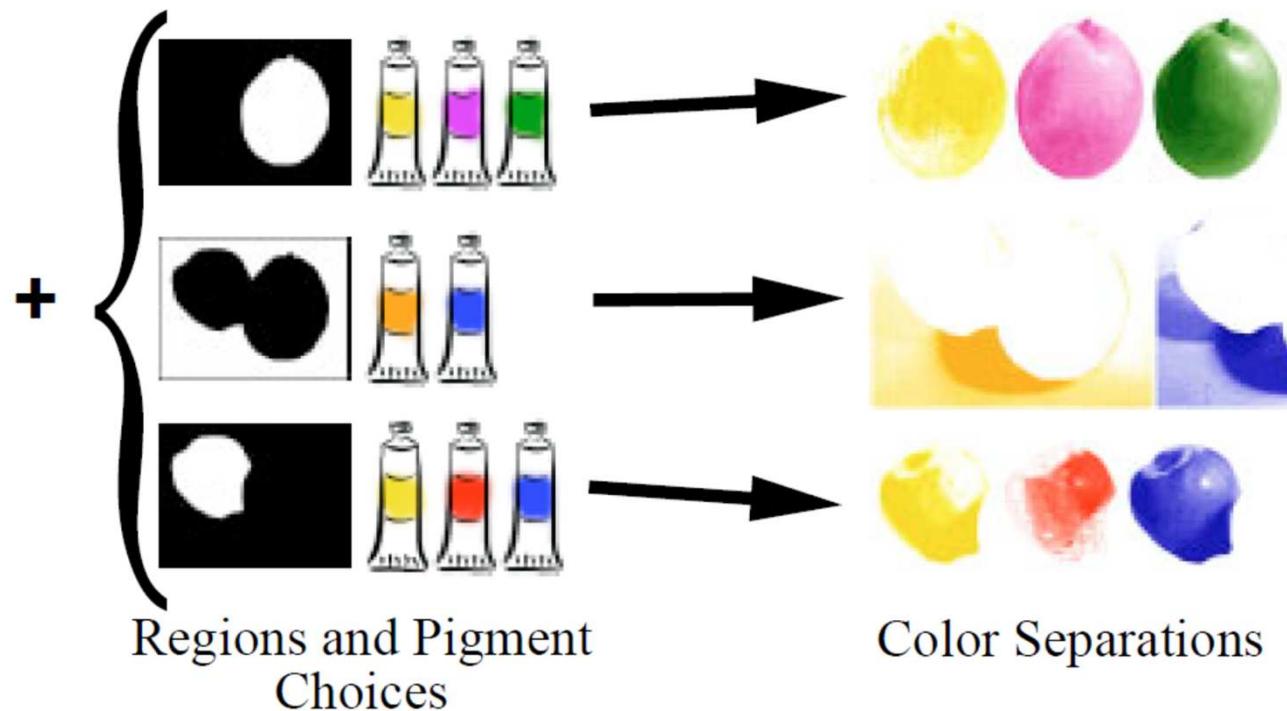


# Watercolor

- ◆ Mimic the effects of all kinds of watercolor techniques



Target Image



# Watercolor

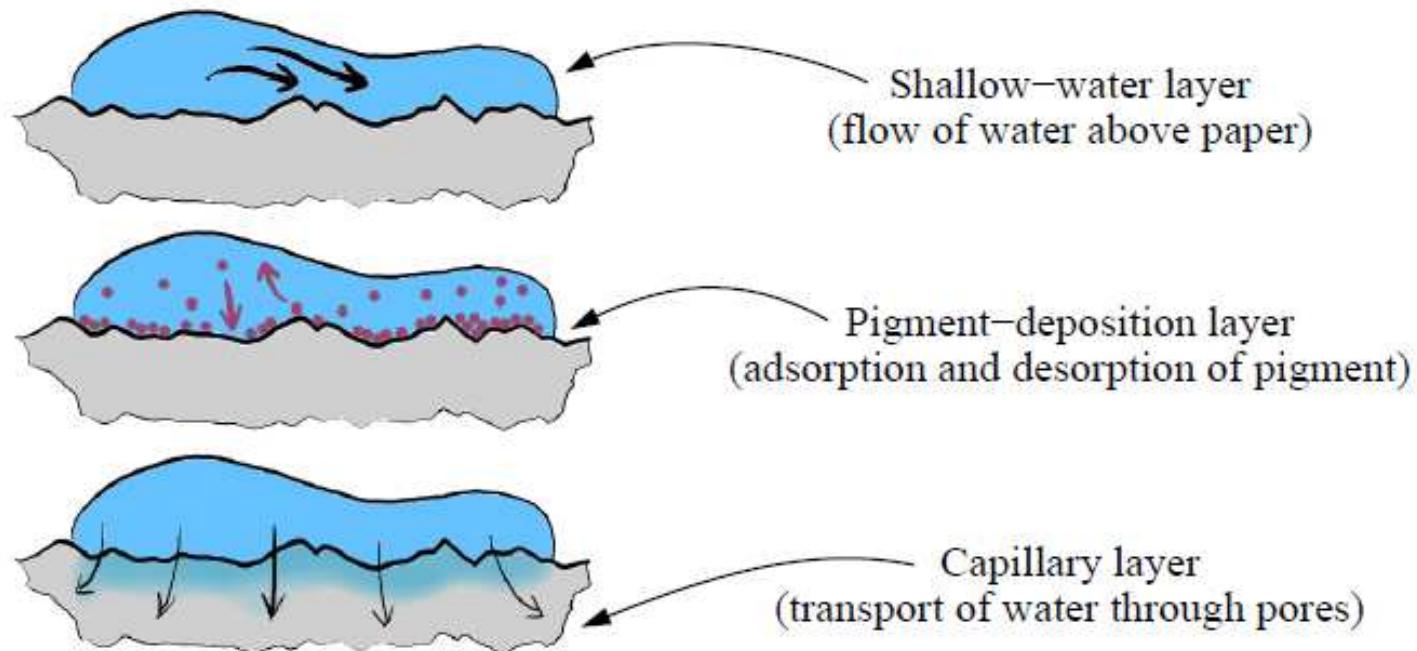
## ◆ Paper modeling



Different kinds of papers

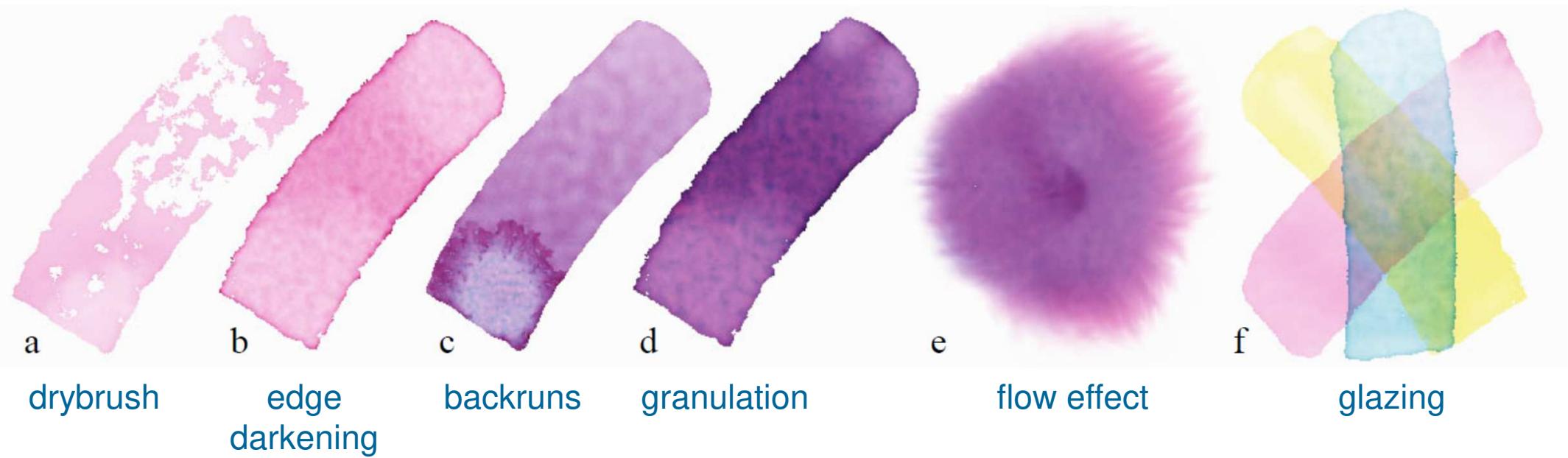
# Watercolor

## ◆ Canvas modeling



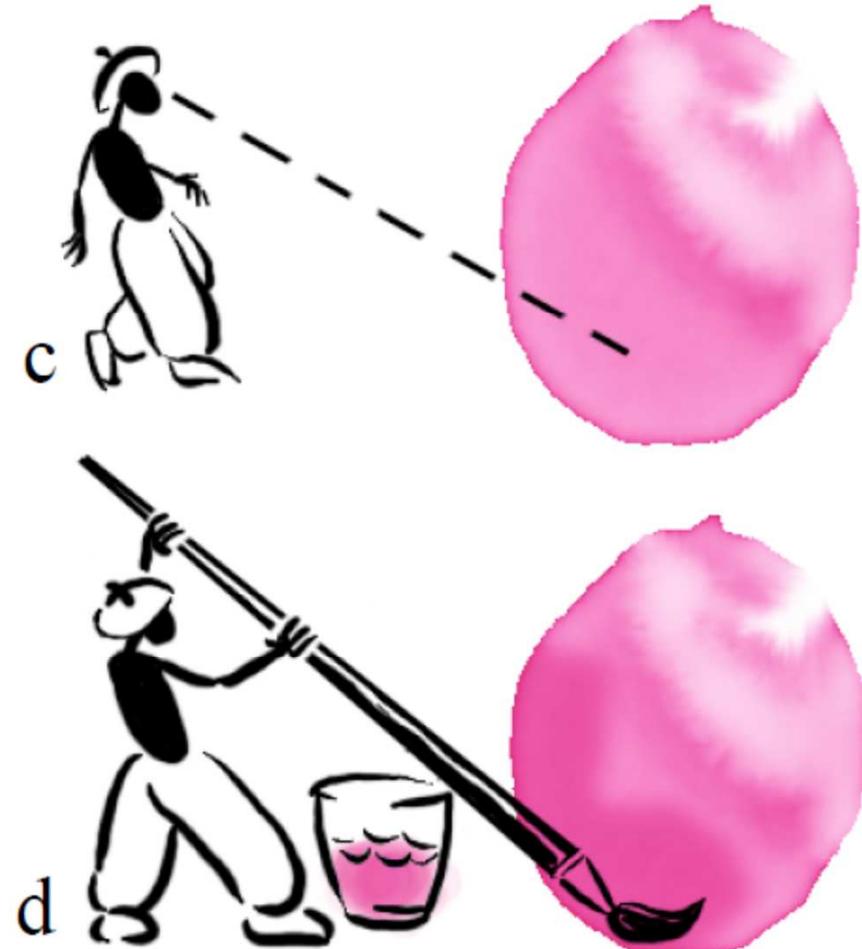
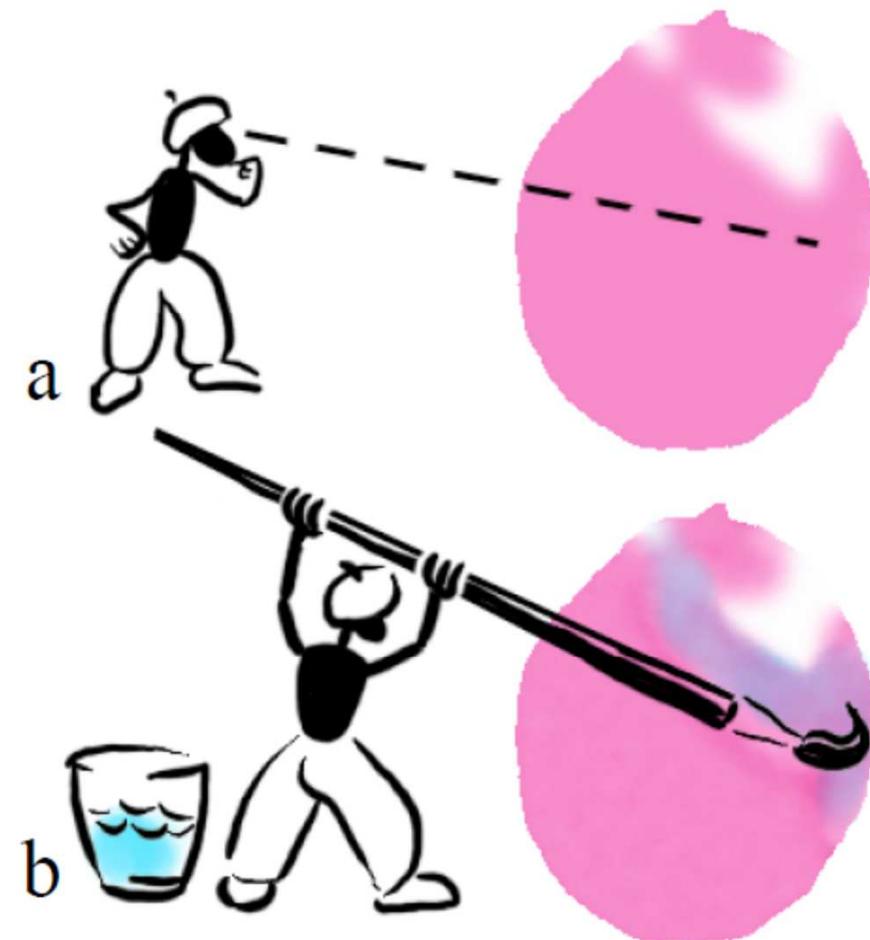
# Watercolor

## ◆ Fluid simulation of pigment and water



# Watercolor

## ◆ Illumination of watercolor pigment



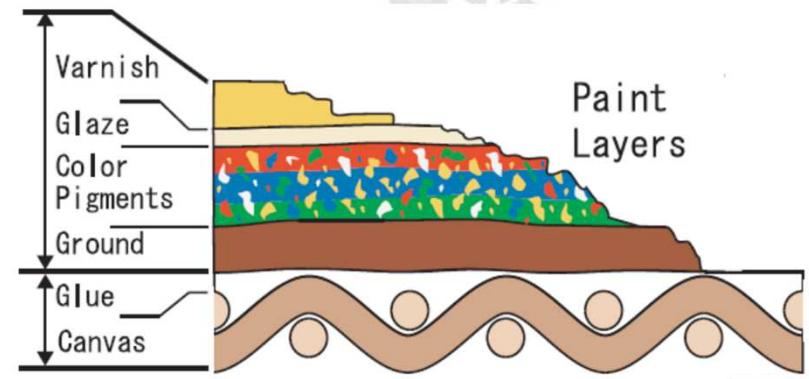
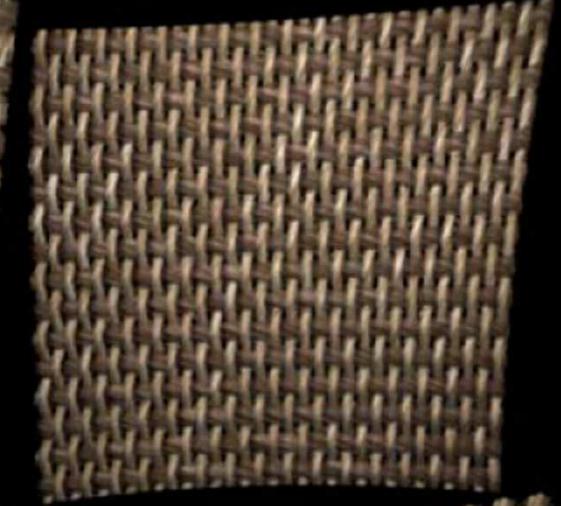
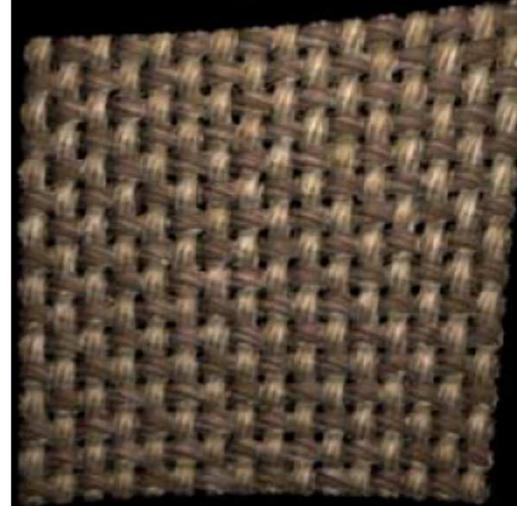
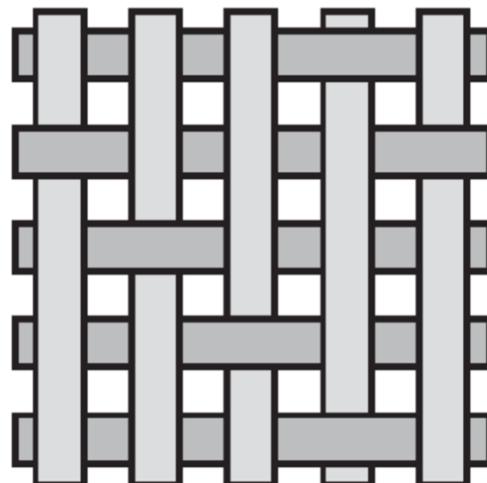
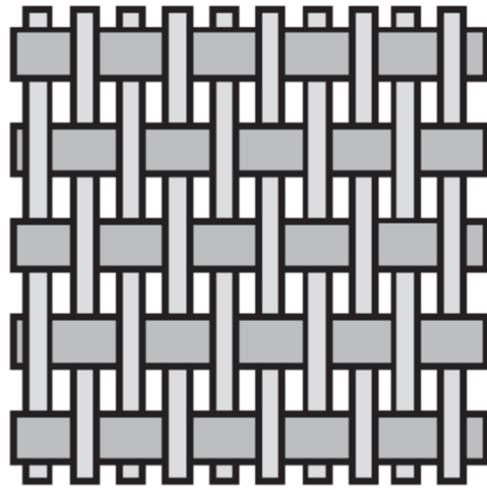
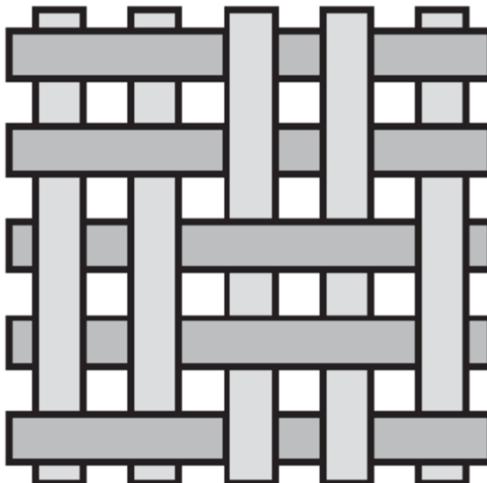
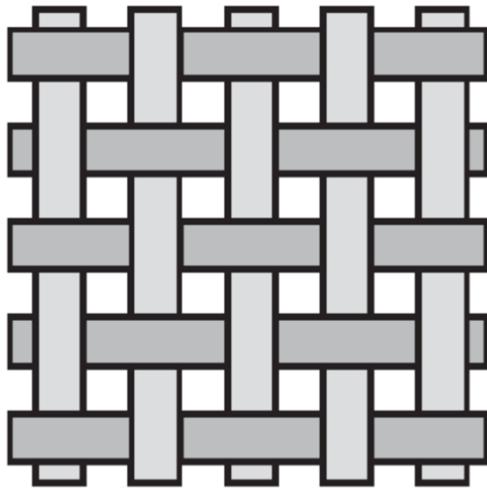
# *Oil Painting*

- ◆ Mimic the stylization of oil painting



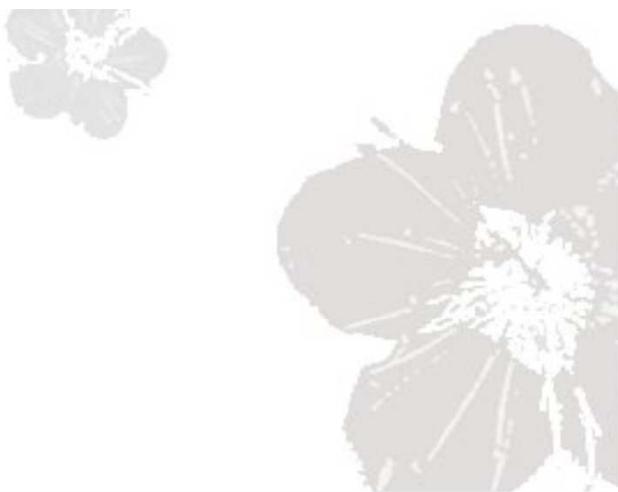
# *Oil Painting*

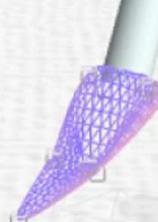
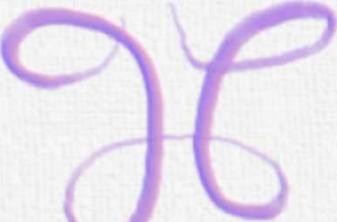
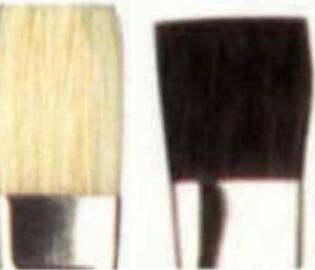
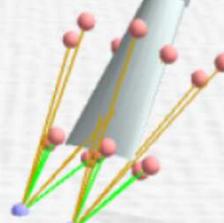
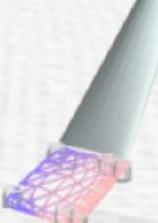
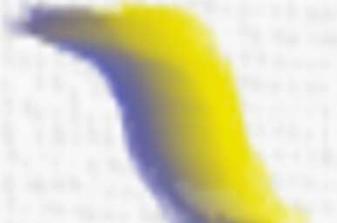
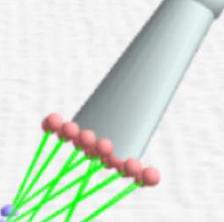
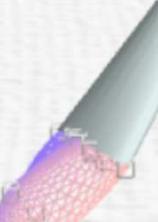
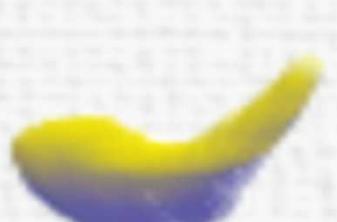
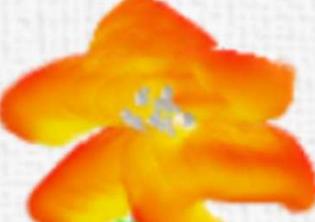
## ◆ Modeling the canvas



# *Oil Painting*

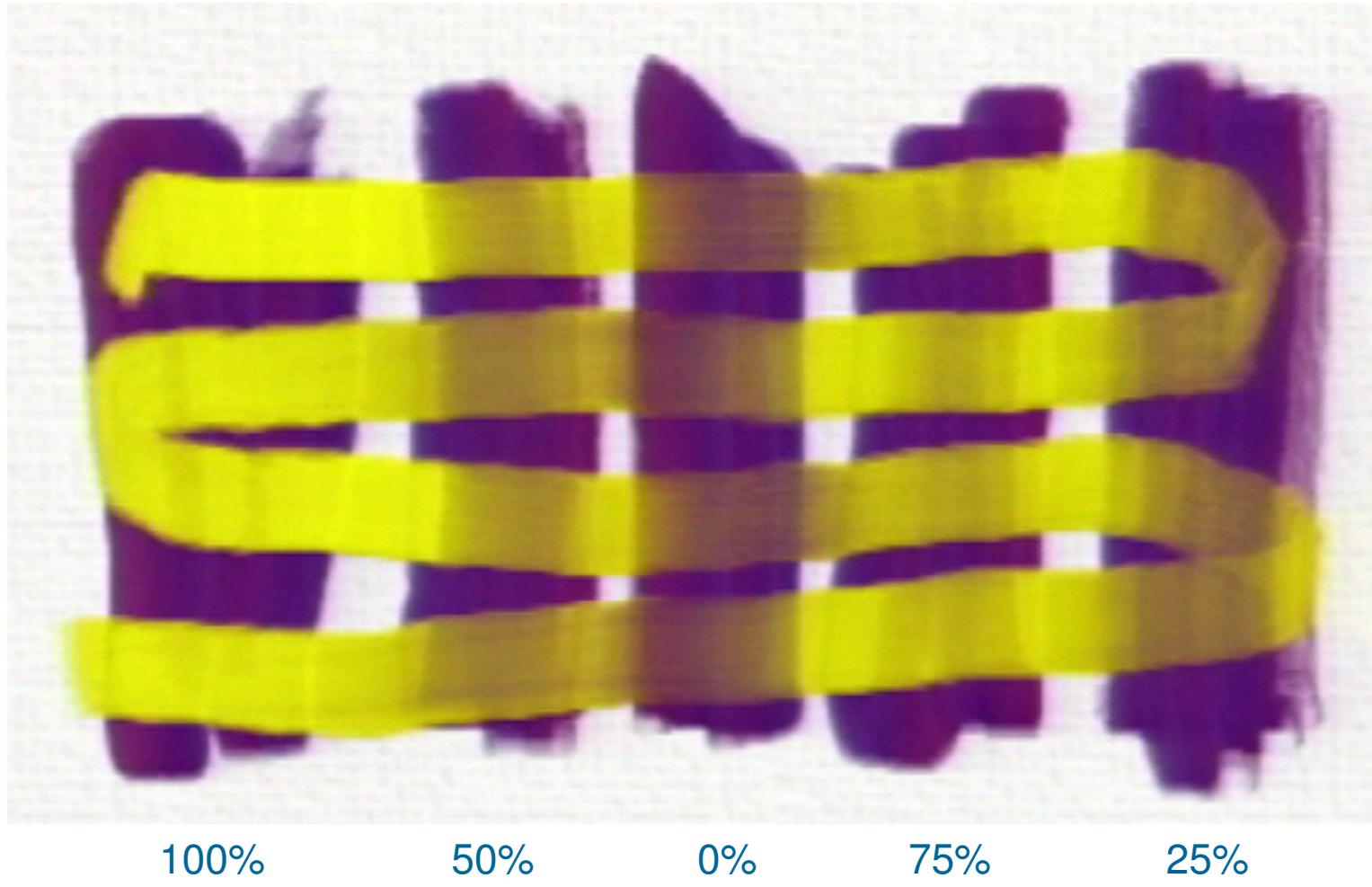
## ◆ Modeling painting brushes



Type	Examples	Model	Structure	Surface	Example Strokes	
Round						
Flat/Bright						
Filbert						

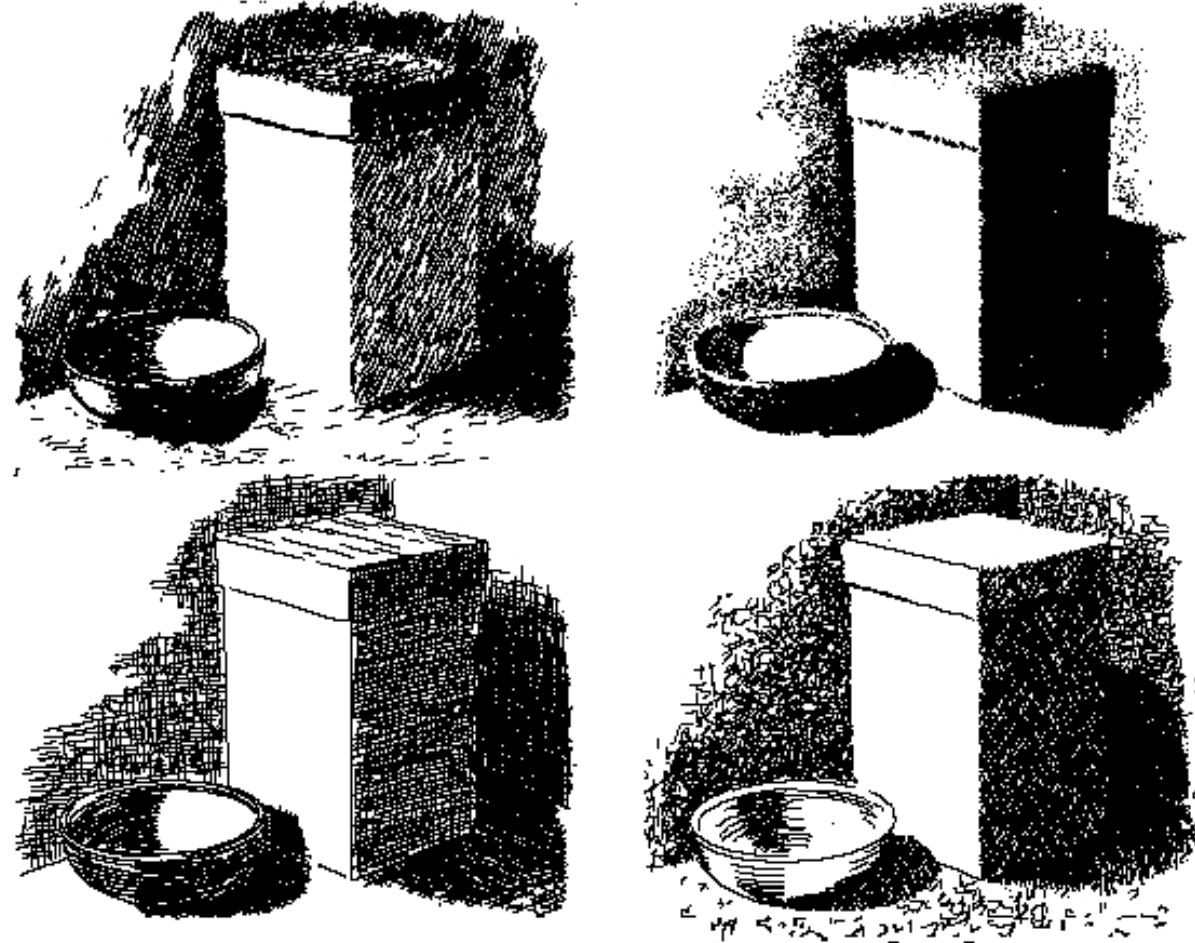
# *Oil Painting*

## ◆ Coloring



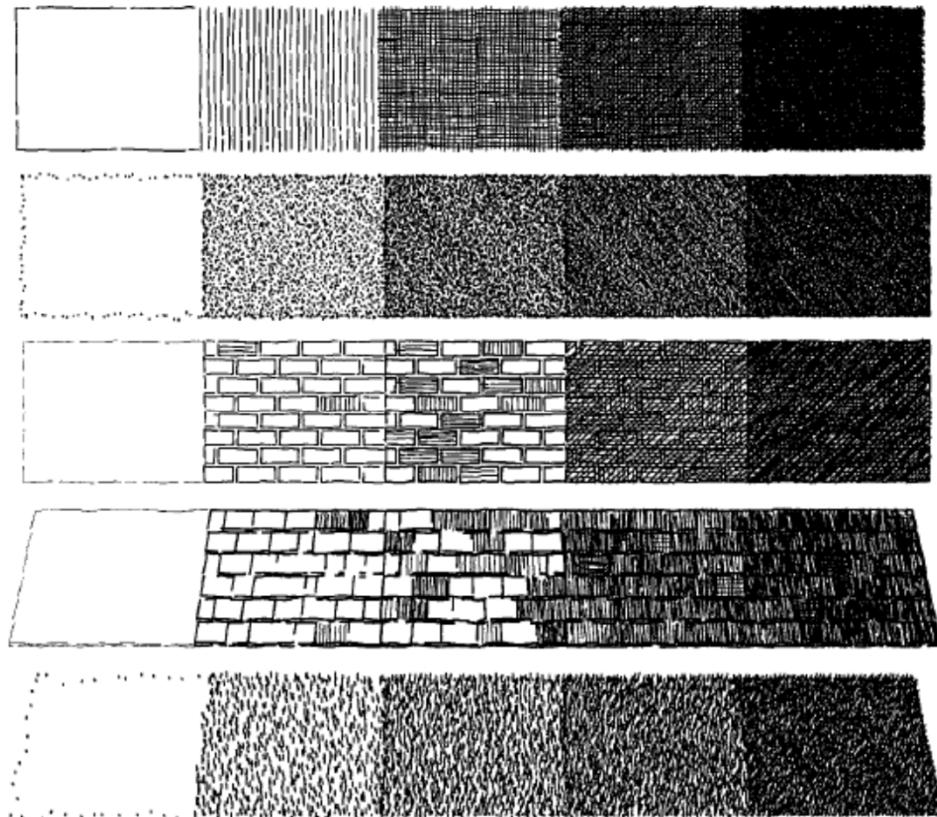
# *Pen-and-Ink illustration*

## ◆ Strokes, tone, textures, outlines

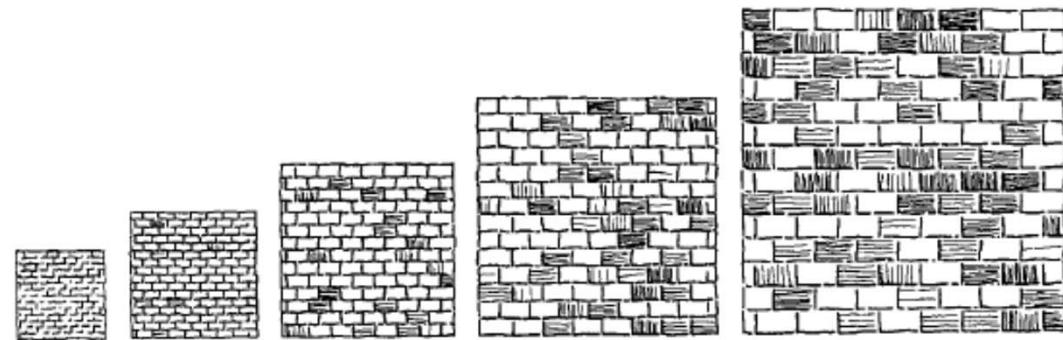


# *Pen-and-Ink illustration*

## ◆ Stroke textures with tone variation



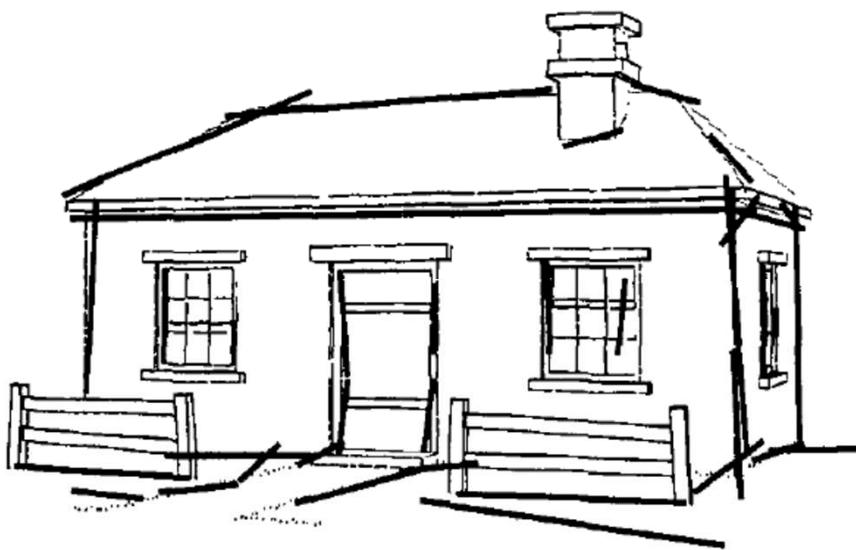
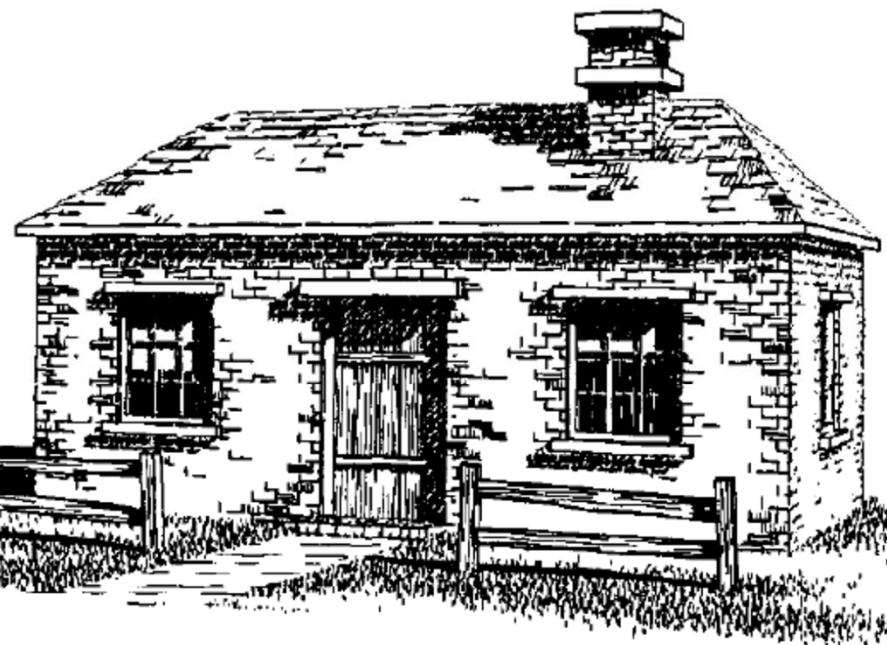
Stroke textures



Level of Detail

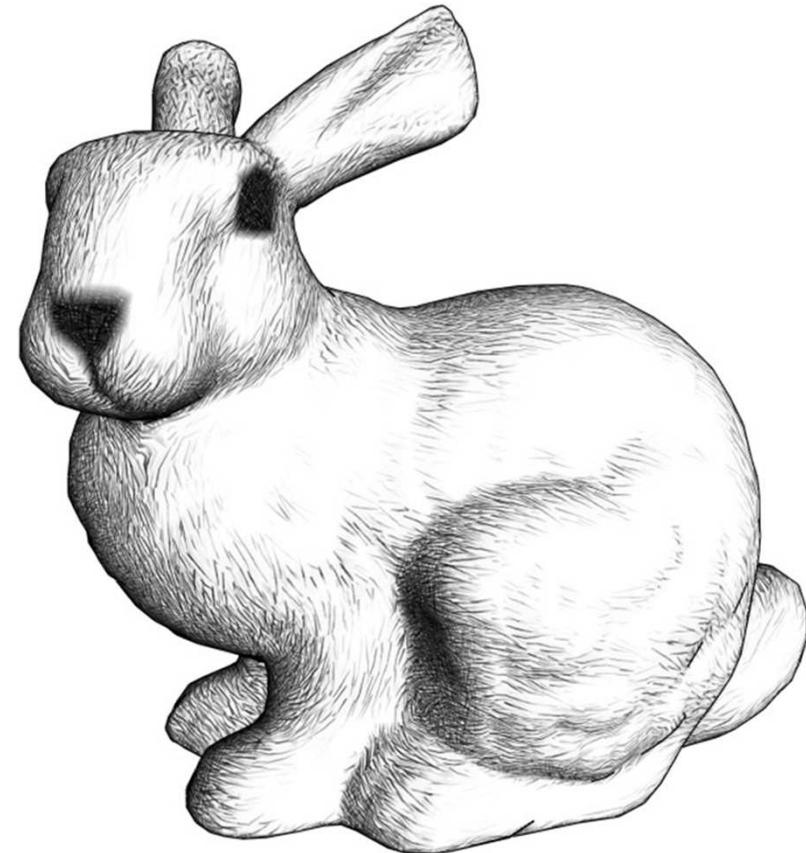
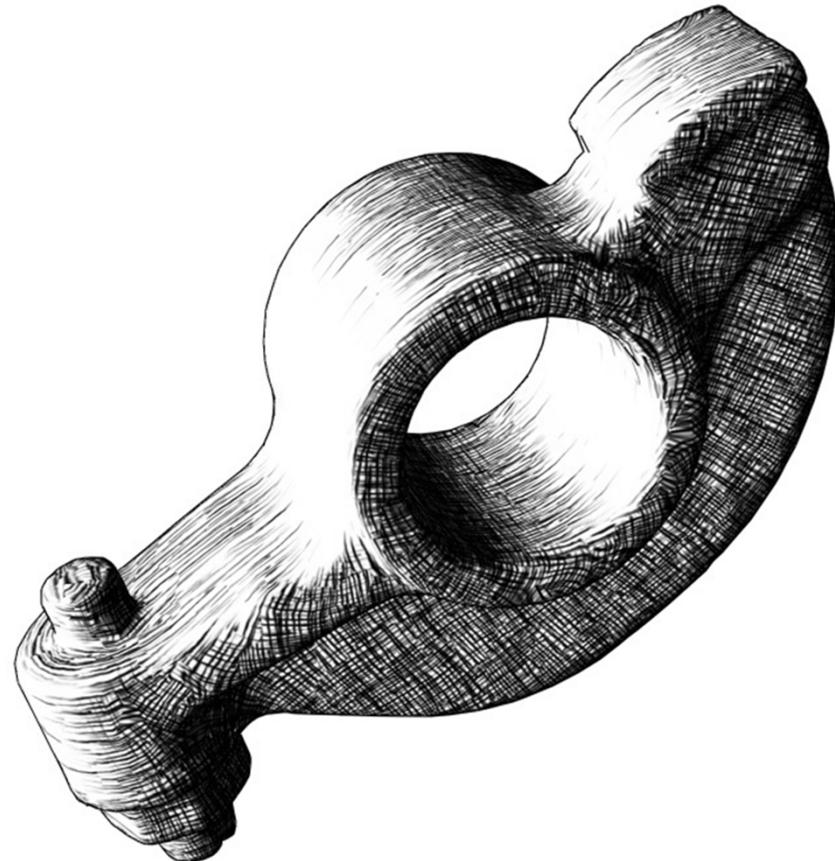


# *Pen-and-Ink illustration*



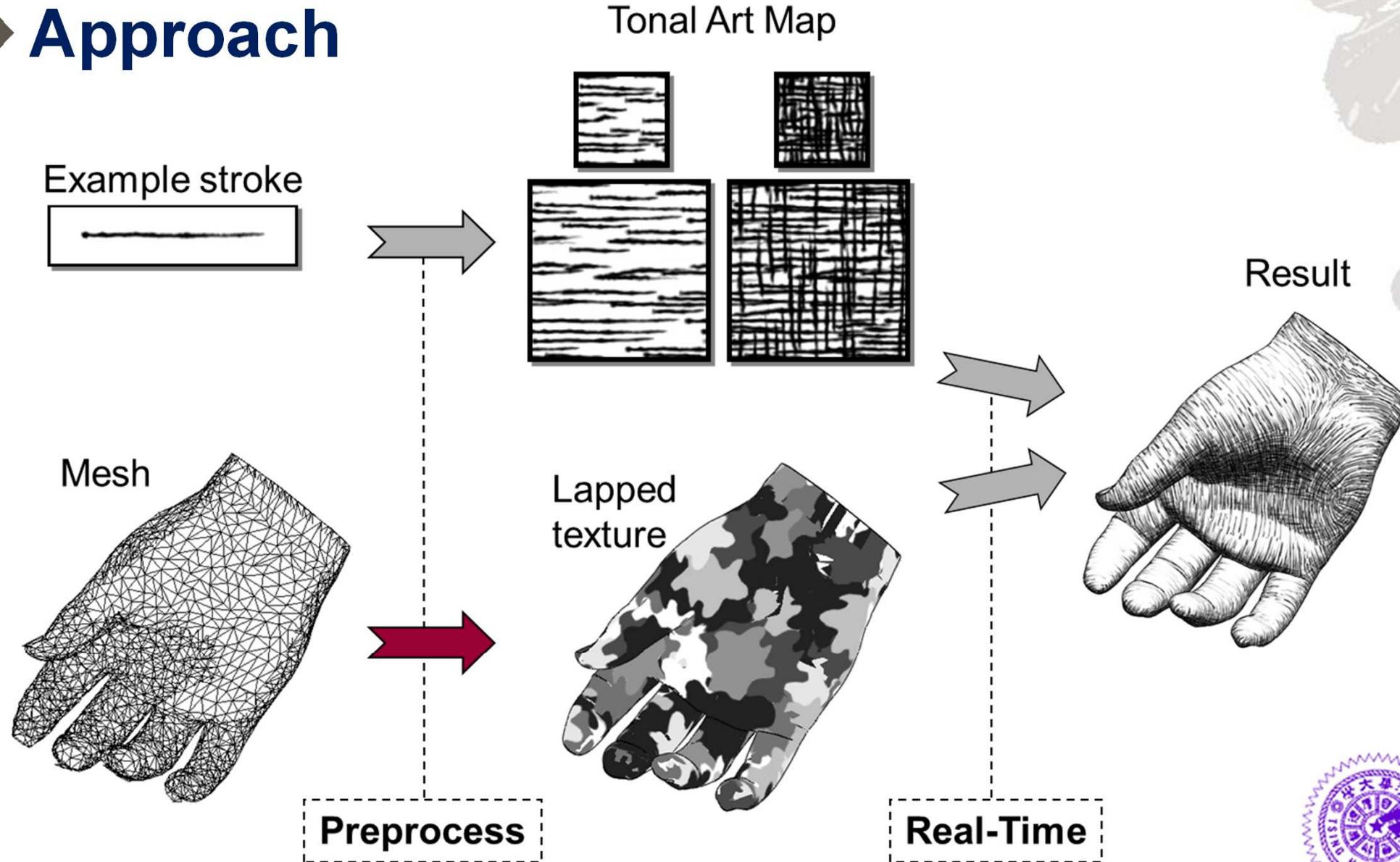
# *Real Time Hatching*

- ◆ Tonal or shading effects are created via closely spaced parallel lines or at an angle to one another



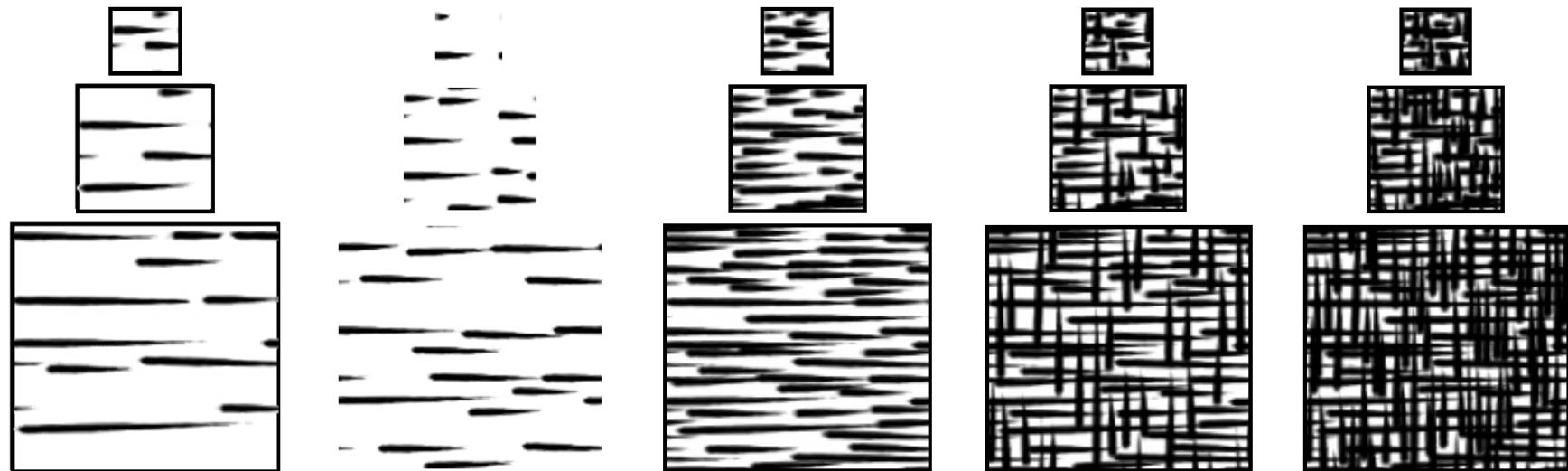
# Real Time Hatching

## ◆ Approach



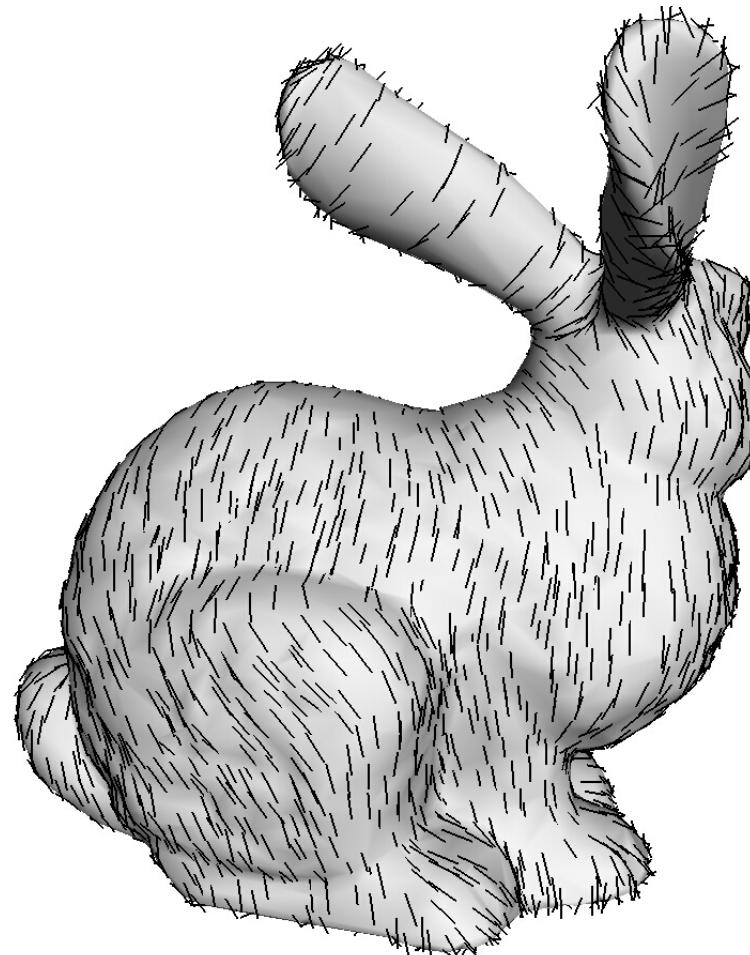
# *Real-Time Hatching*

- ◆ Generating tonal art maps

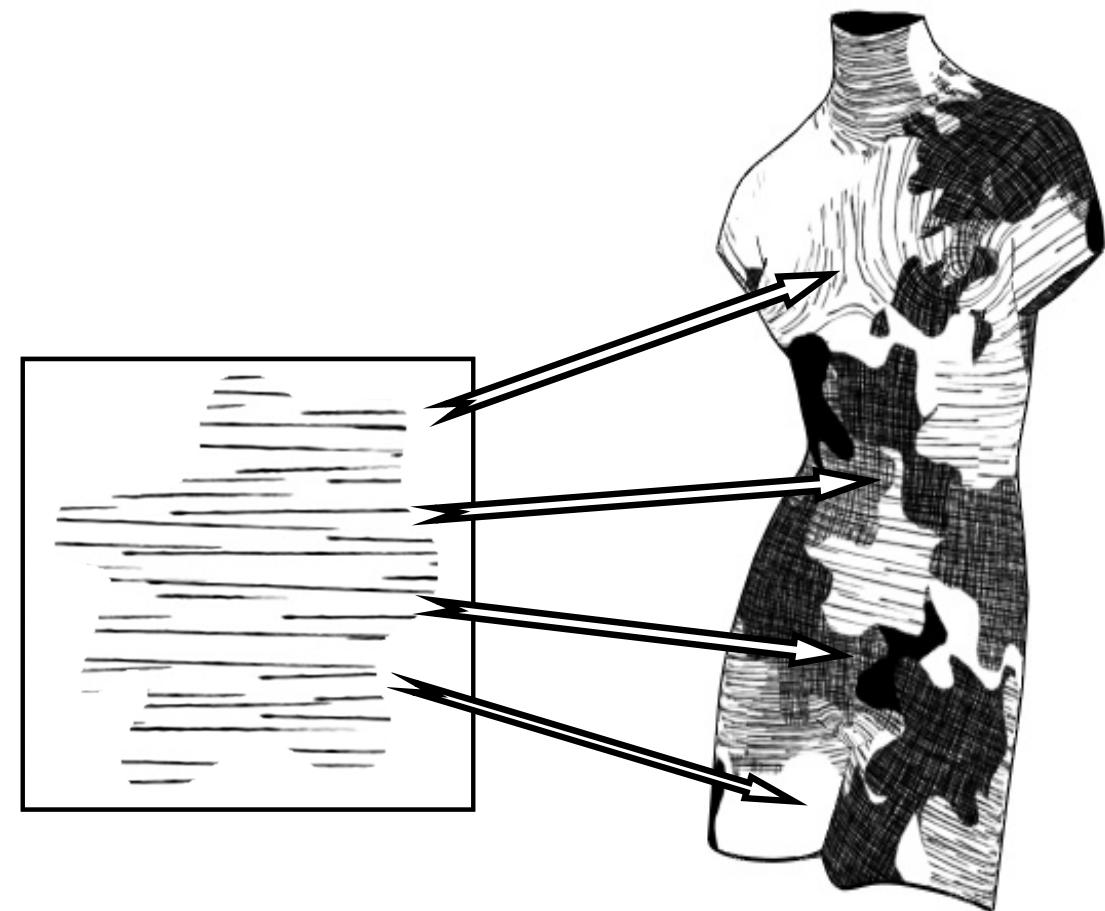


# *Real Time Hatching*

## ◆ Direction field and lapped textures



Based on surface principal curvatures

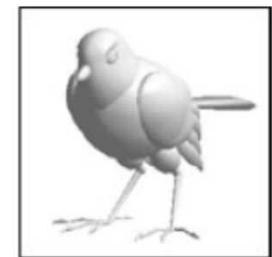
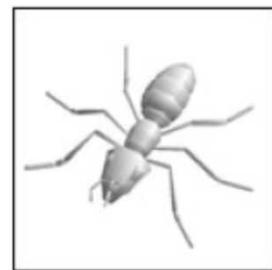
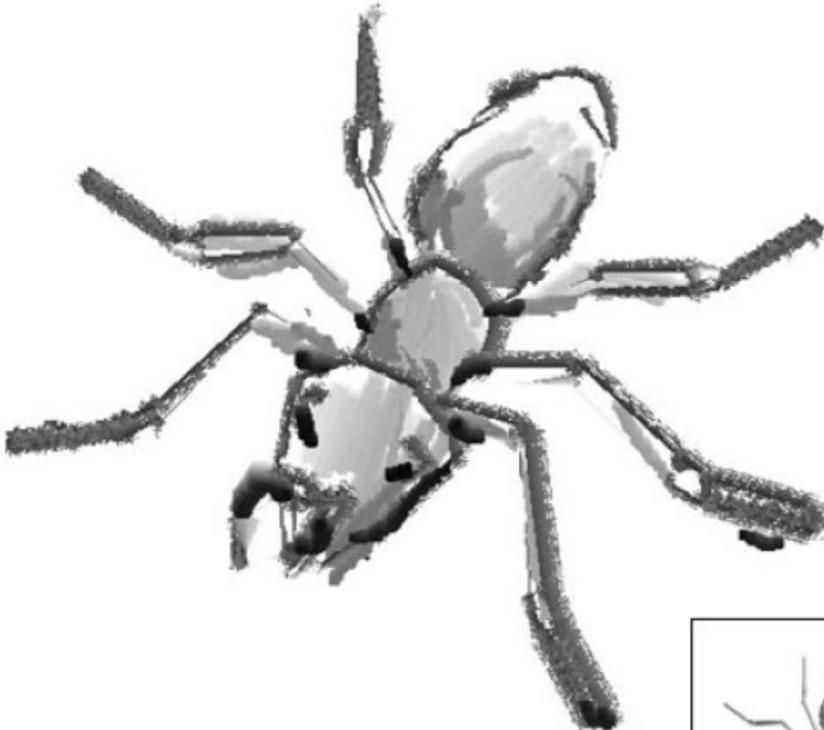


# *Real Time Hatching*



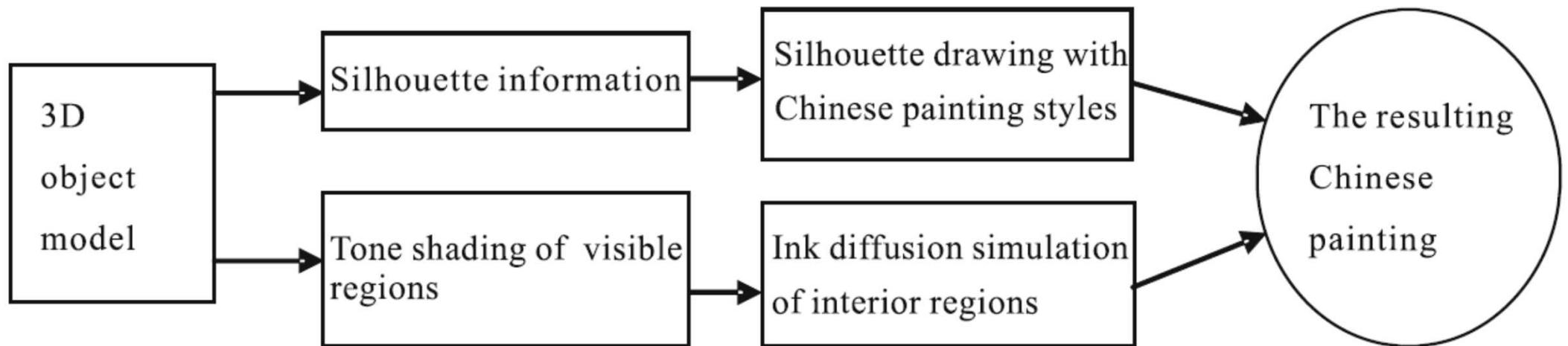
# *Chinese Painting*

- ◆ Mimic the style of Chinese painting



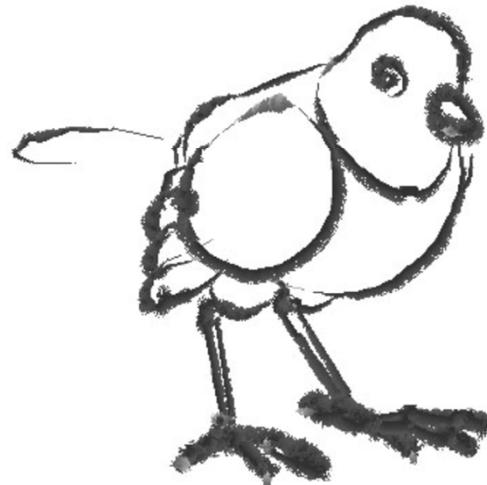
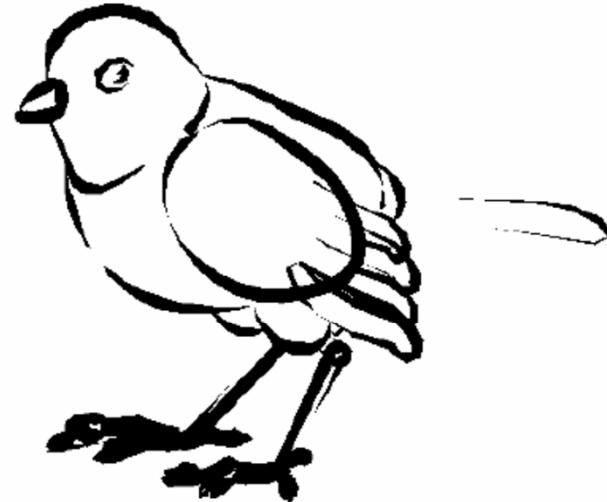
# *Chinese Painting*

## ◆ Pipeline for Chinese painting from 3D model



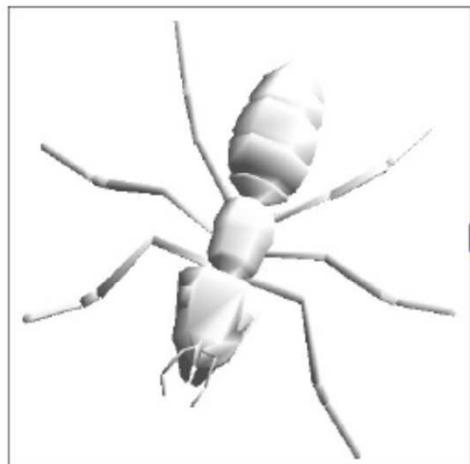
# *Chinese Painting*

- ◆ Find silhouette and synthesis strokes

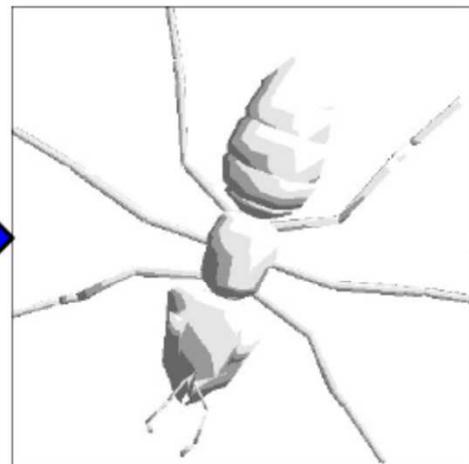


# *Chinese Painting*

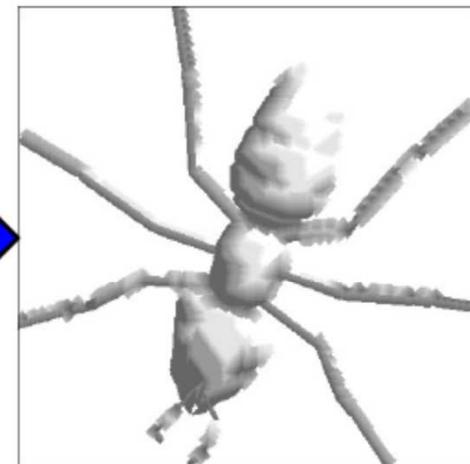
## ◆ Interior shading pipeline



Original Image



Color Quantization



Ink Diffusion



Box filtering

# Chinese Painting



# Q&A

