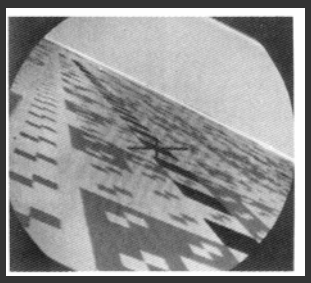
Conveying Shape:
Lighting and Texturing

Pat Hanrahan

Visual Cues

SGI flight 1987



GE Apollo Simulator 1963

Lighting and Shading

Shape from Shading

Fig 11.1 Common fate: all convex or concave

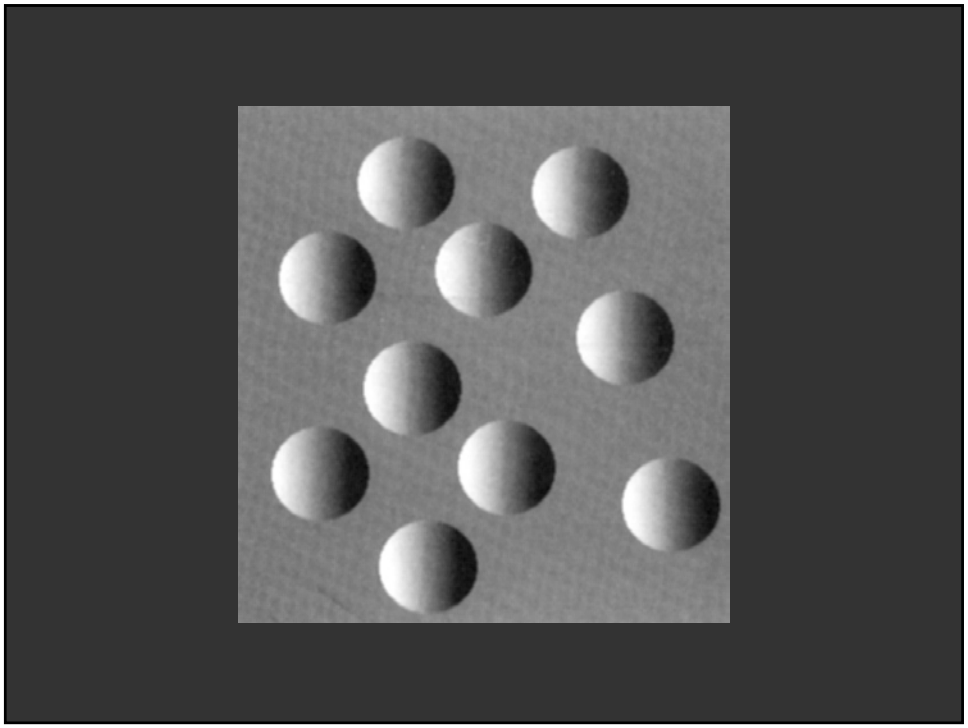
Fig 11.2 Single light source constraint

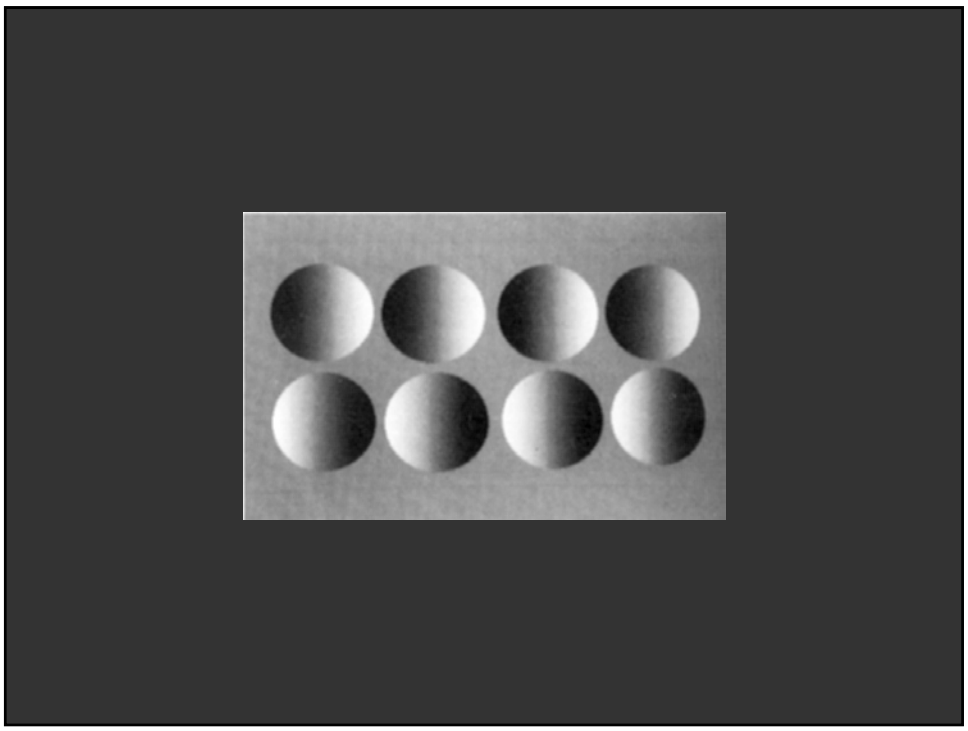
Fig 11.3 Global inference

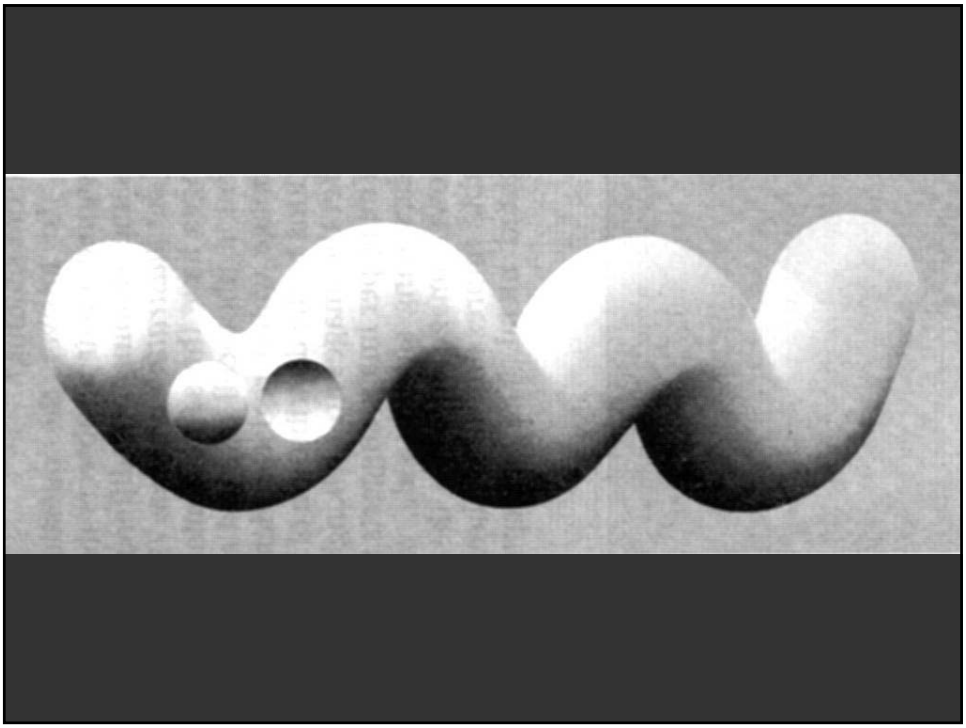
Fig 11.4 Light source above

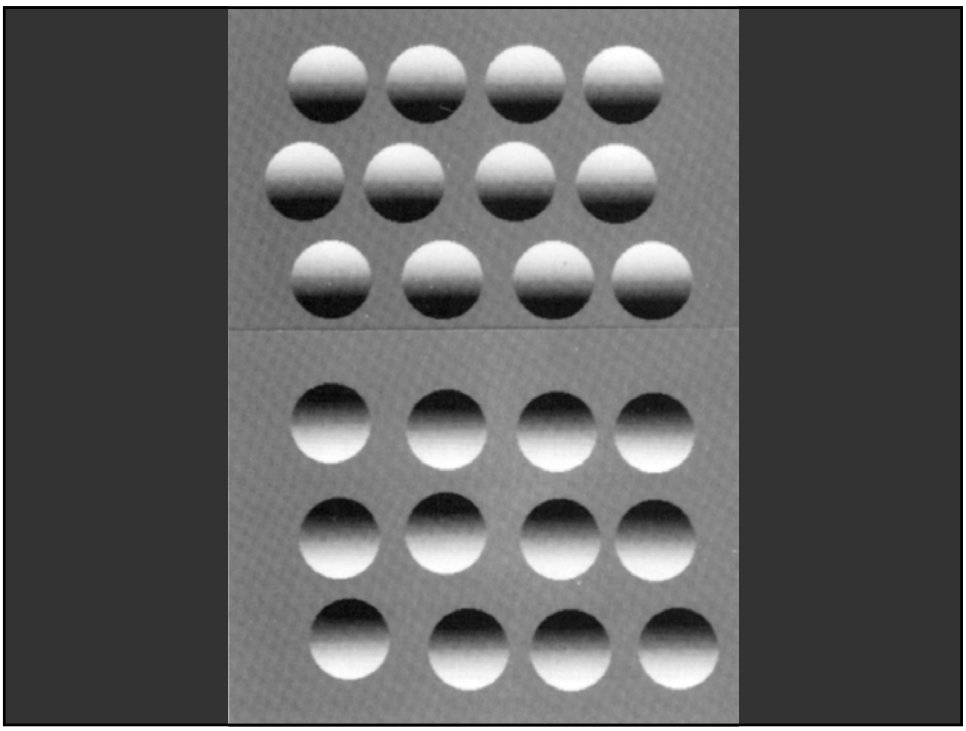
Fig 11.12 Hollow mask; reverse assumption

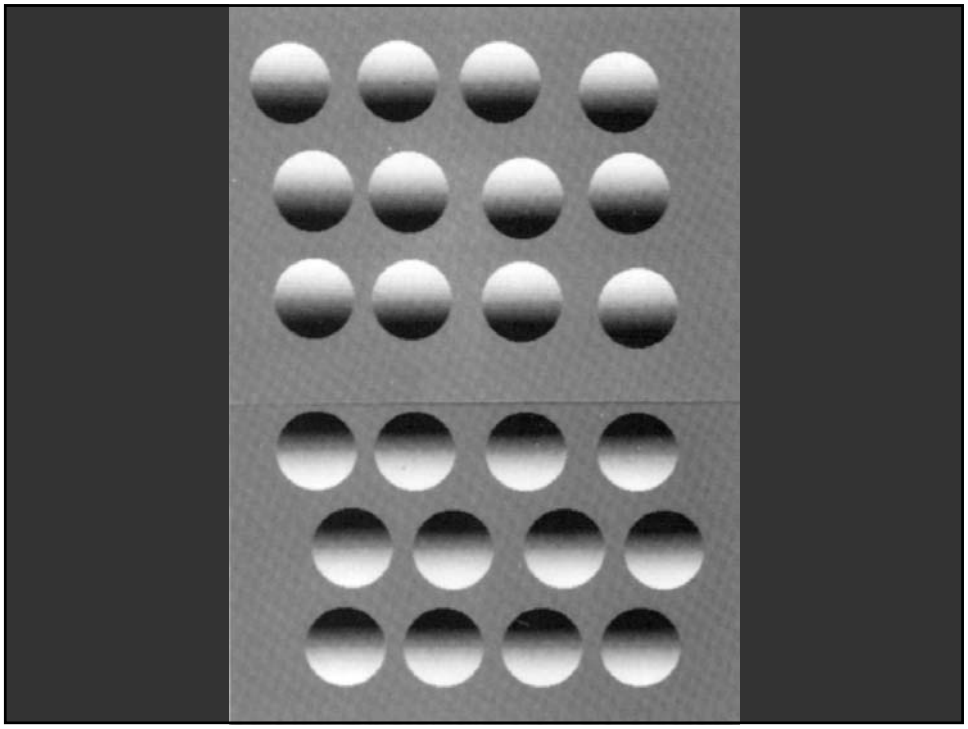
V. S. Ramachandran, 2-D or not 2-D – that is the question

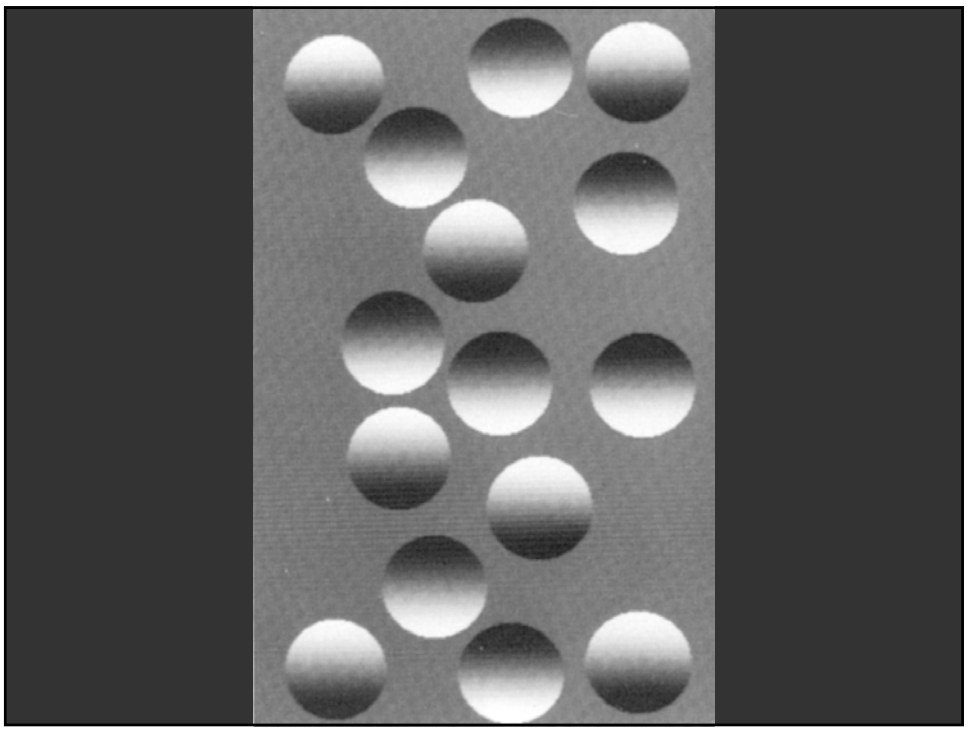


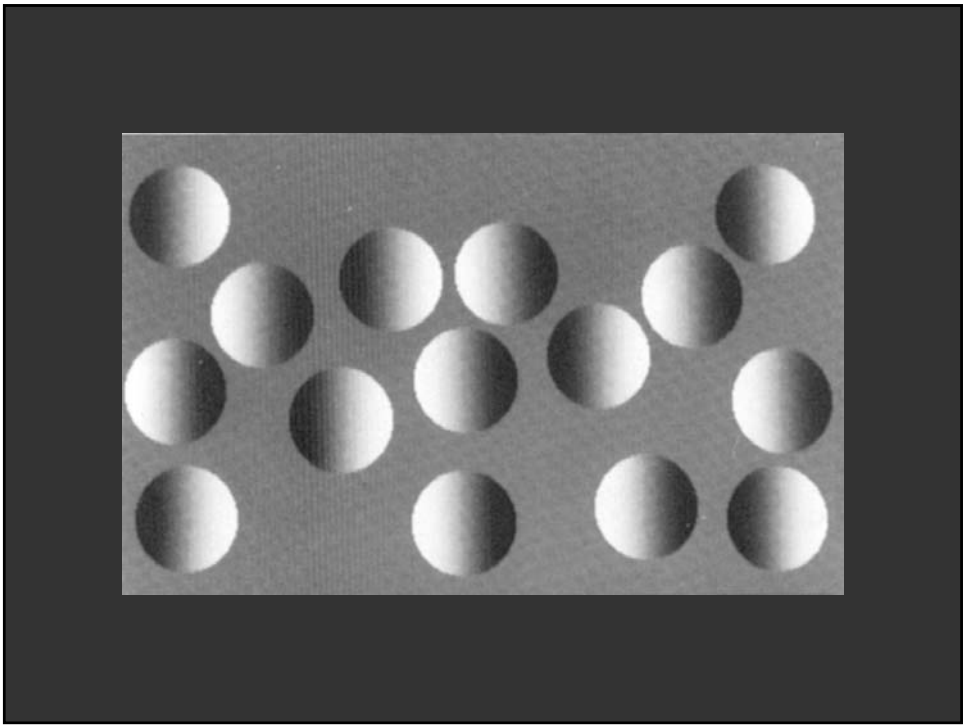


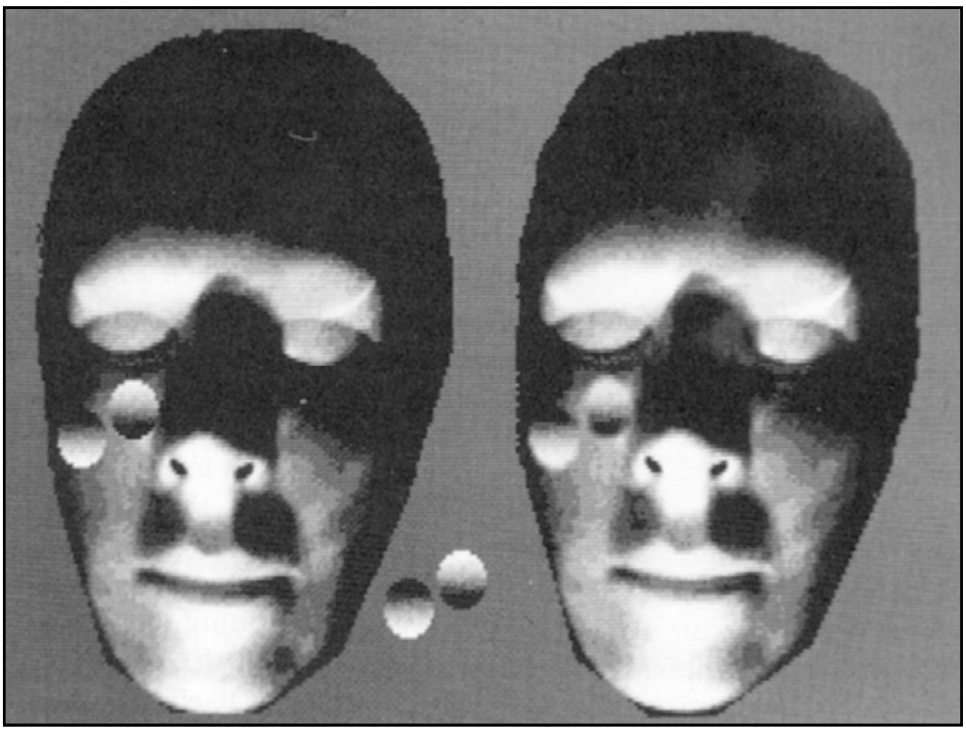




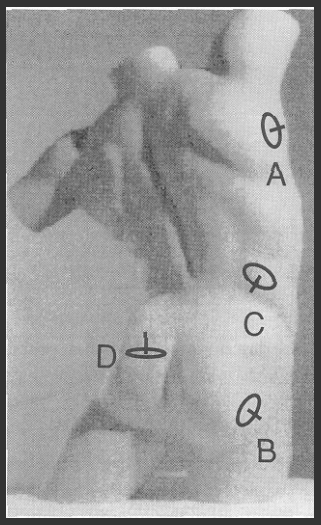


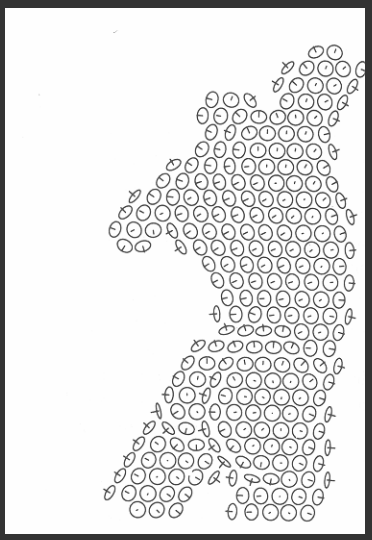






Estimating Orientation





From Koenderink, van Doorn, Kappers [1992, 1996]

Goals of Lighting

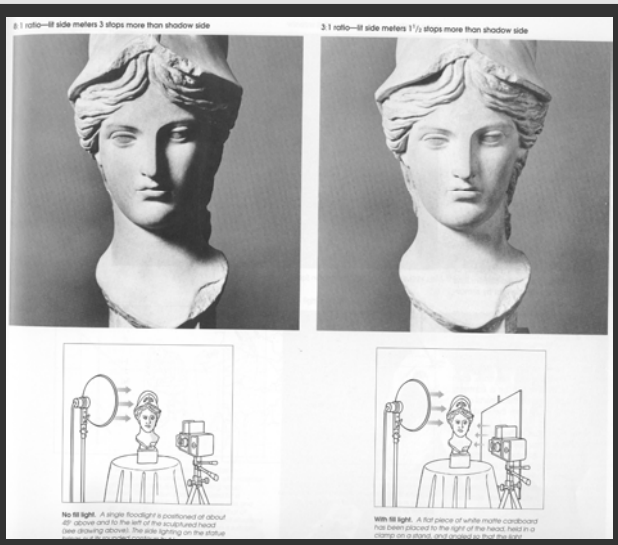
Power of lighting

- Show form and orientation of surface
- Emphasize high curvature with highlights
- Show silhouette clearly
- Separate object from background
- Rake bumps and surface textural details

Unintended side effects

- Over- and under-exposure
- Unintended shadows
- Distracting highlights and glare

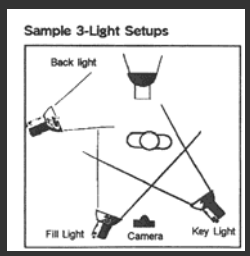
Lighting Design



From *Photography*, 5th Ed., by London & Upton. Harper Collins. 1992.

Lighting Design

Multiblitz lighting system, RTS Inc.



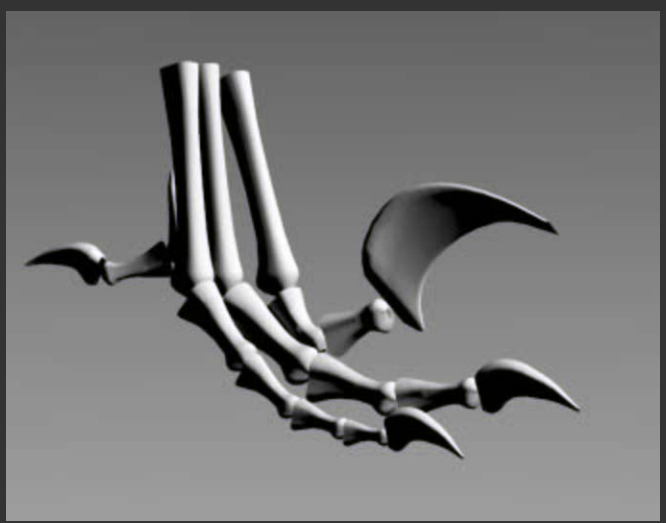
Basic Portrait Lighting Set-Up Guide, Warehouse Photography

Categories of Light/Shade

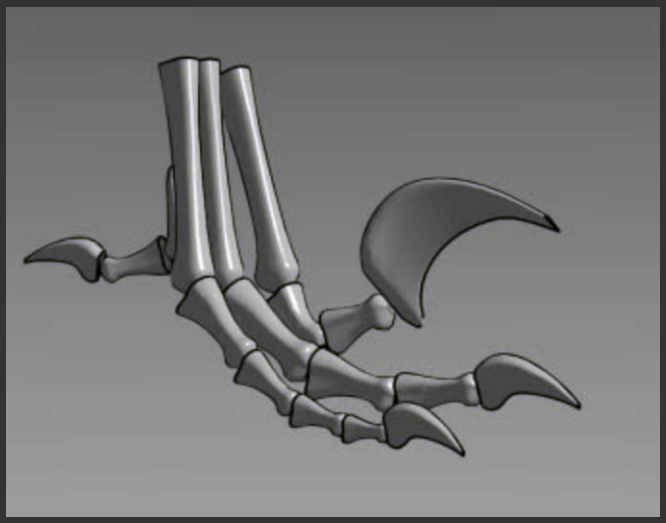
Single source light
Double source light
Flat, diffused light
Moonlight
Sculptural light
...

B. Hogarth. Dynamic Light and Shade

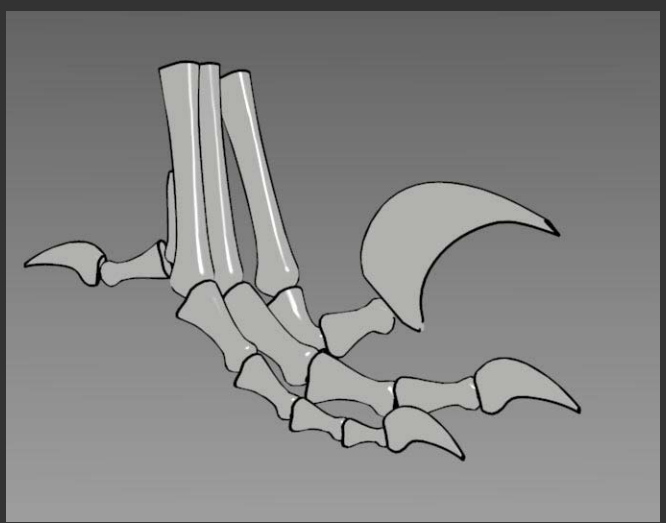
Diffuse Only



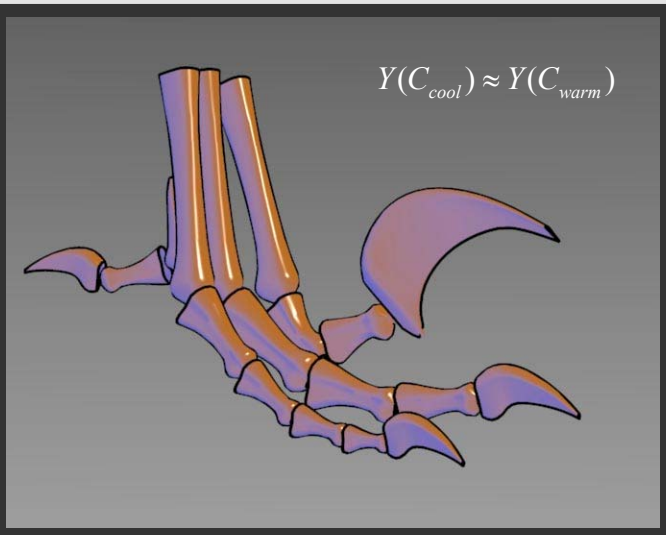
Best Ambient, Diffuse, Specular



Edges + Highlights

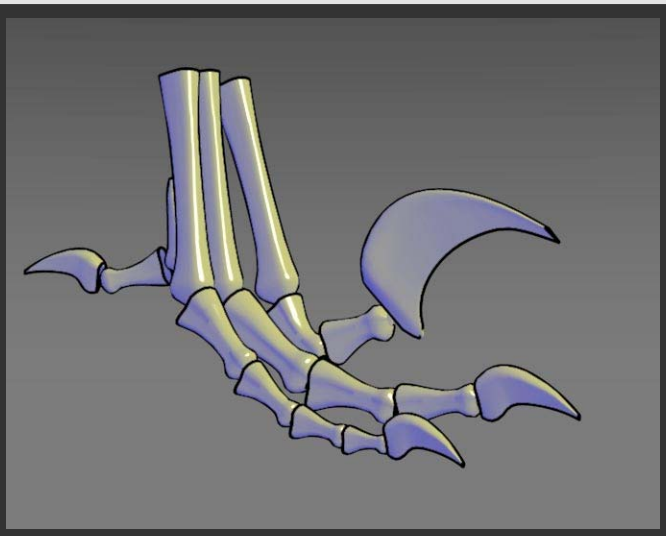


Constant Luminance/Tone



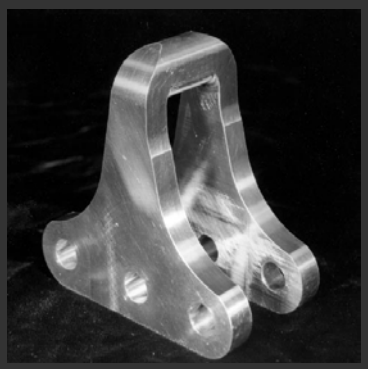
$$L = \text{lerp}(\frac{1+\hat{\mathbf{N}} \bullet \hat{\mathbf{L}}}{2}, C_{cool}, C_{warm})$$

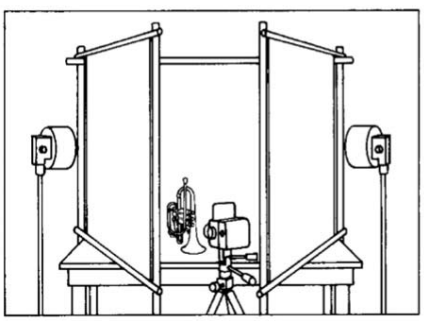
Luminance and Tone



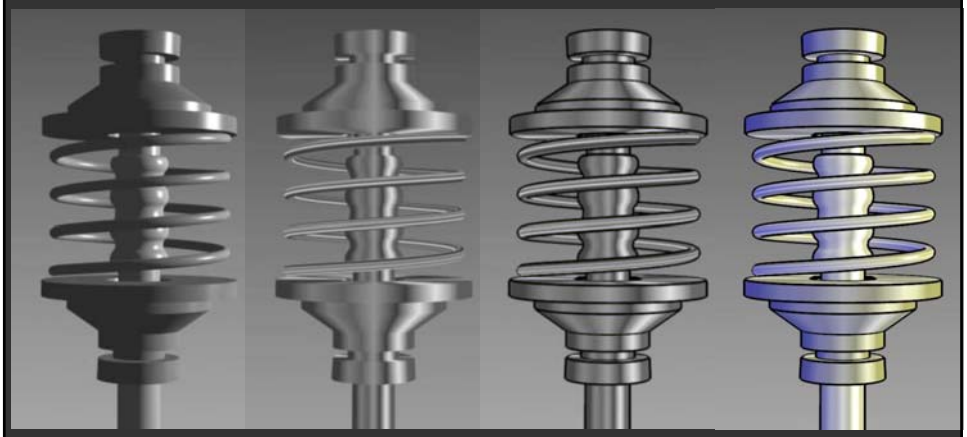
Blue to yellow + object color

Anisotropic Metallic Objects

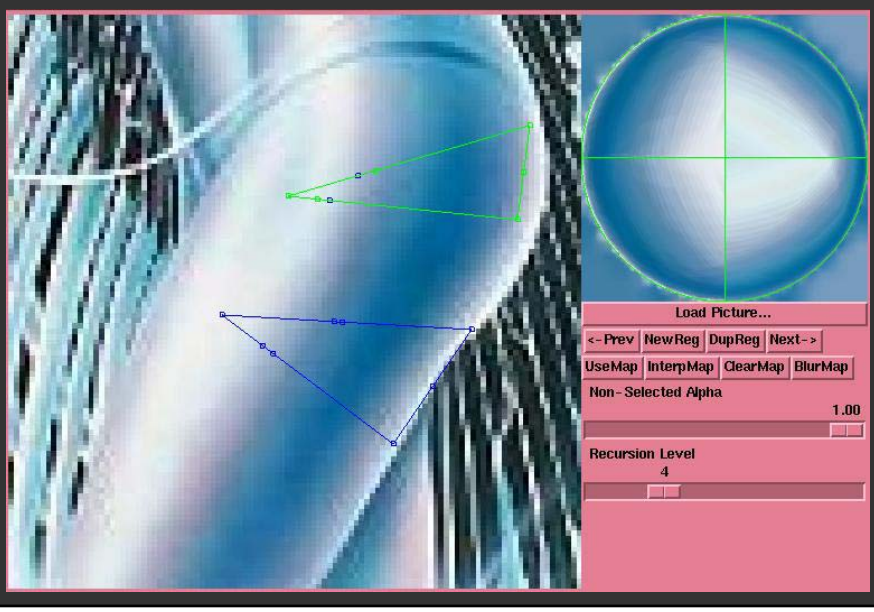




Metallic Shading



The Lit Sphere [Sloan et al.]



Reflection Lines

From Farin and Harnsford

Photo-Retouching

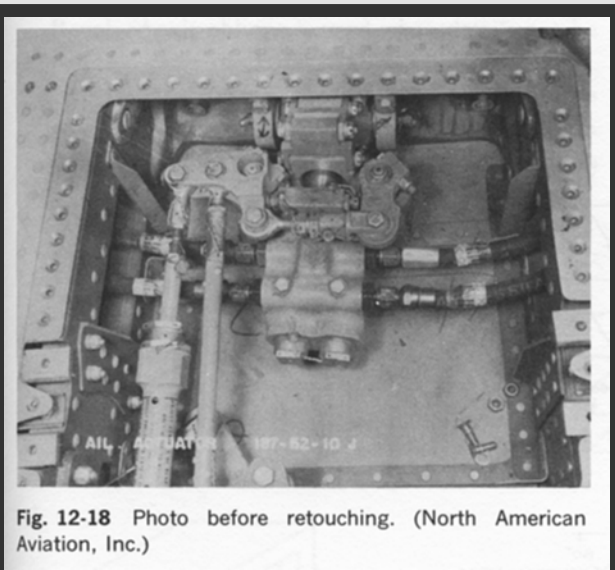


Fig. 12-18 Photo before retouching. (North American Aviation, Inc.)

T. A. Thomas, Technical illustration

Photo-Retouching

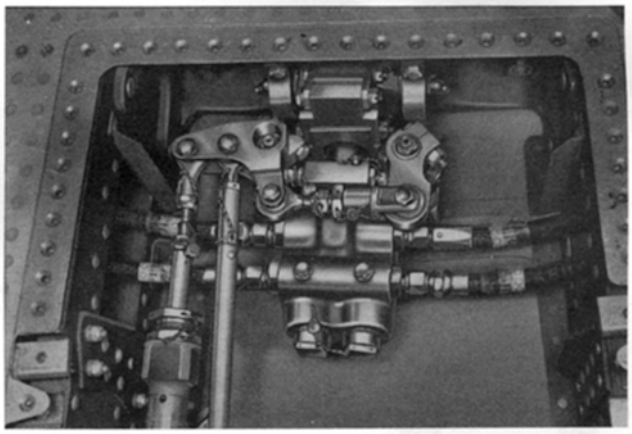


Fig. 12-19 Photo after retouching. (North American Aviation, Inc.)

T. A. Thomas, Technical illustration

Illustration

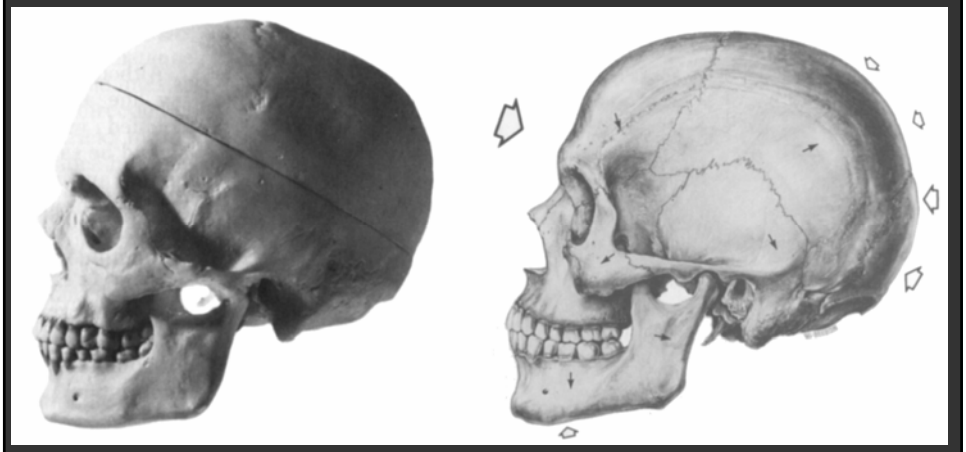
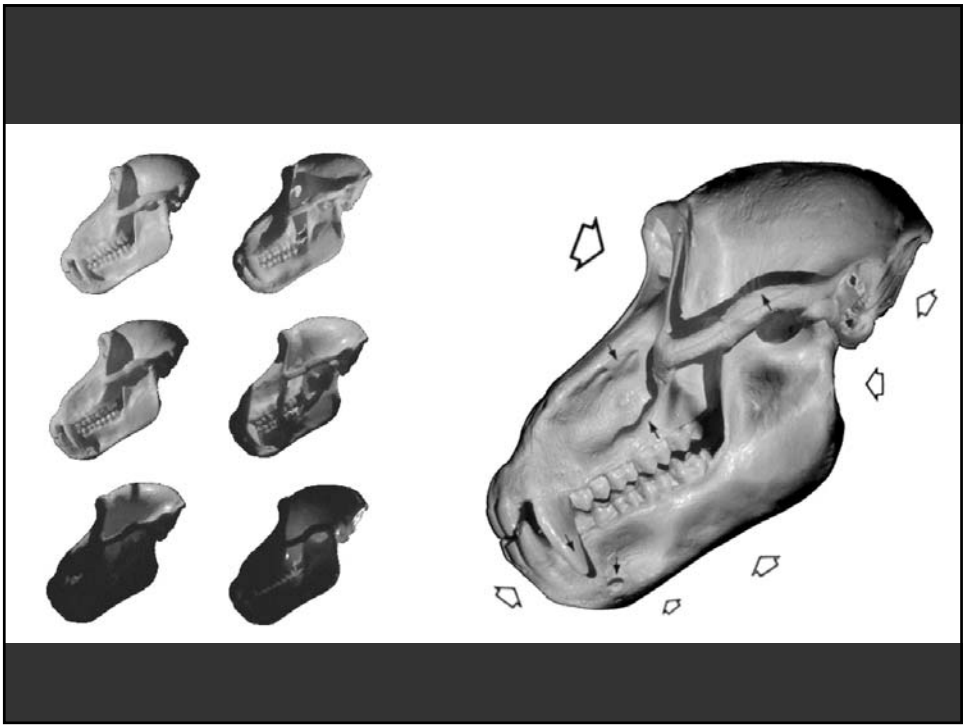
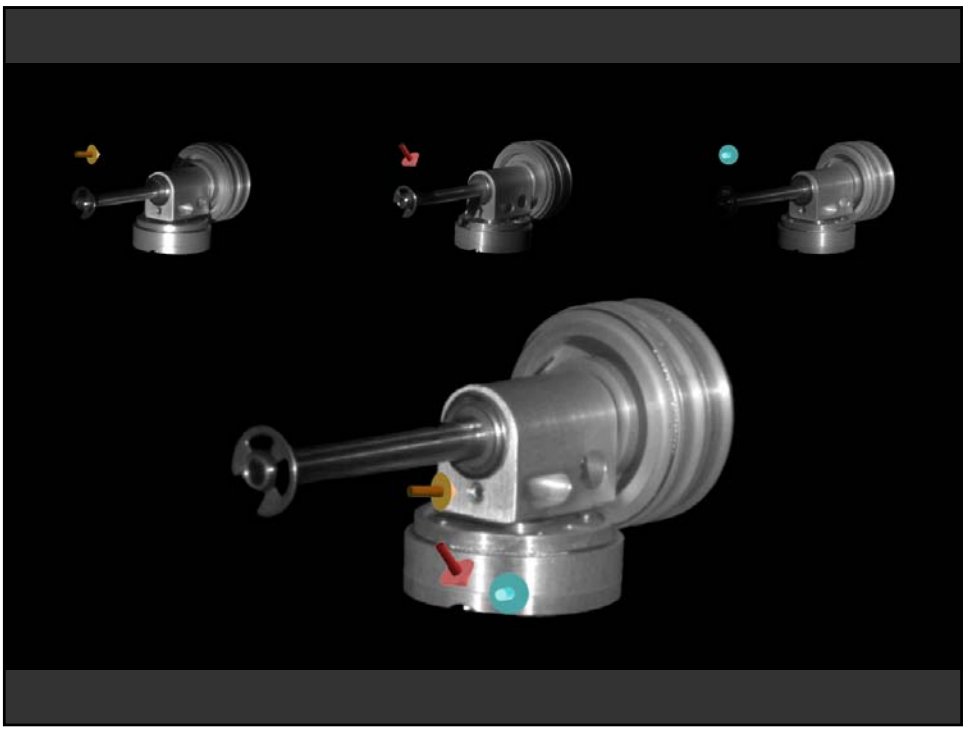


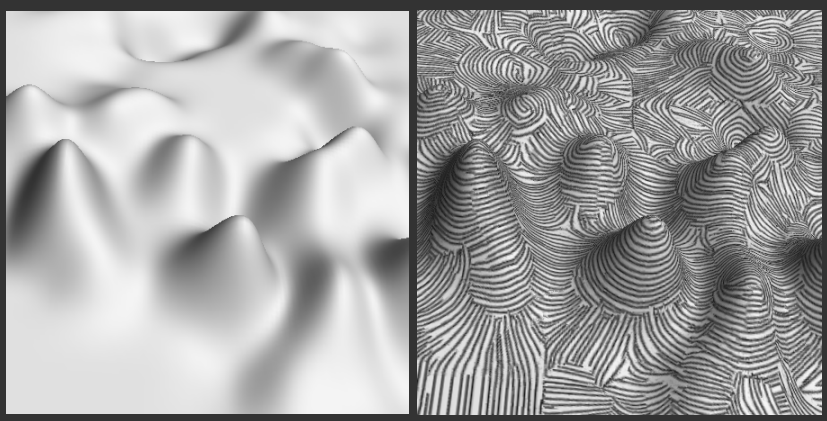
Photo & Illustration by William L. Brudon,
from *Essentials of Human Anatomy*, 8th Ed. 1988. Oxford University Press





Texturing

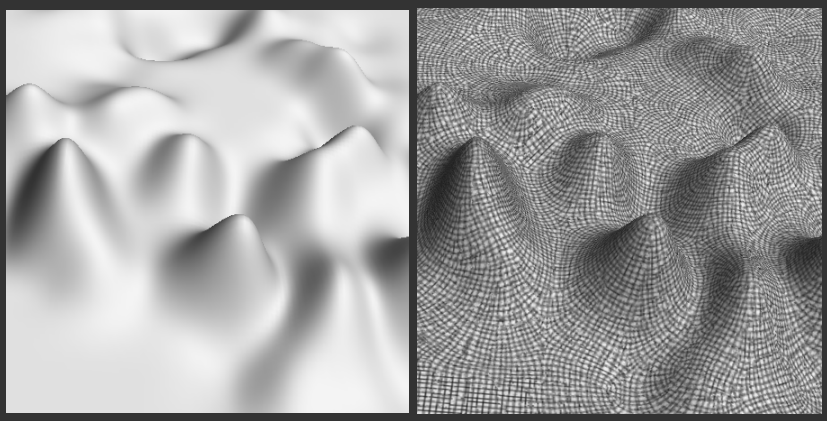
Texturing



From V. Interrante

http://www-users.cs.umn.edu/~interran/texture/index.html

Texturing



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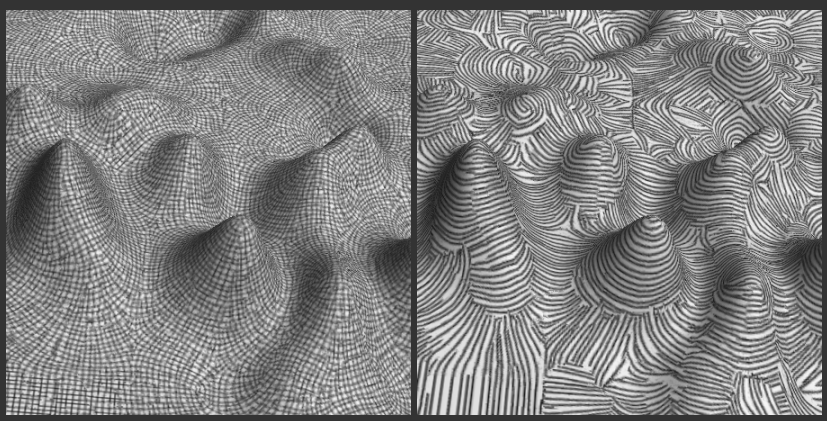
Texturing



From V. Interrante

http://www-users.cs.umn.edu/~interran/texture/index.html

Summary

Goals of lighting and shading

- Reveal shape
- Separate foreground from background
- Show surface detail

Lighting design is extremely challenging

Surface-oriented texture powerful cue