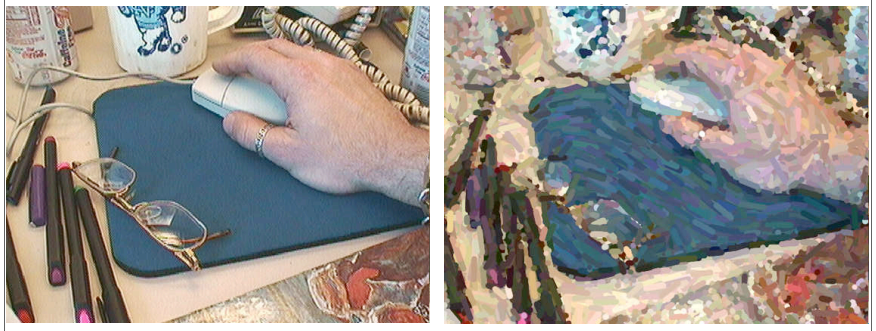
Cornell University CS 569: Interactive Computer Graphics

Interactive Non-Photorealistic Rendering

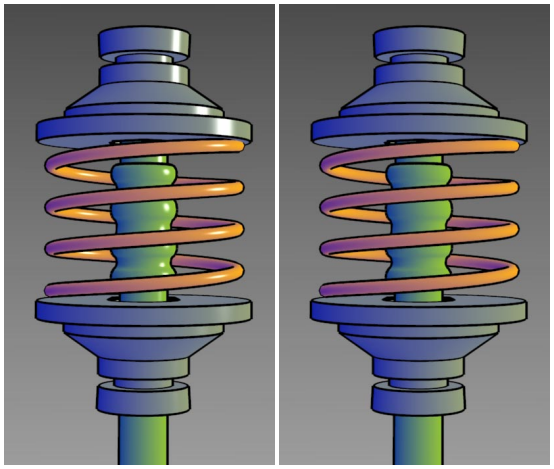
Lecture 16

Painting from photo



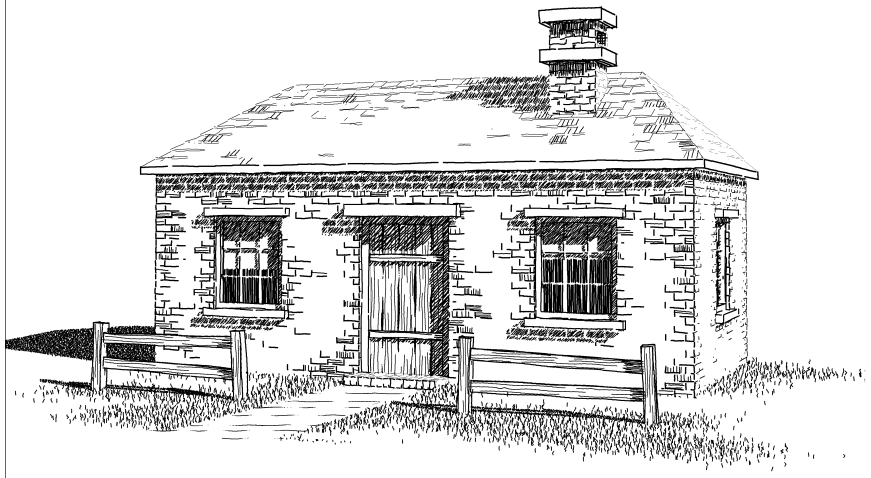
Litwinowicz 1997

Silhouettes, creases, shading



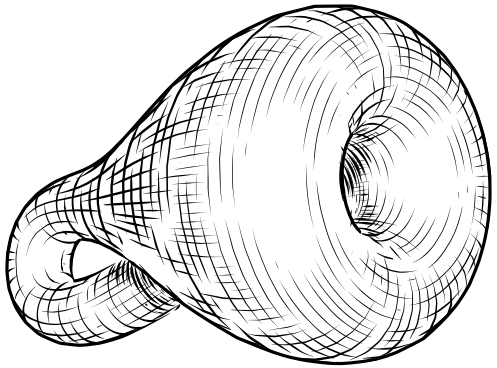
Gooch et al. 1997

Pen and ink from 3D



Winkenbach & Salesin 1994

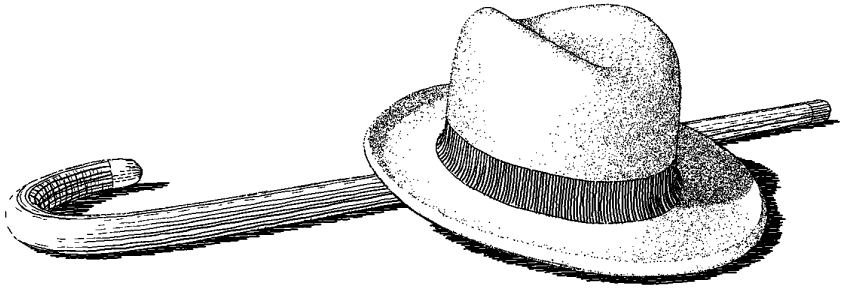
Silhouettes + parametric hatching



Hertzmann & Zorin

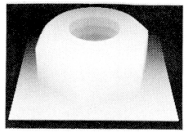
Figure 2: Klein bottle. Lighting and hatch directions are chosen to convey surface shape. Undercuts and Mach bands near the hole and the self-intersection enhance contrast.

Parametrically aligned stroke textures

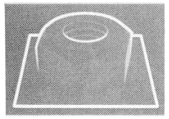


Winkenbach & Salesin 1996

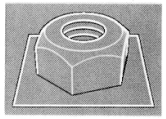
G-buffer operations



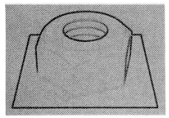
depth image



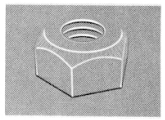
1st order differential



2st order differential



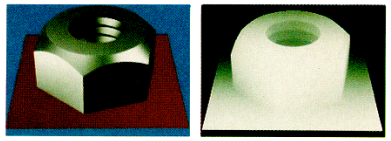
profile image



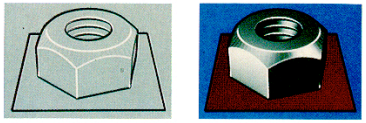
internal edge image

Saito & Takahashi 90

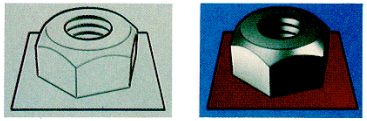
Renderings using G-buffers



(a) shaded image (b) depth image



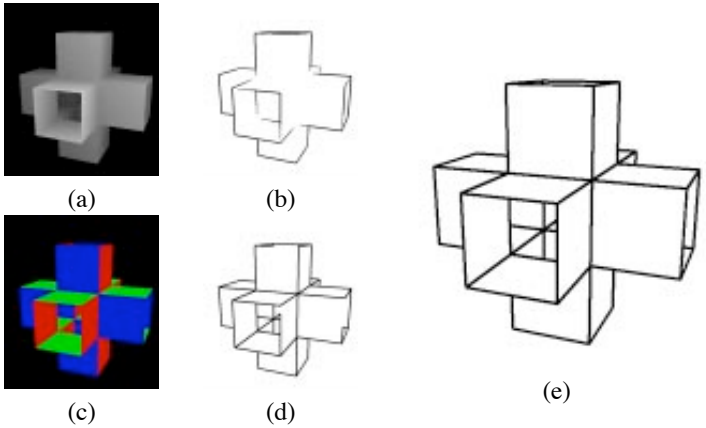
(c) edge image (1) (d) enhanced image (1)



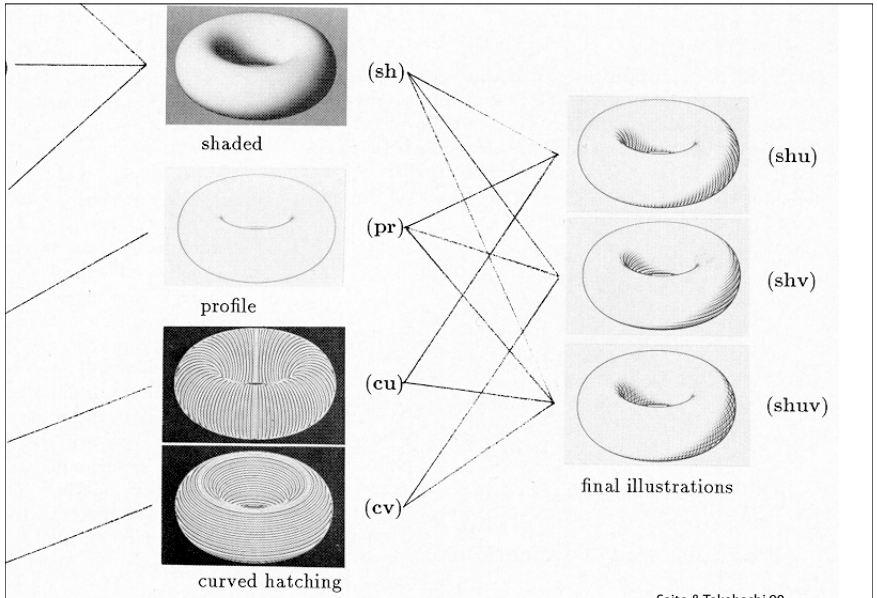
(c') edge image (2) (d') enhanced image (2)

Saito & Takahashi 90

Discontinuities in depth and normals

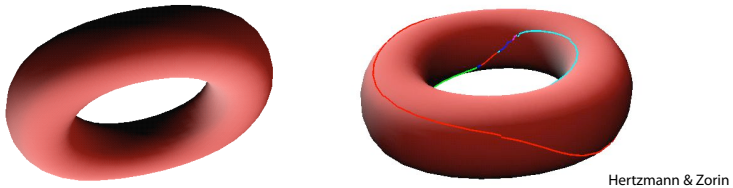


Hertzmann course notes 1999

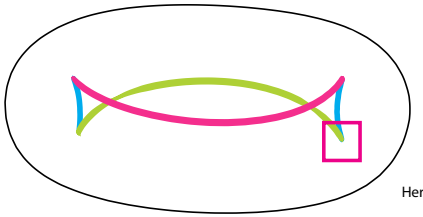


Saito & Takahashi 90

Silhouette curves



Hertzmann & Zorin



Hertzmann & Zorin 00

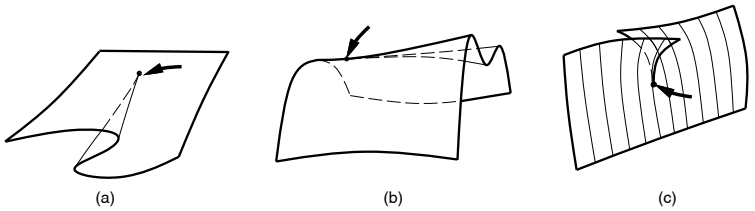
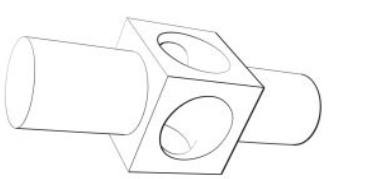
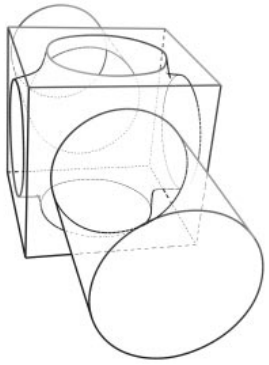


Figure 1 Arrows indicate cusps. (a) A typical cusp. (b) A more exotic cusp. (c) A border cusp (the two edges meeting at the center of the sheet are border edges).

Markosian et al. 1997

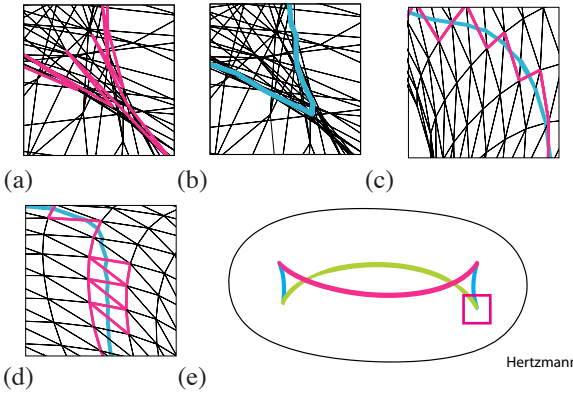
Drawn using geometric silhouettes and creases





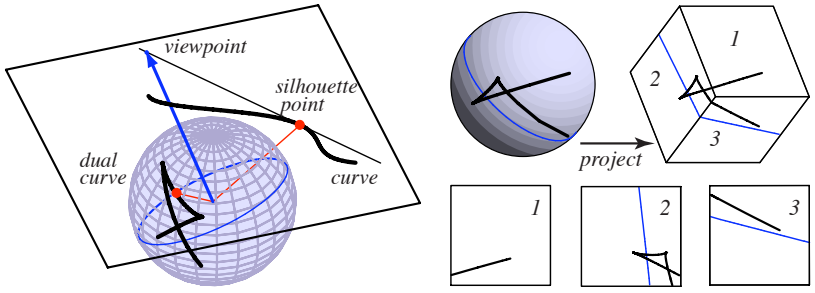
Markosian et al. 1997

Problems with faceted silhouettes



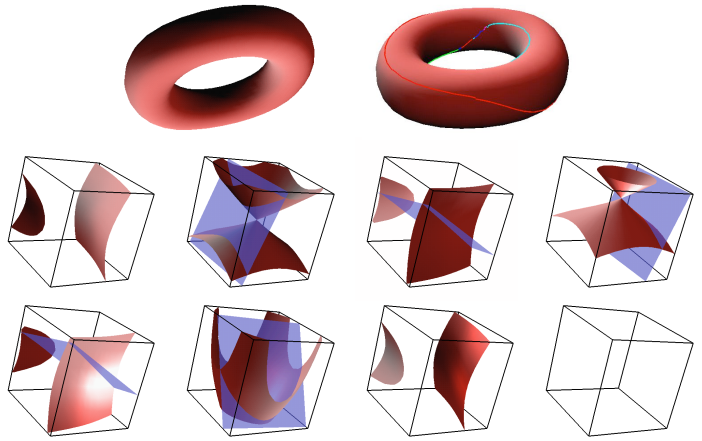
Hertzmann & Zorin 00

Perspective silhouettes (2D example)



Hertzmann & Zorin 00

Perspective silhouettes (3D example)



Hertzmann & Zorin 00

Hatching directions from principal curvatures

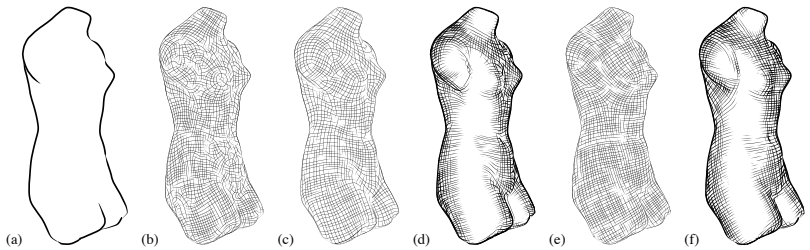


Figure 8: Direction fields on the Venus. (a) Silhouettes alone do not convey the interior shape of the surface. (b) Raw principle curvature directions produce an overly-complex hatching pattern. (c) Smooth cross field produced by optimization. Reliable principal curvature directions are left unchanged. Optimization is initialized by the principal curvatures. (d) Hatching with the smooth cross field. (e) Very smooth cross field produced by optimizing all directions. (f) Hatching from the very smooth field.

Hertzmann & Zorin 00

Contour (silhouette)

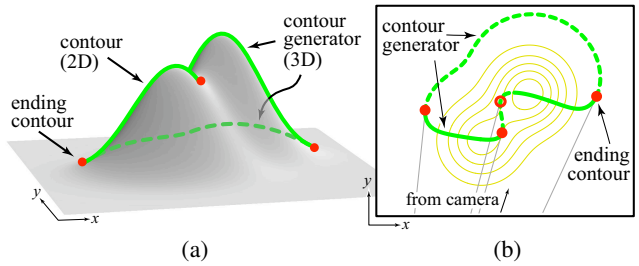


Figure 2: The contour generator is the set of points on the surface whose normal vector is perpendicular to the viewing direction. (a) When projected into the image, its visible portions are called the contour. (b) A topographic map of the surface in (a) with the contour generator shown in green. The portion that projects to the contour is drawn solid.

DeCarlo et al. 2003

Suggestive contour

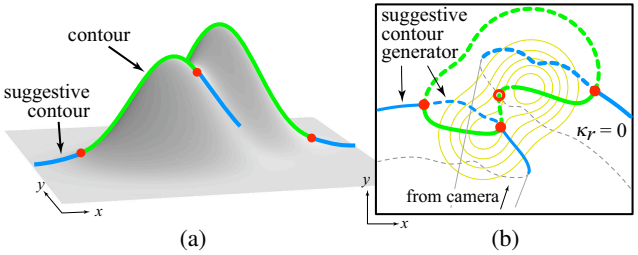
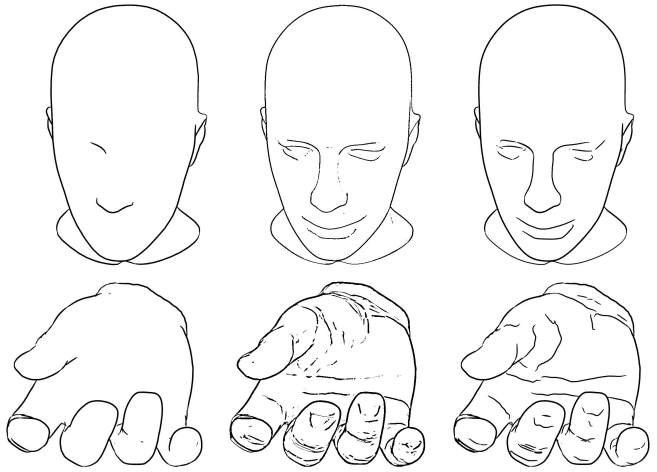


Figure 4: (a) Suggestive contours (shown in blue) extend the actual contours of the surface (shown in green). (b) A topographic view showing how the suggestive contour generators cross contours at the ending contours. The portion of the suggestive contour generator that projects to the suggestive contour is drawn solid.

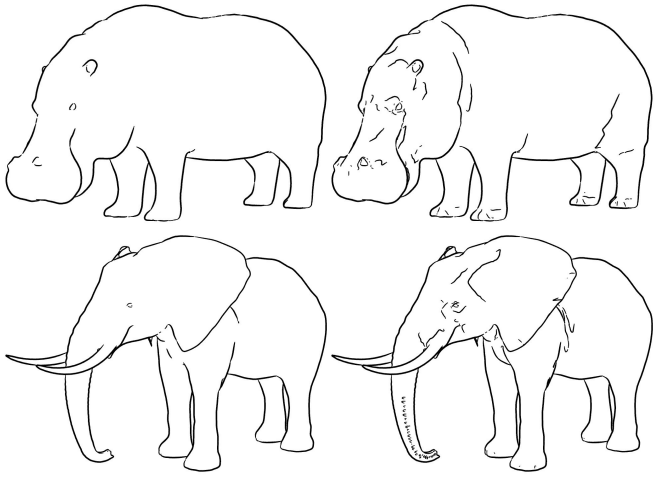
DeCarlo et al. 2003

Suggesive contours



DeCarlo et al. 2003

Suggesive contours



DeCarlo et al. 2003