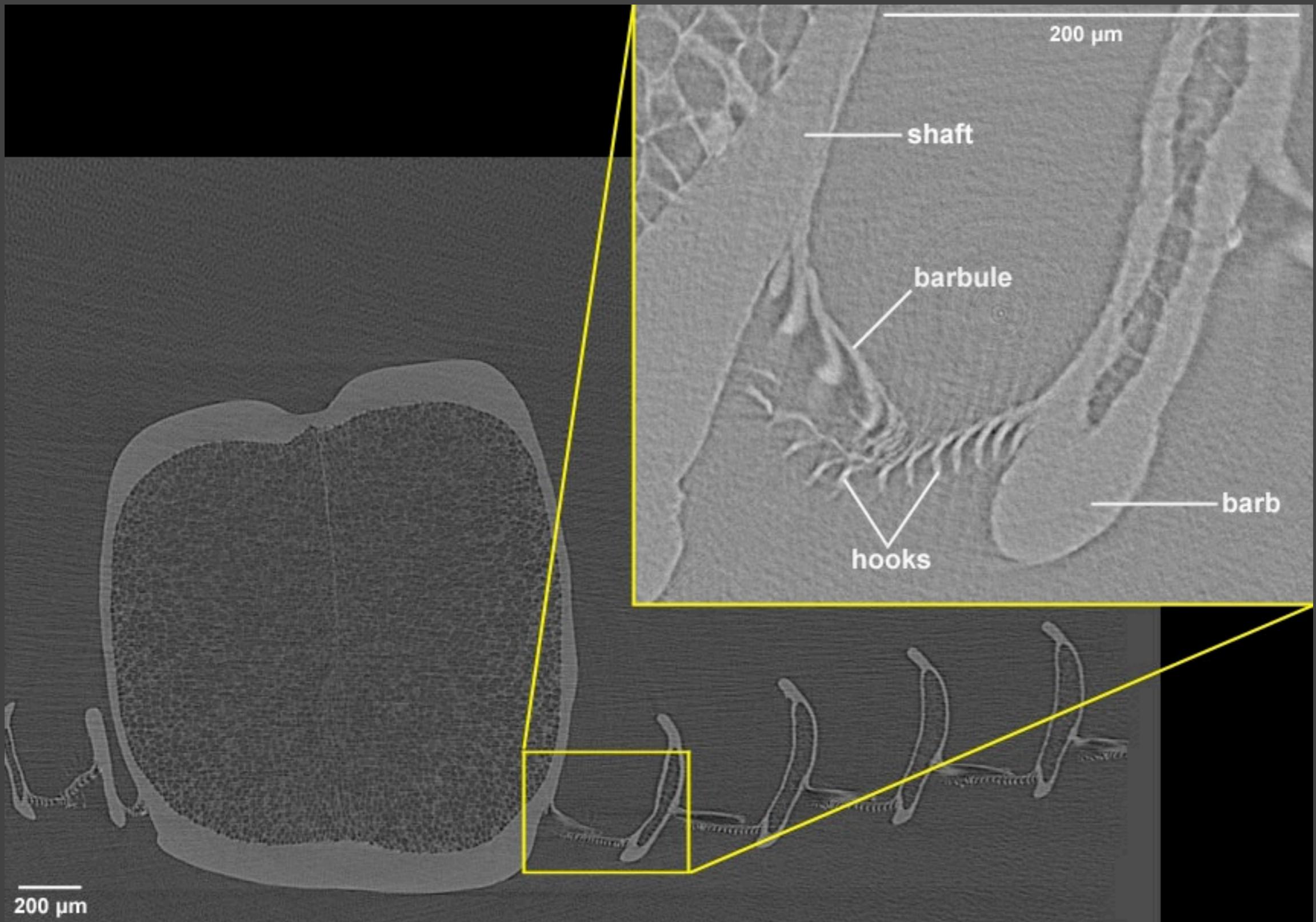


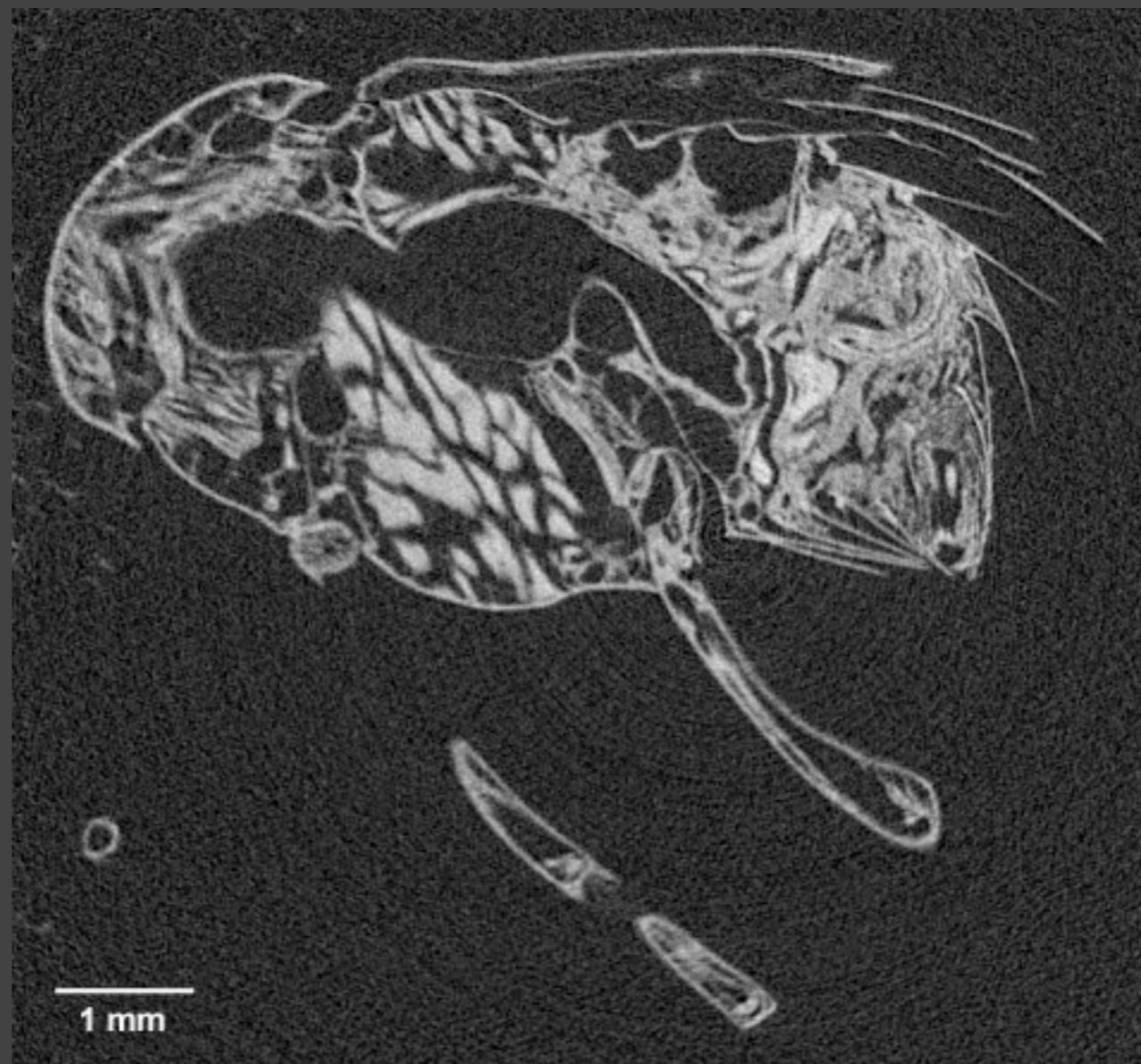
# Volume visualization

Steve Marschner  
CS 6630 — Fall 2009



U. Texas High-Res CT Facility



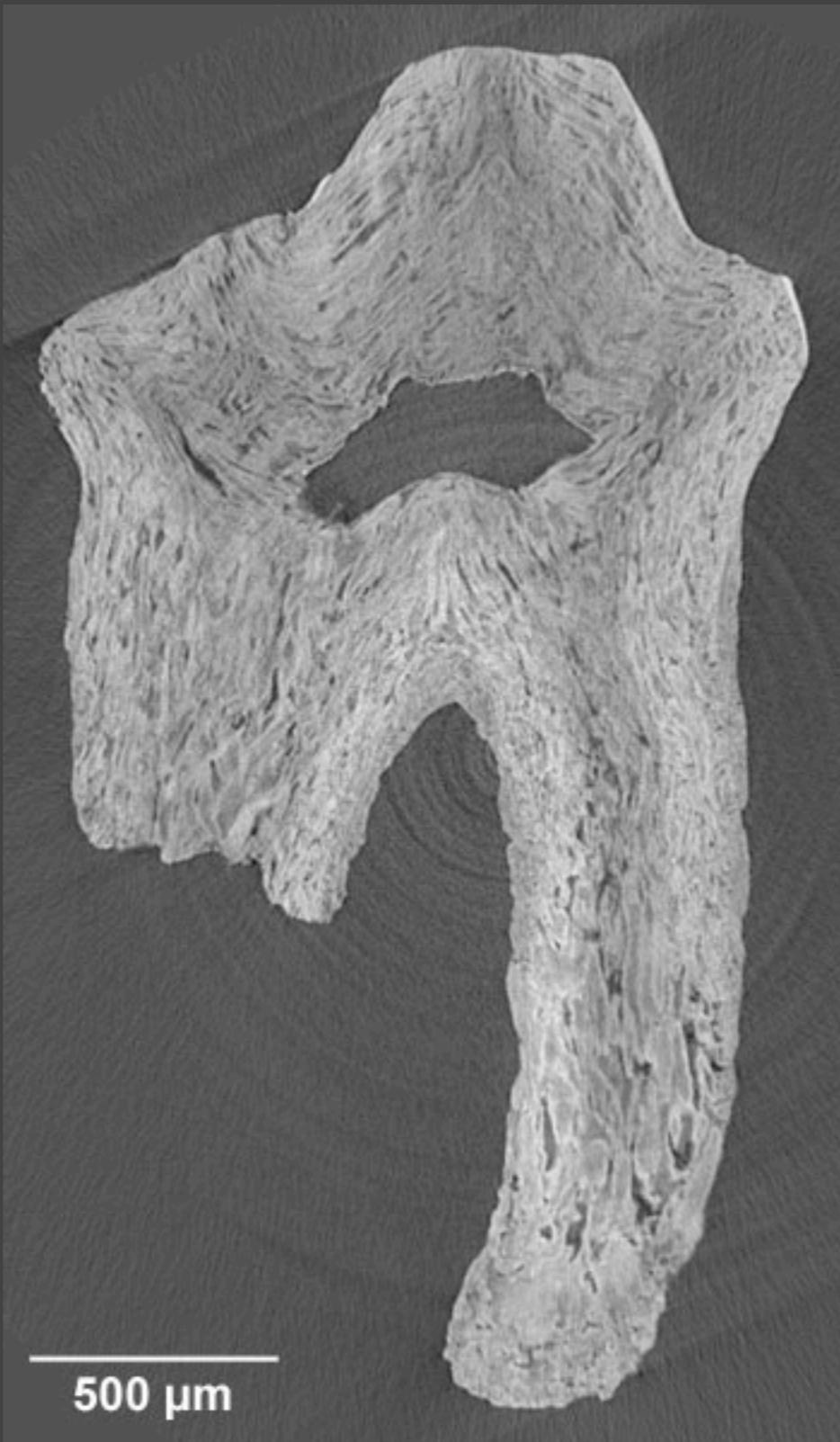


U. Texas High-Res CT Facility

2 mm



U. Texas High-Res CT Facility



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500  $\mu\text{m}$

U. Texas High-Res CT Facility



U. Texas High-Res CT Facility

# Volume rendering methods

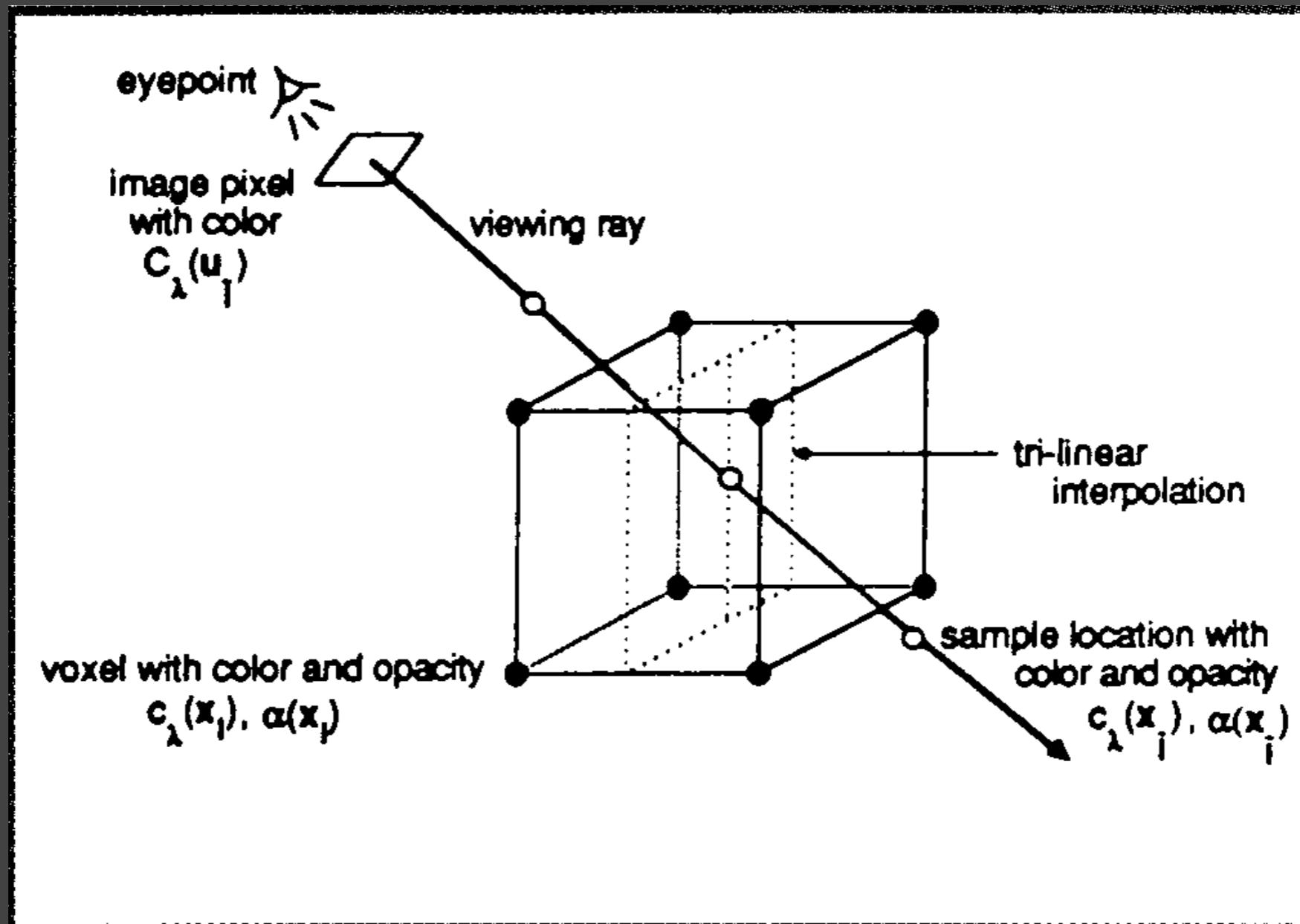
Ray casting (image order)

Compositing (object becomes image order)

Spatting (object order)

Fourier

# Volume rendering by ray casting



[Levoy 1988]

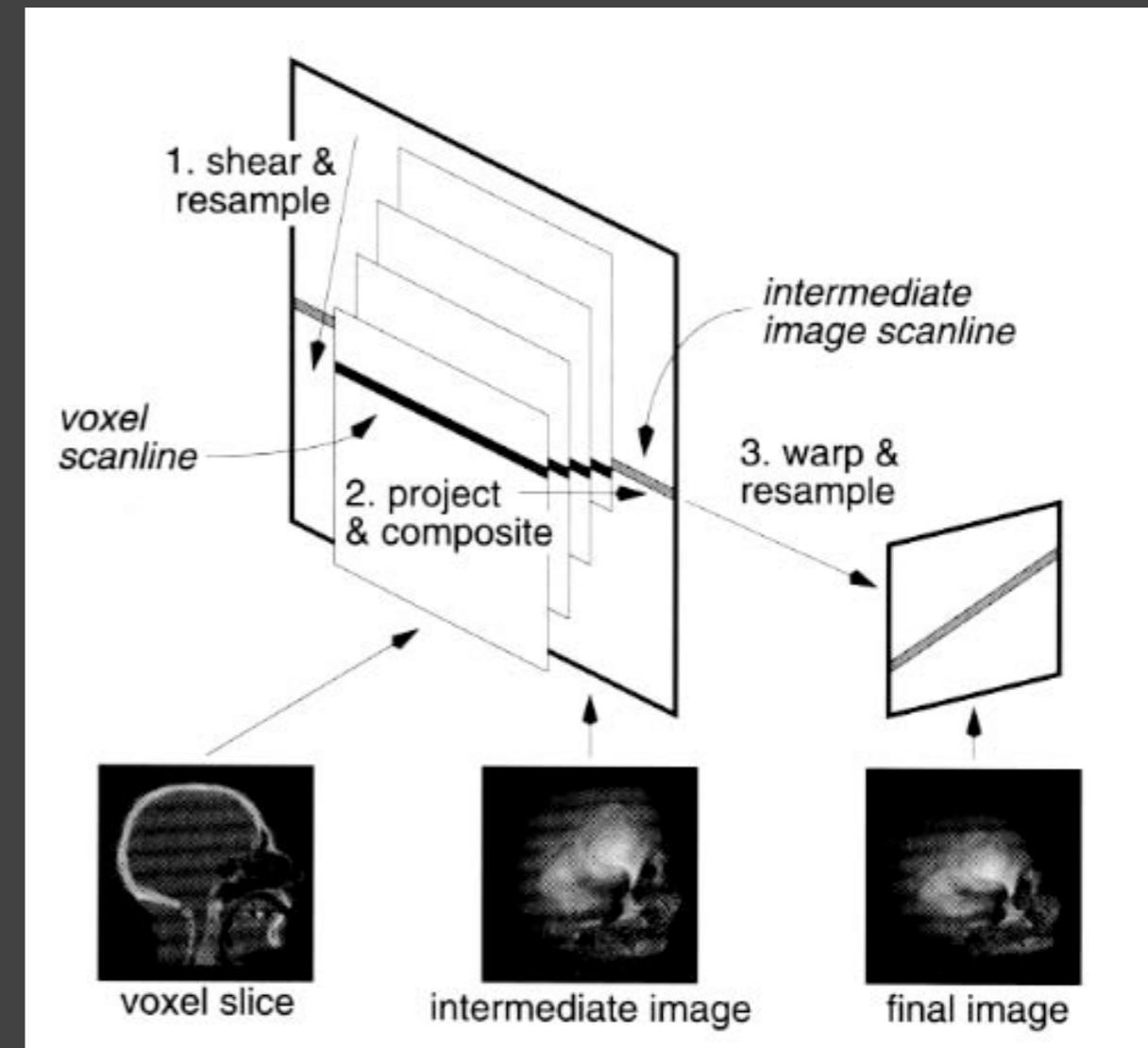
# Volume rendering by resampling

and resampled to lie in that coordinate system. This is done as a sequence of 4 transformations,

$$T = P_z(z_e) R_z(\psi) R_y(\phi) R_z(\theta)$$

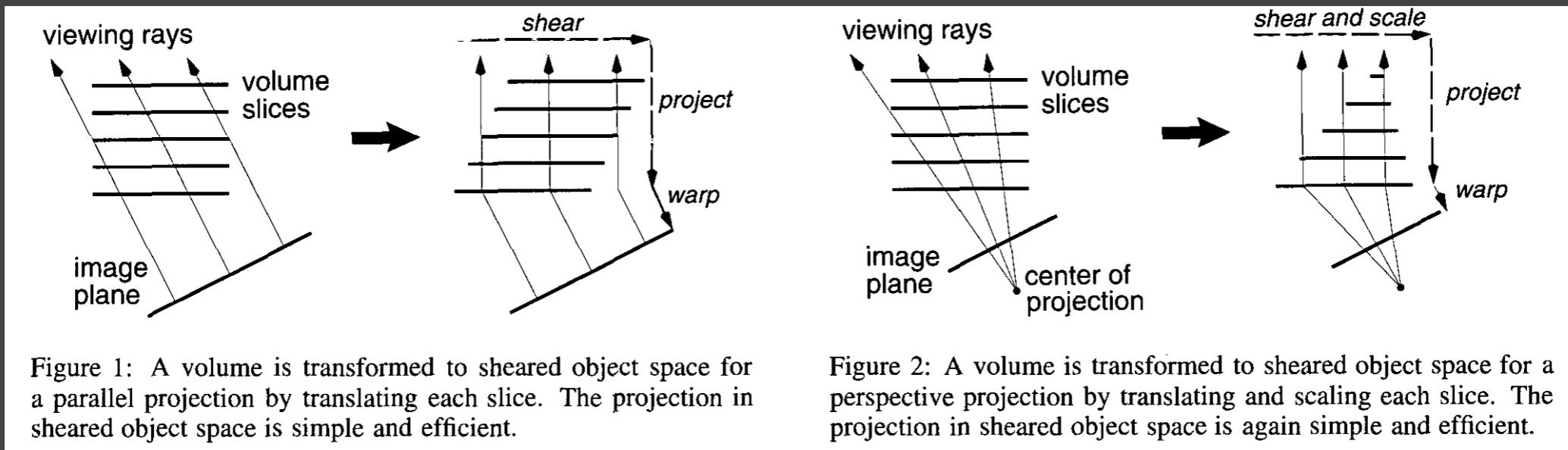
where  $R_z$  and  $R_y$  are rotations about the  $z$  and  $y$  axes, respectively, and  $P_z$  is the perspective transformation. The transform-

[Drebin et al. 1988]

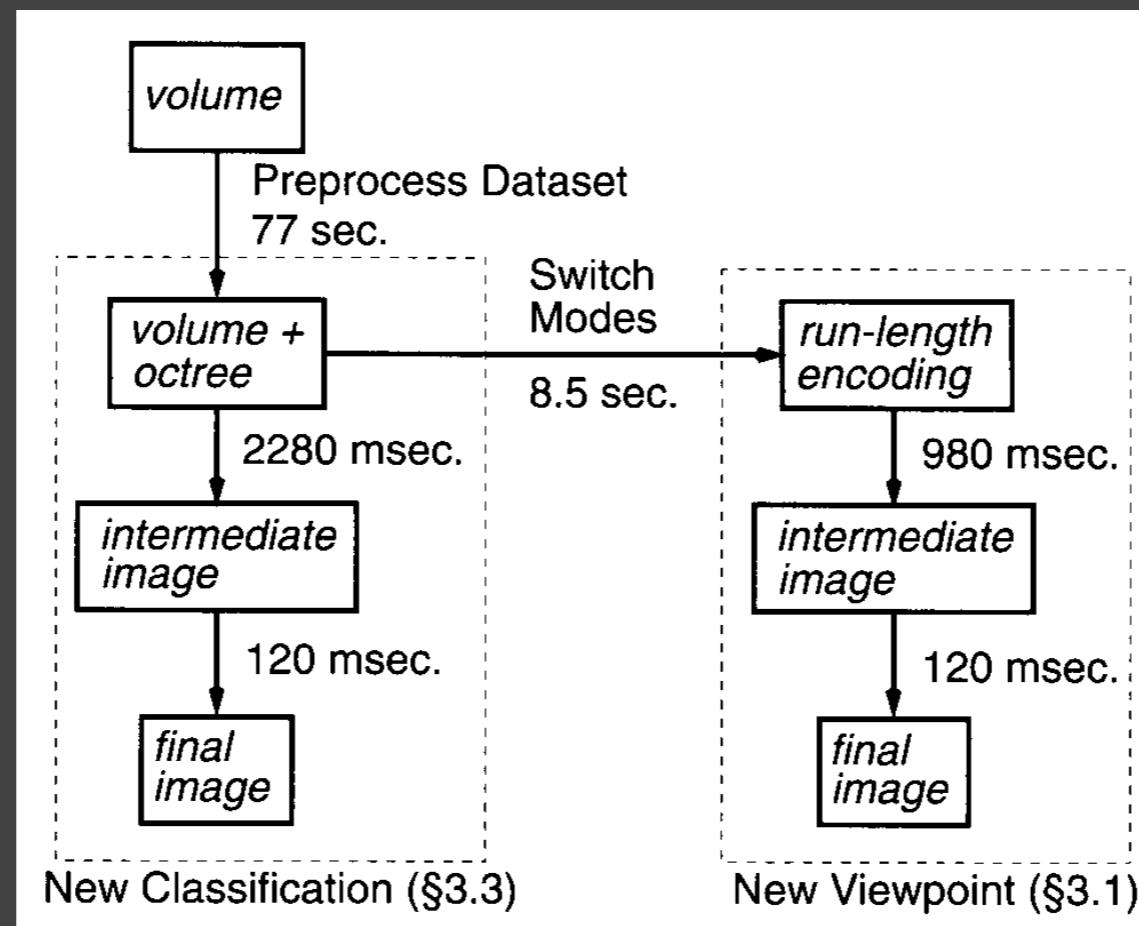


[Lacroute & Levoy 1994]

# Volume rendering by resampling

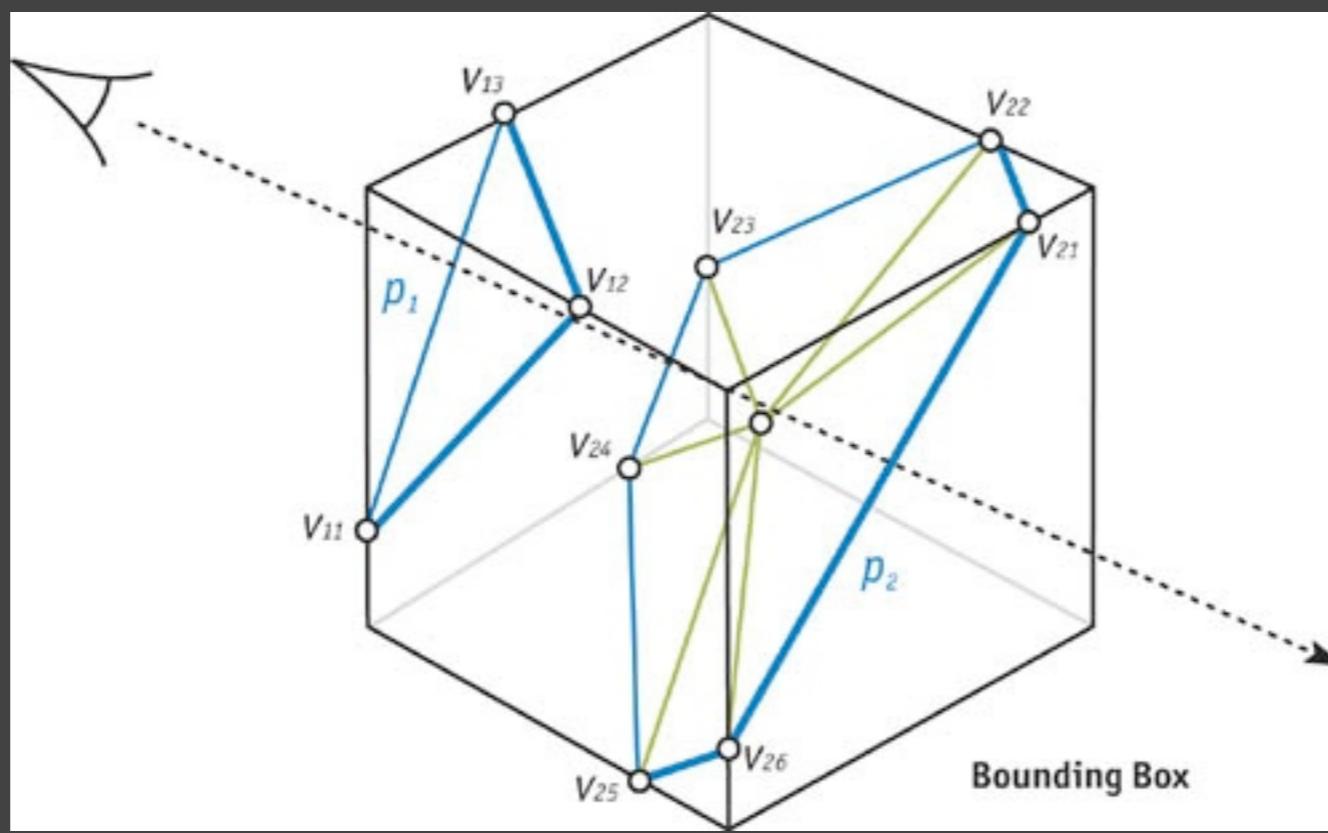
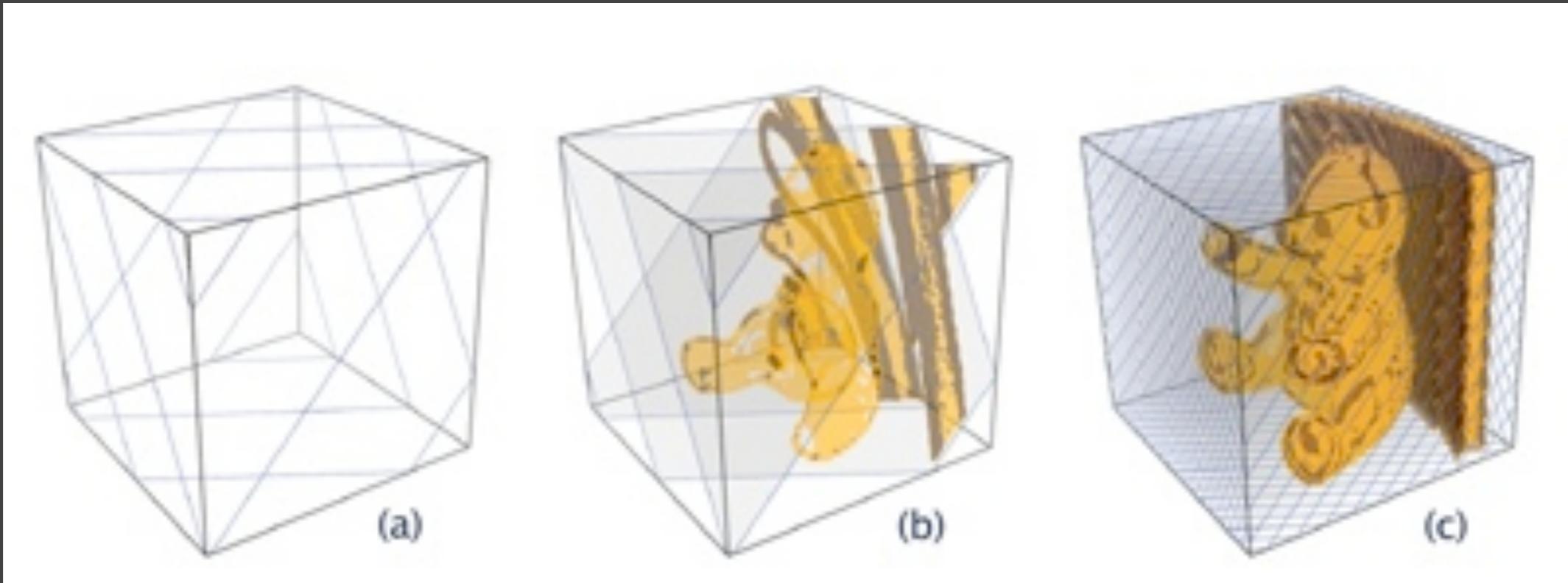


[Lacroute & Levoy 1994]



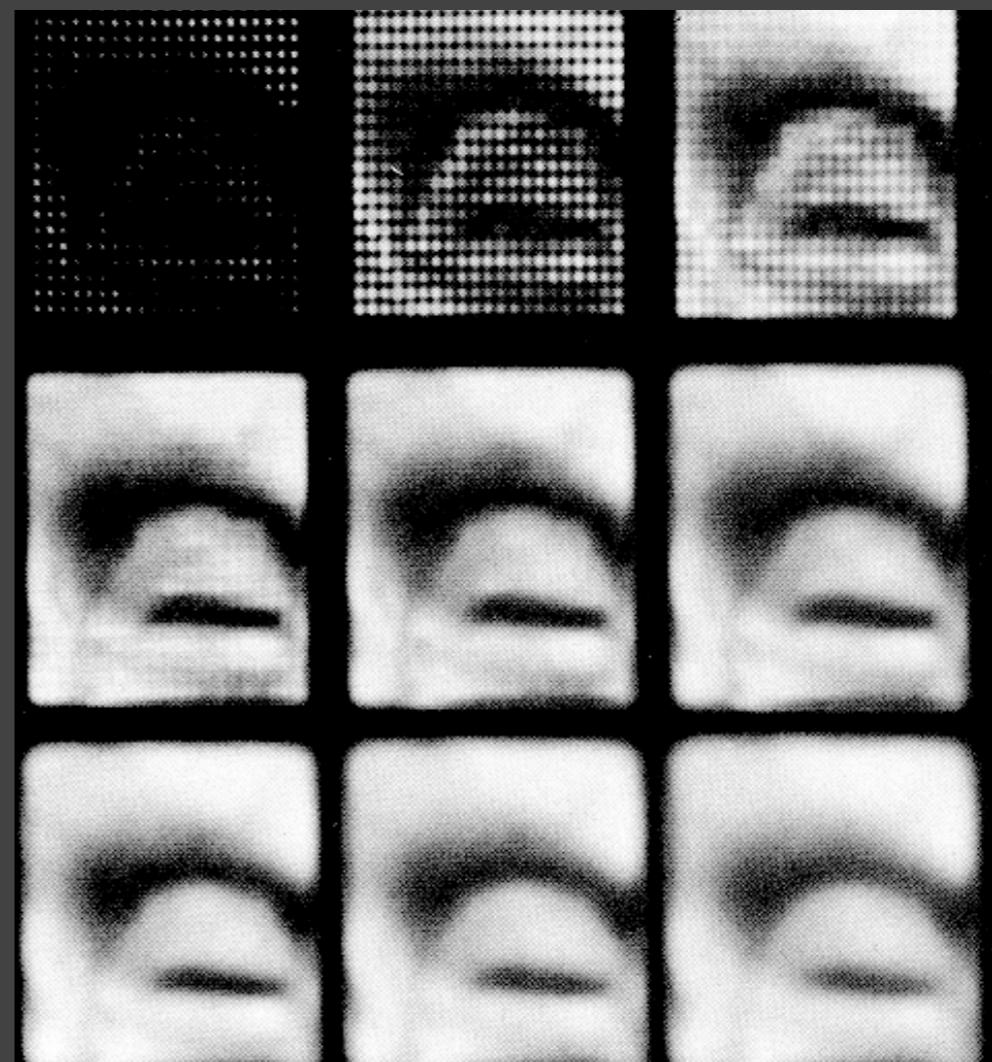
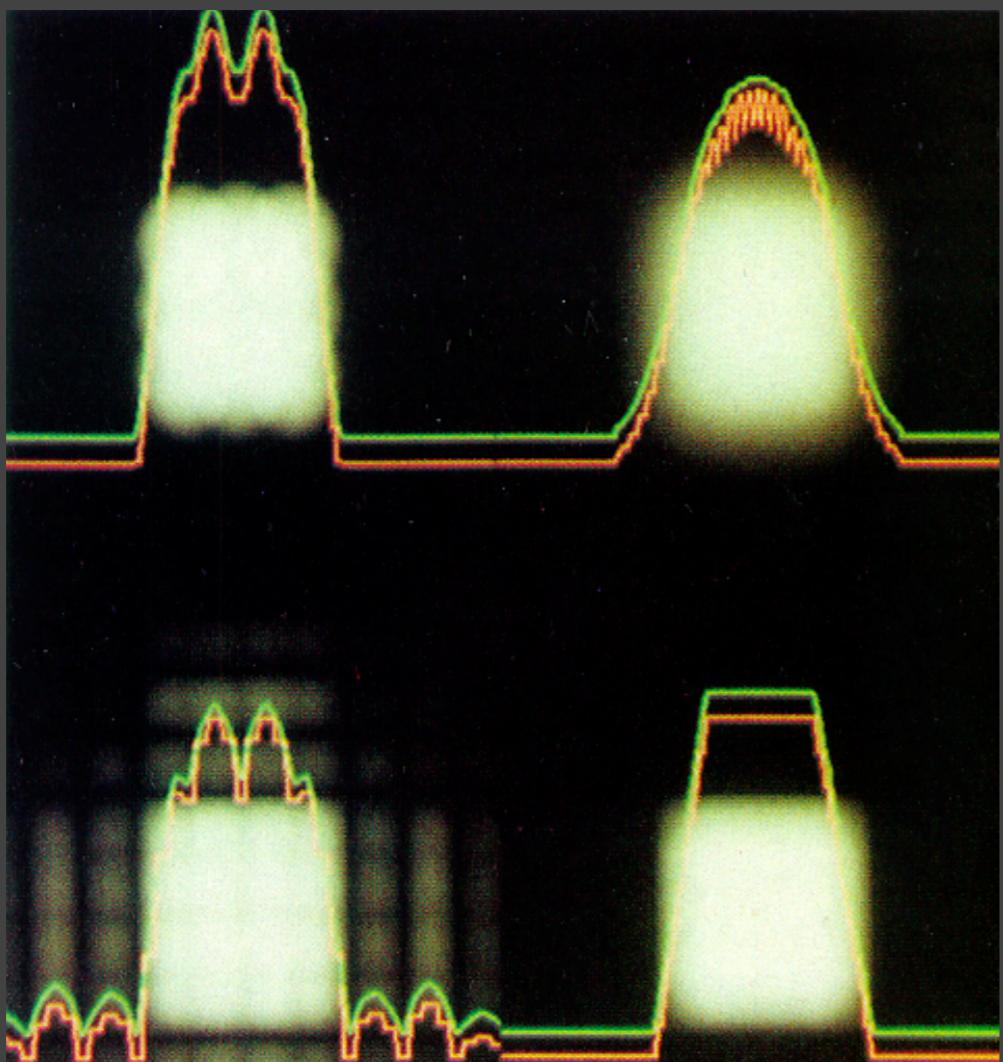
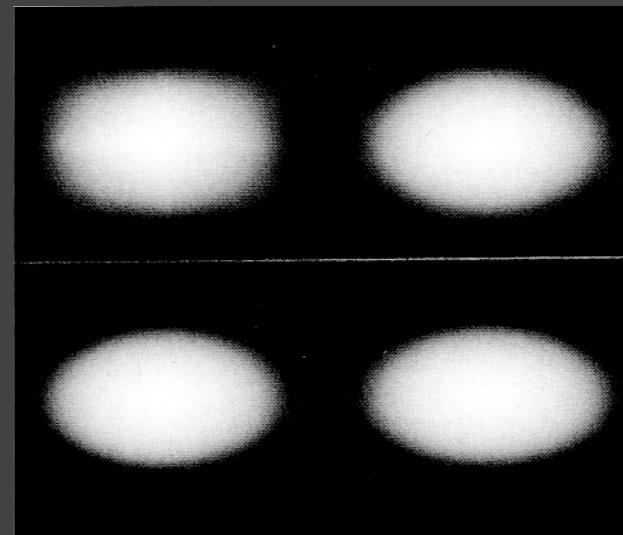
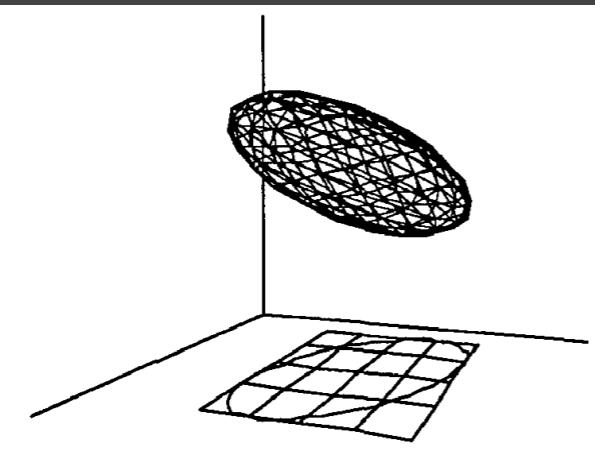
[Lacroute & Levoy 1994]

# Texture-based resampling



[Ikits et al. 2004]

# Volume rendering by splatting



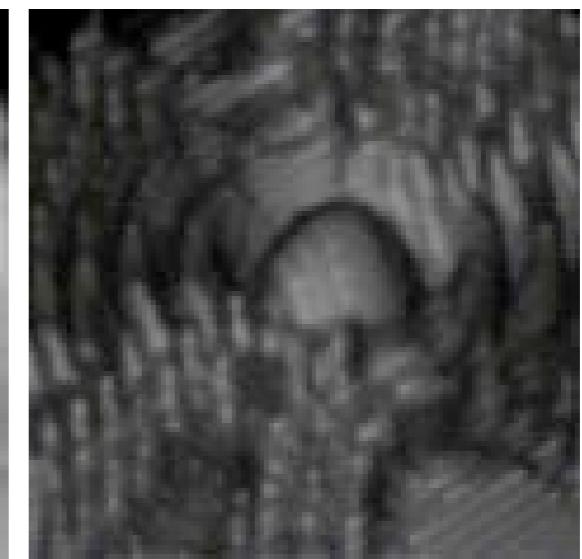
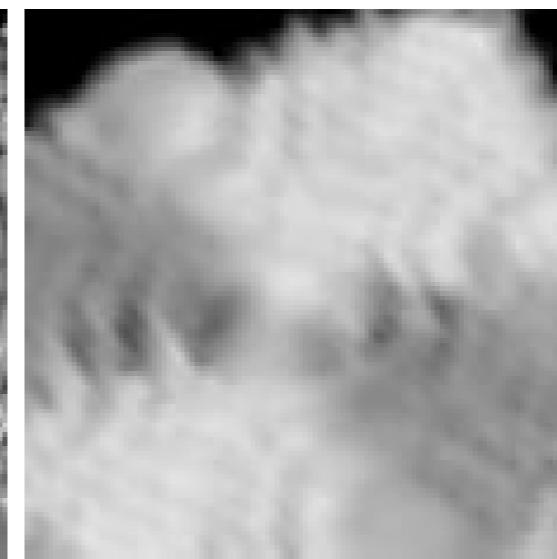
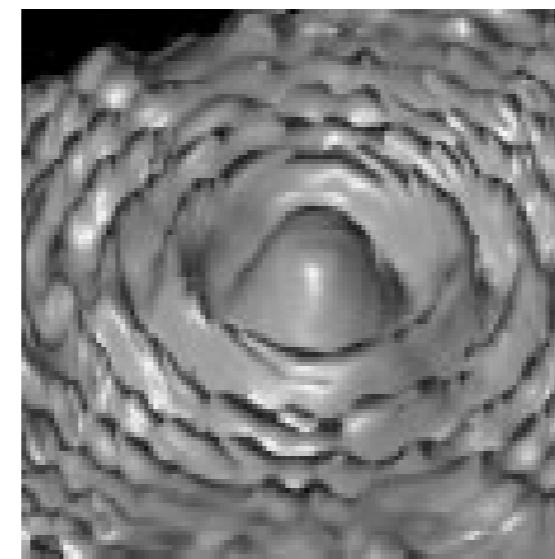
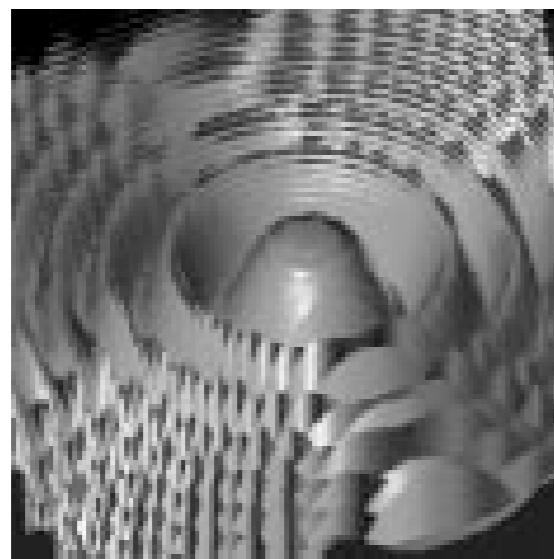
**Raycasting**

**Splatting**

**Shear-Warp**

**Texture Mapping**

Marschner-Lobb Function



(k)

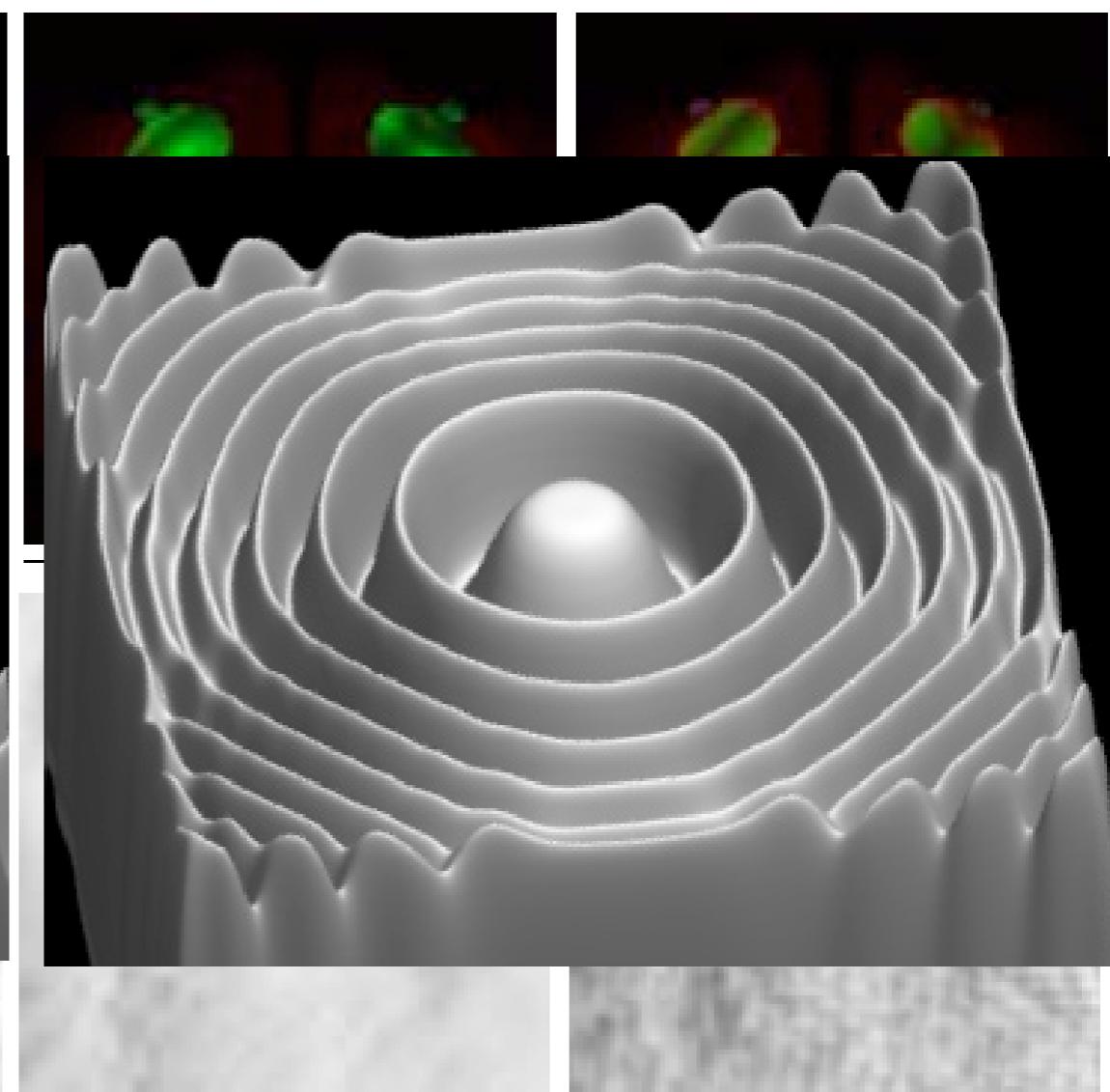
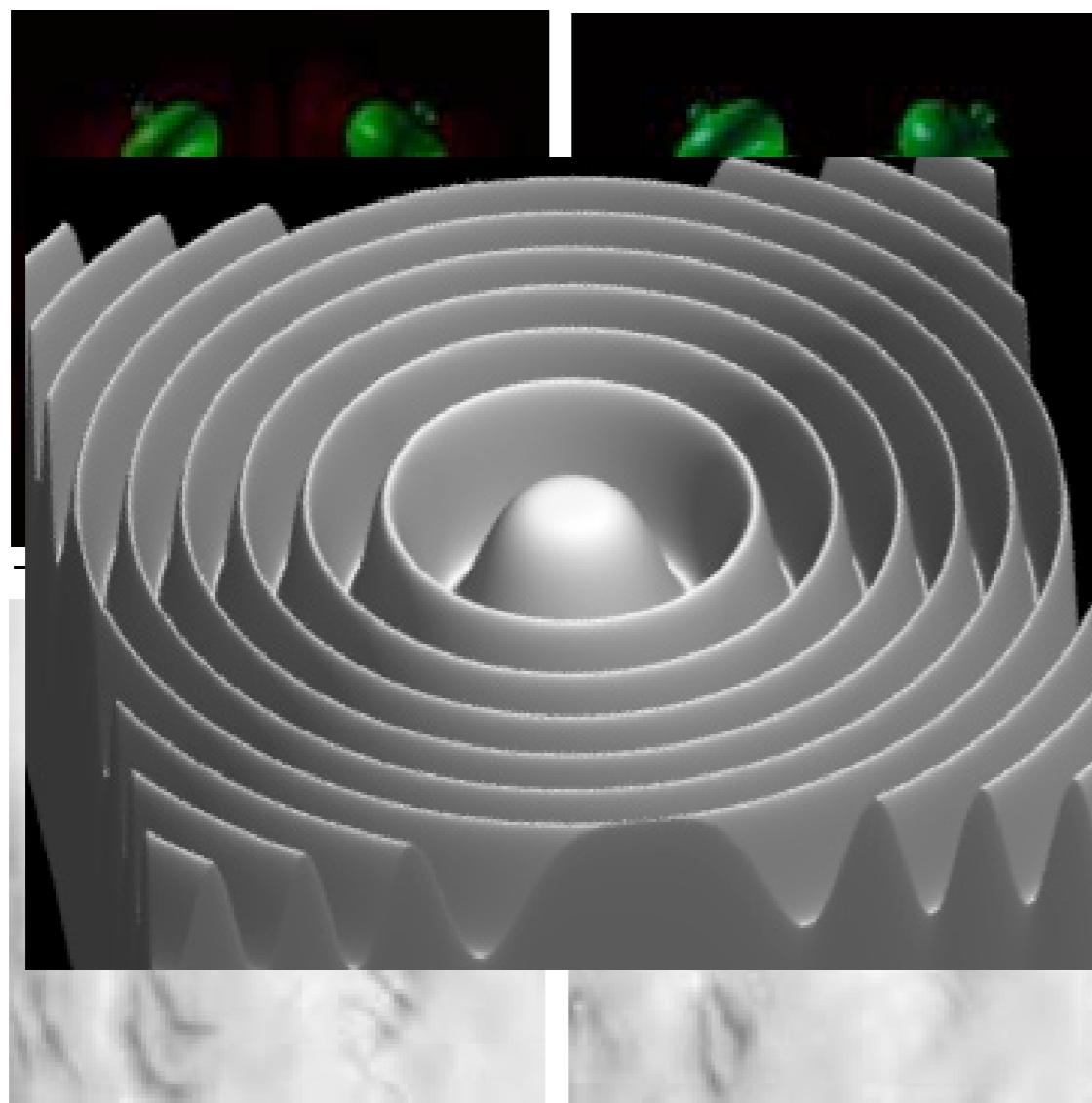
Magnification: 6

(h)

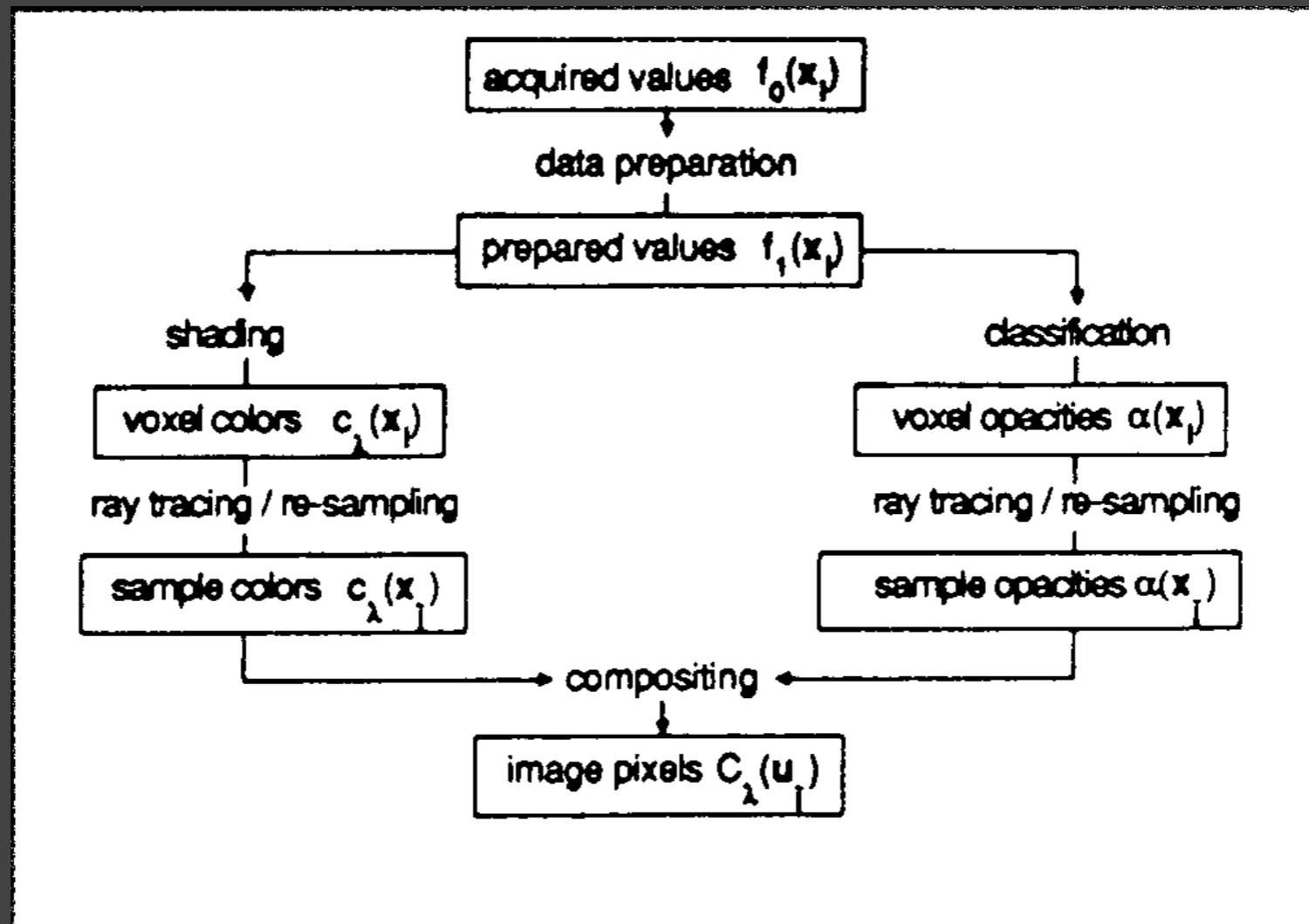
Viewed at 45°

(c)

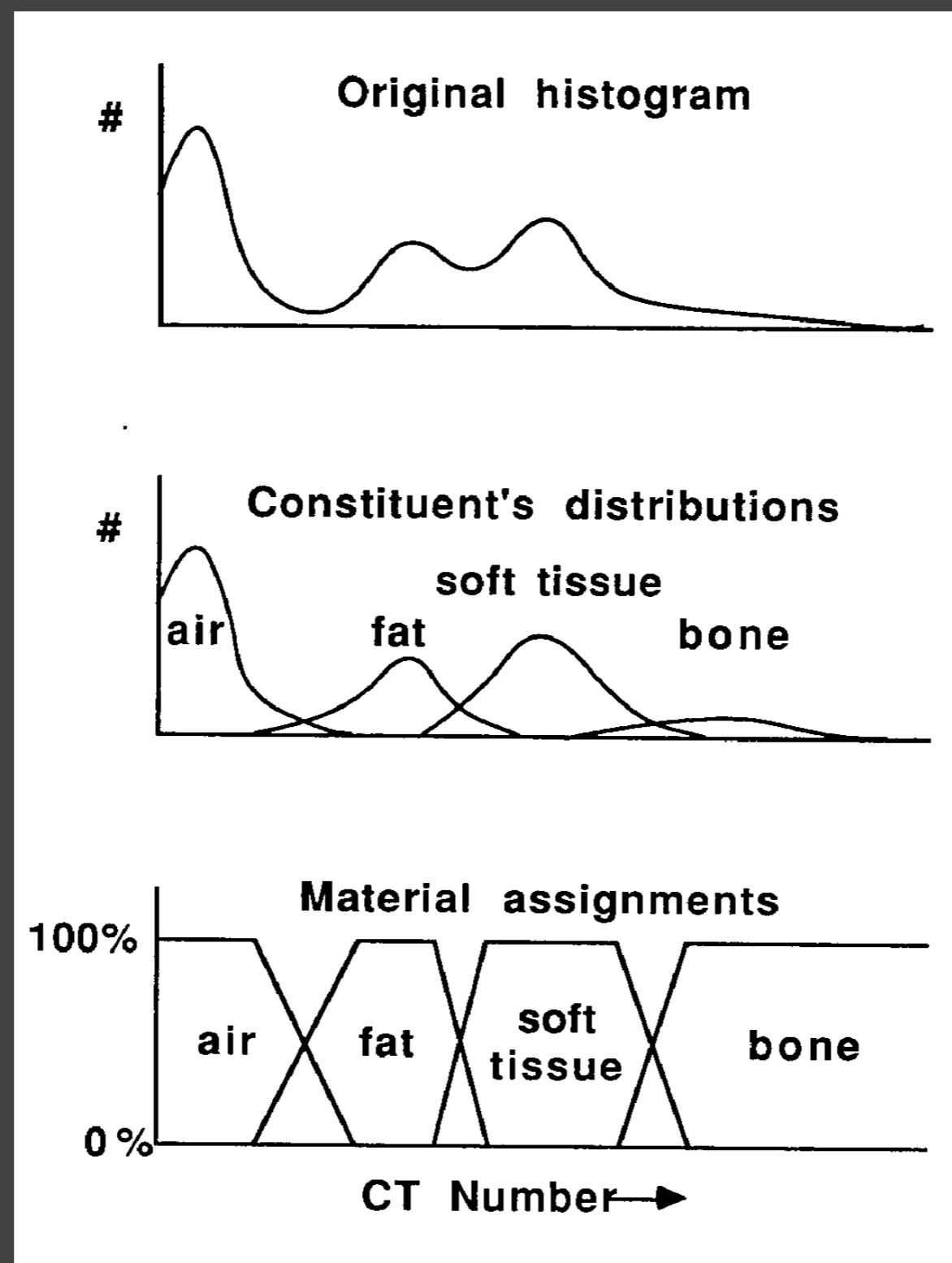
Magnification: 8



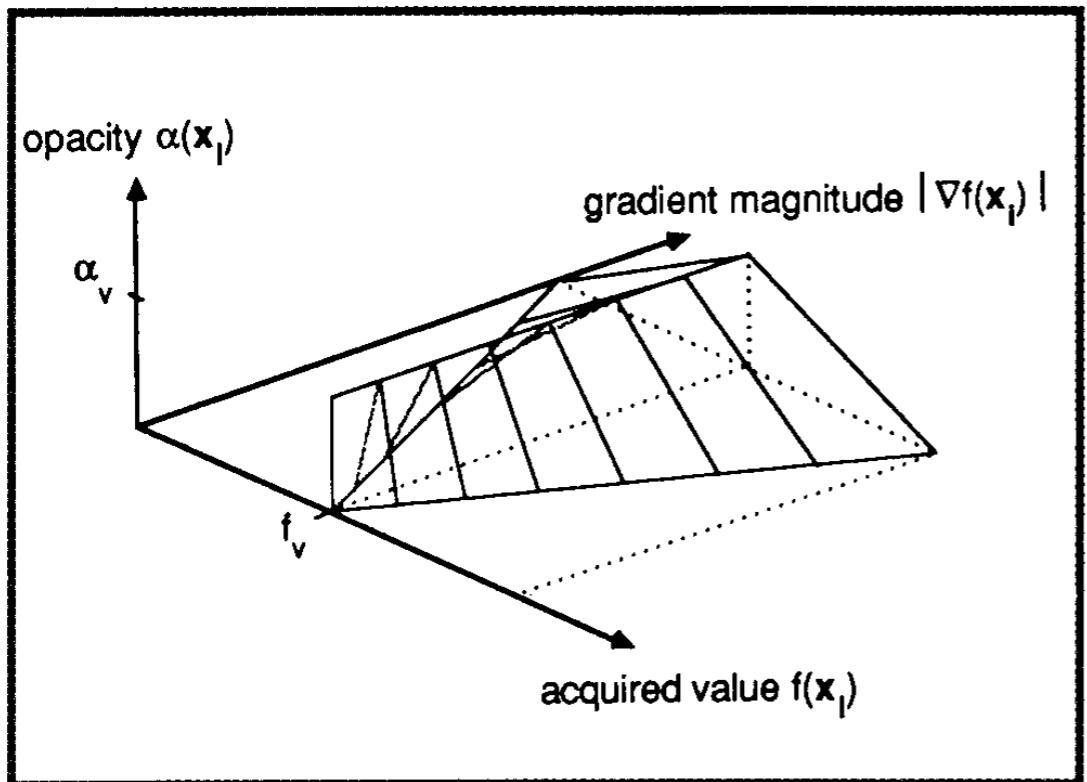
# Classification and shading



[Levoy 1988]

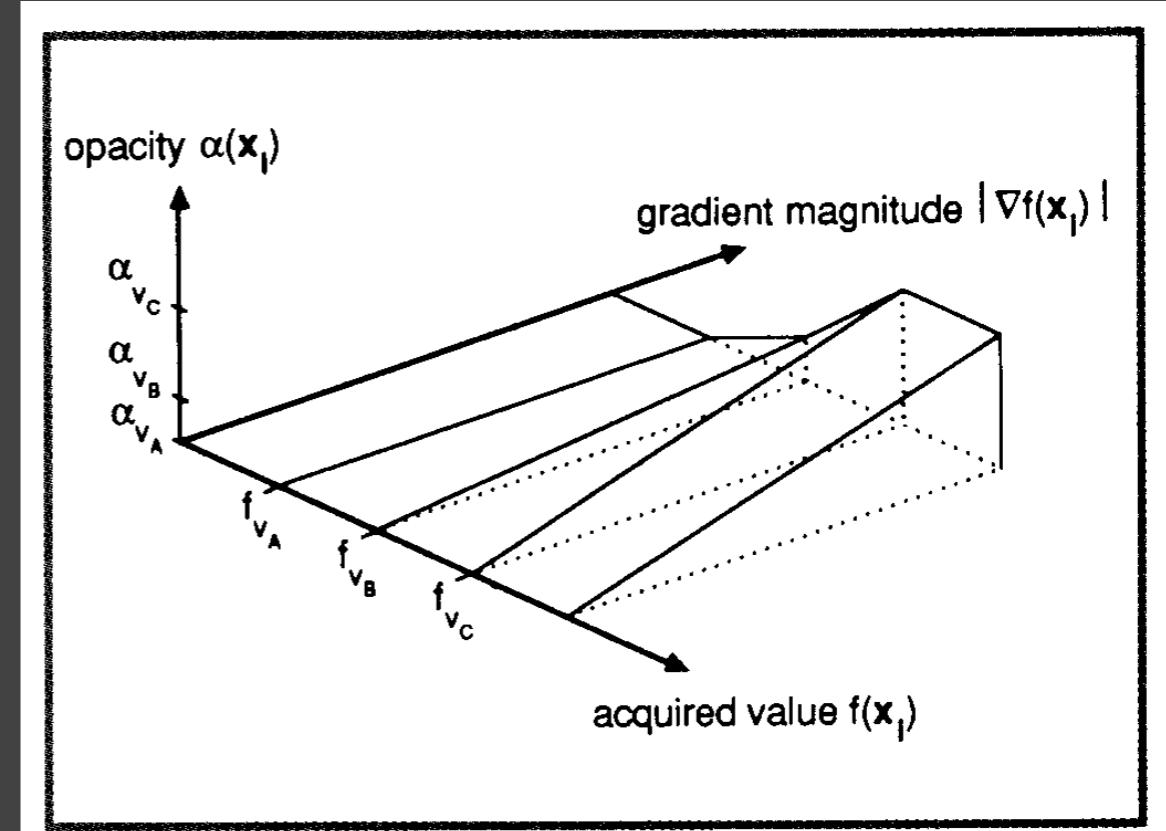


[Drebin 1988]



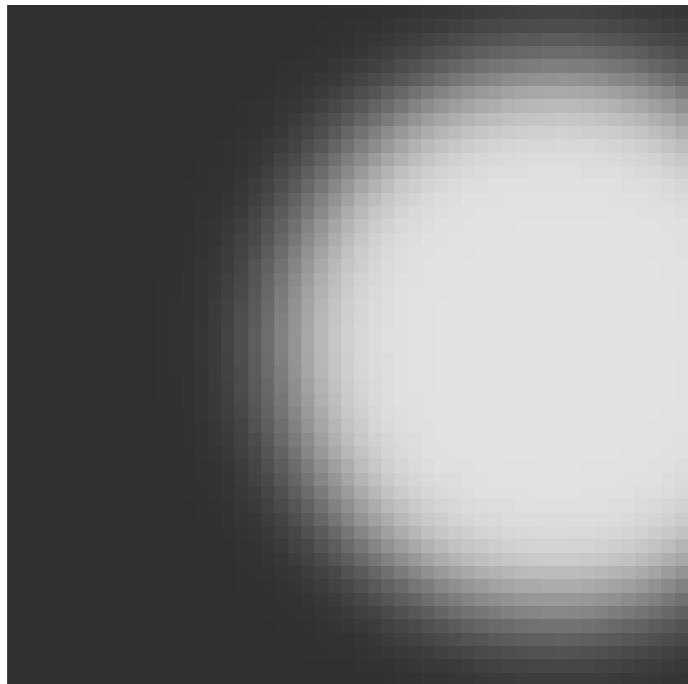
**Figure 3. Calculation of opacities for isovalue contour surfaces.**

[Levoy 1988]

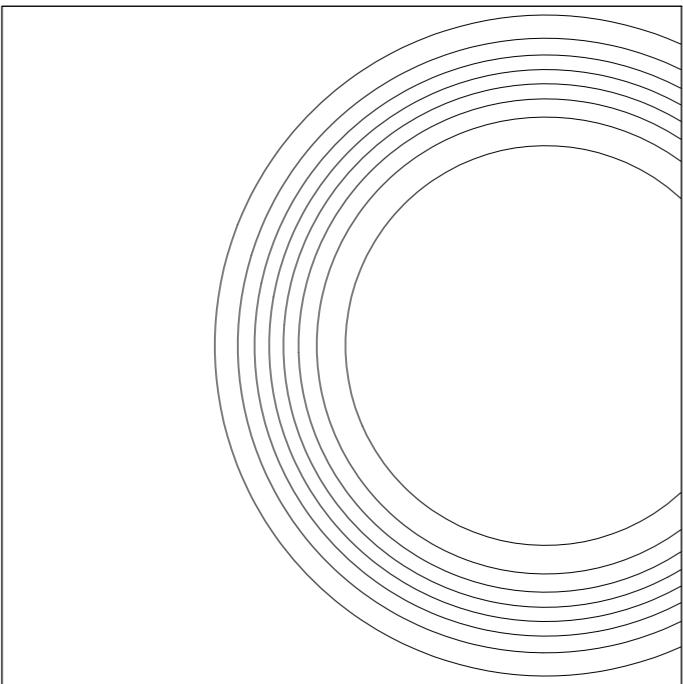


**Figure 4. Calculation of opacities for region boundary surfaces.**

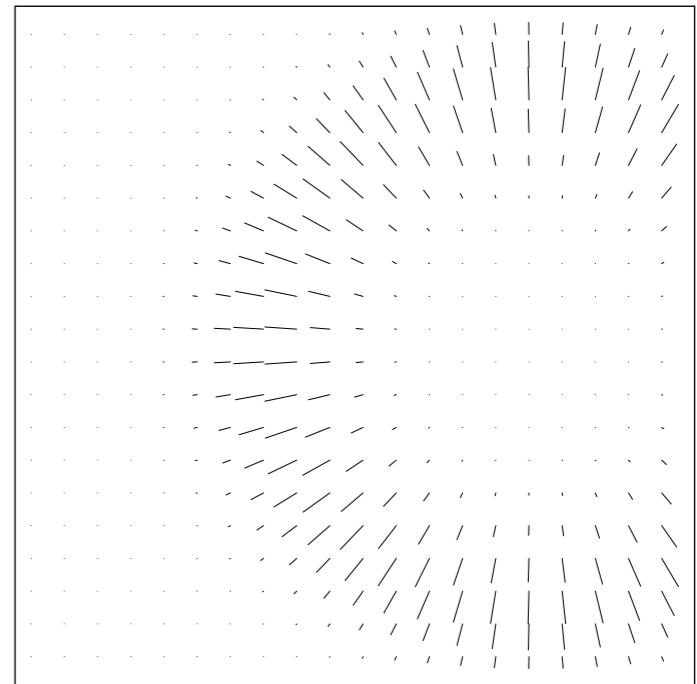
[Levoy 1988]



(a)  $f(\mathbf{x})$



(b) Isosurfaces of  $f$



(c)  $\nabla f$

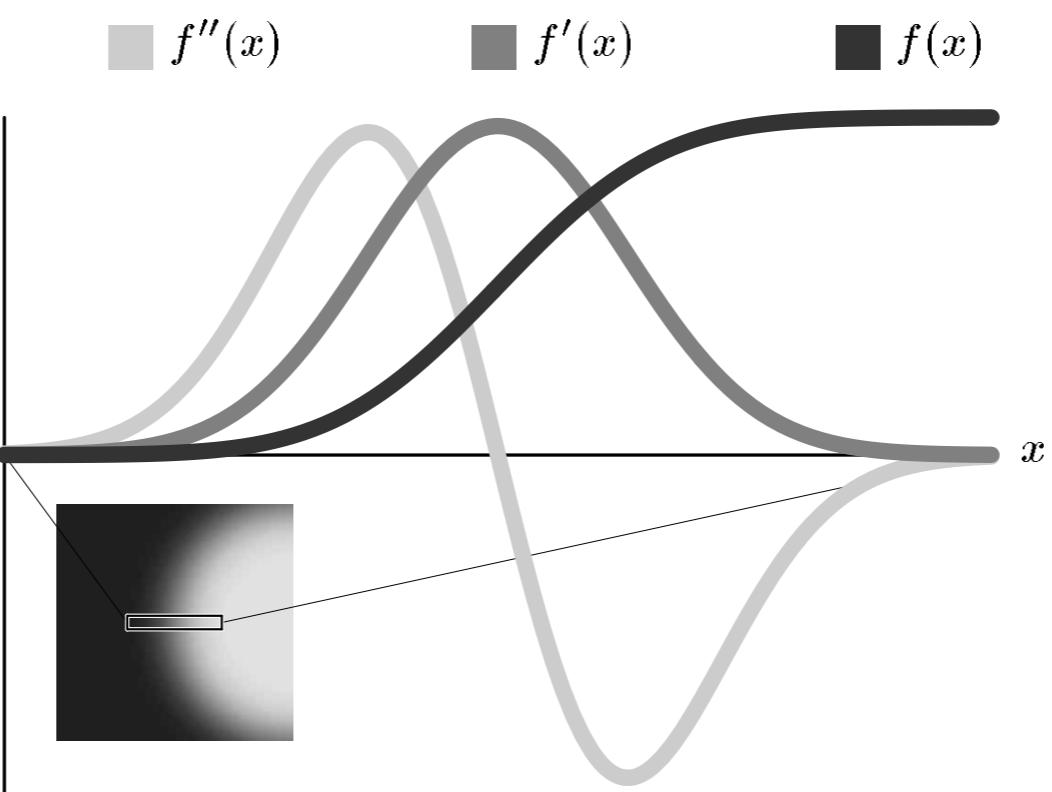


Figure 4: Measuring  $f$ ,  $f'$ , and  $f''$  across boundary.

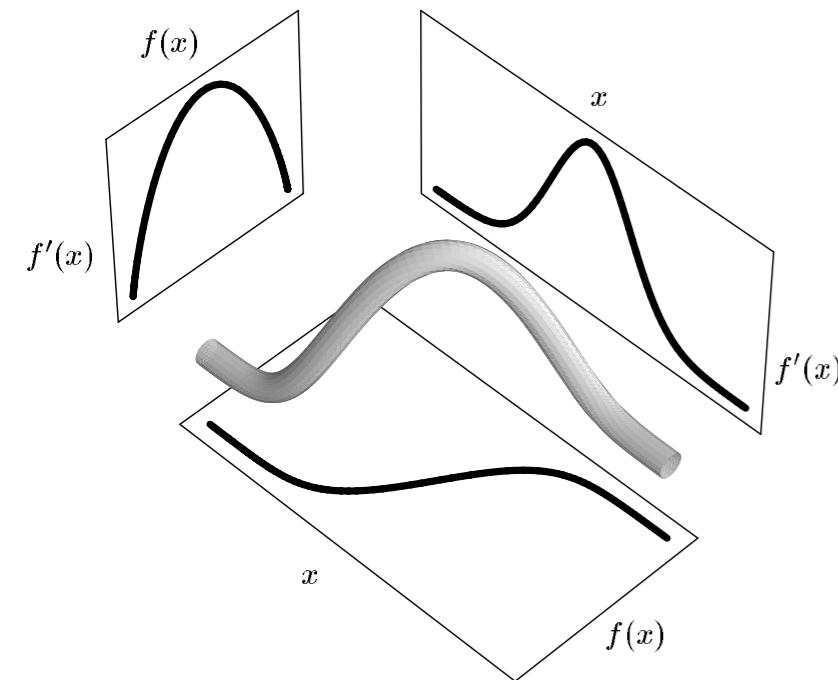


Figure 5:  $f$ ,  $f'$  and position  $x$ .

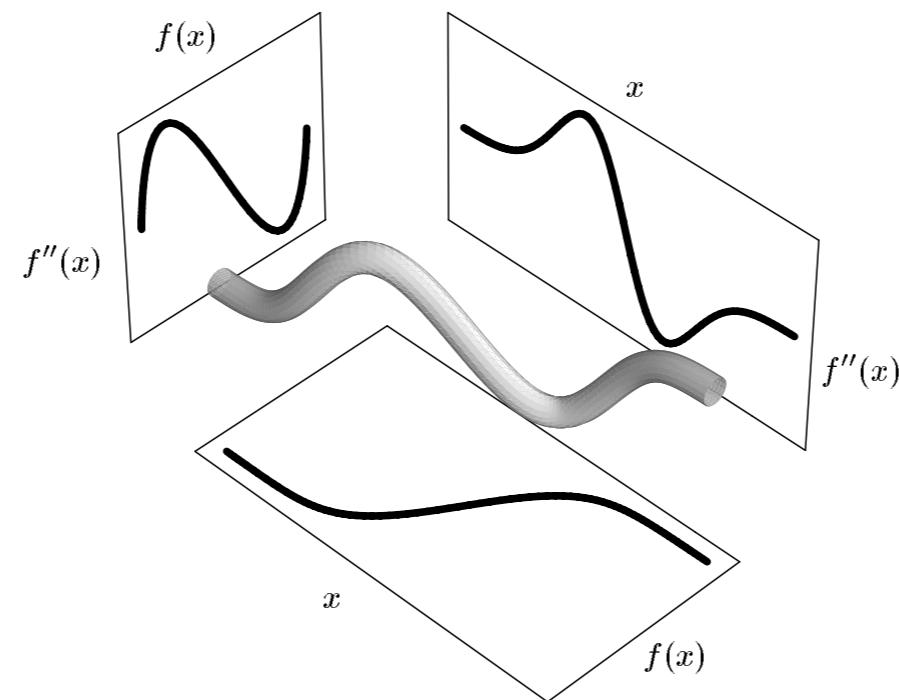


Figure 6:  $f$ ,  $f''$  and position  $x$ .

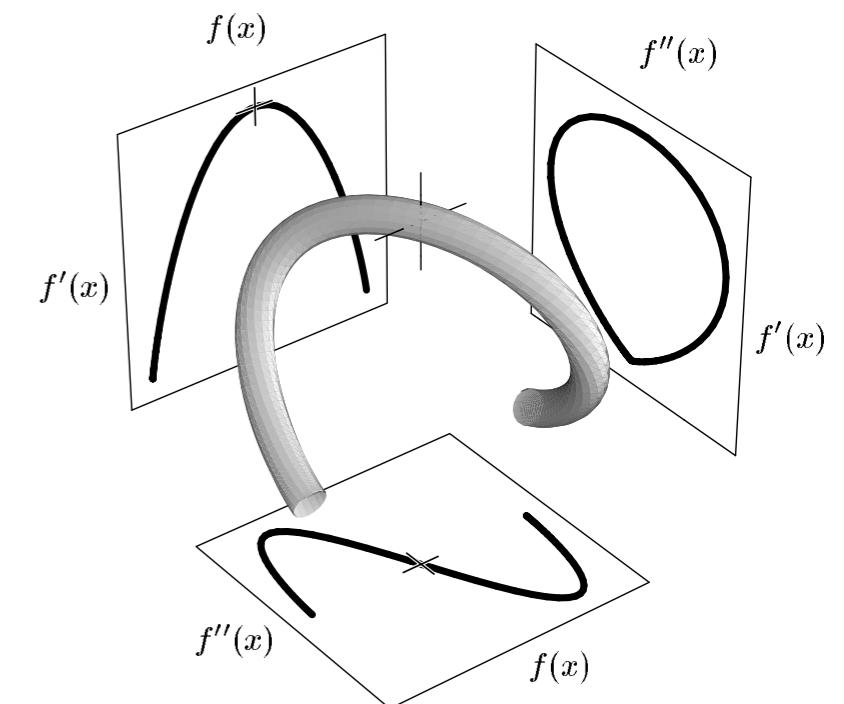
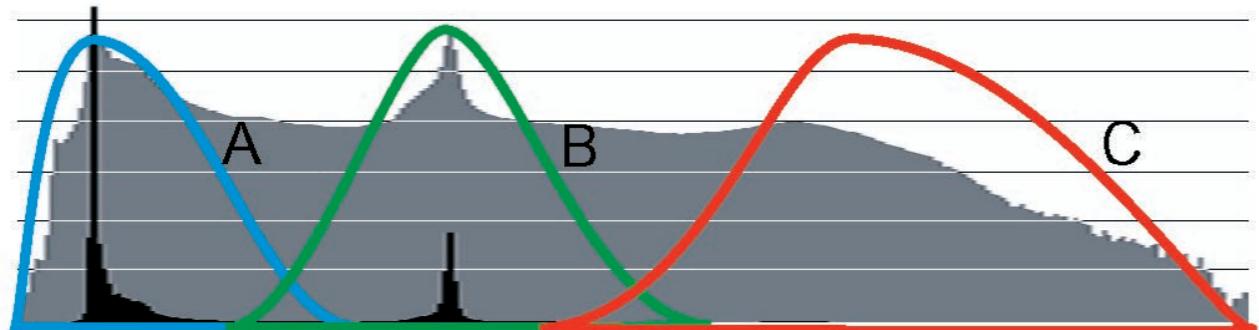
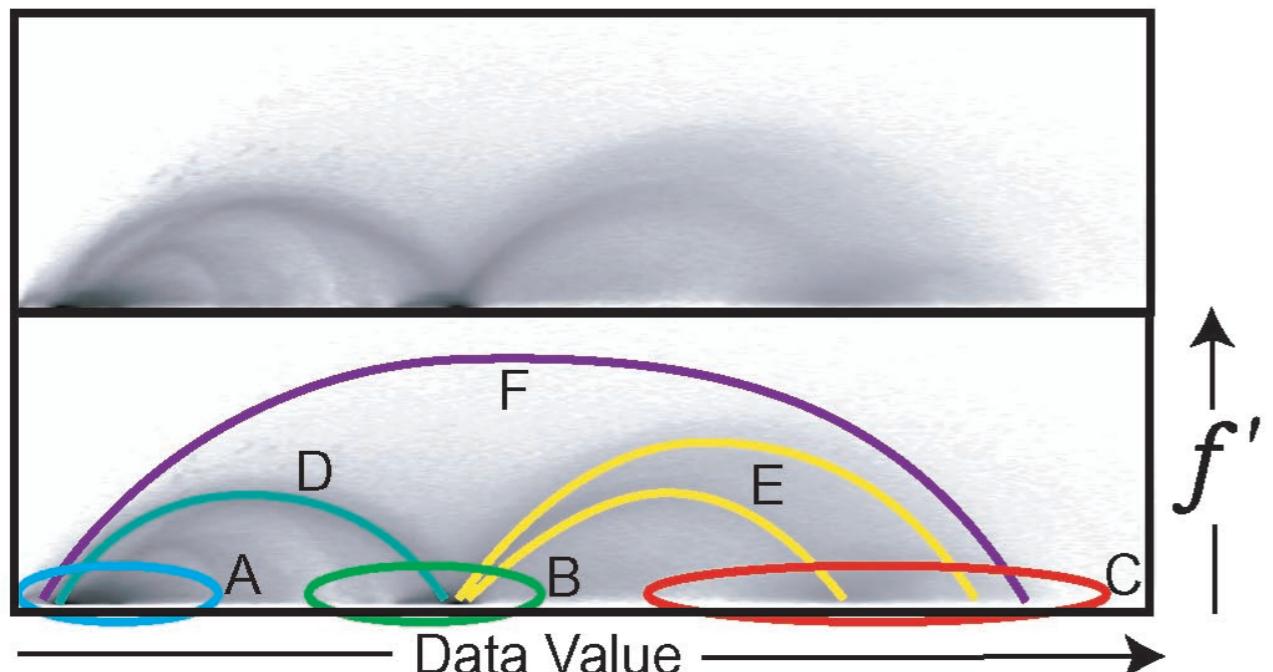


Figure 7: The underlying relationship of  $f$ ,  $f'$ , and  $f''$ .

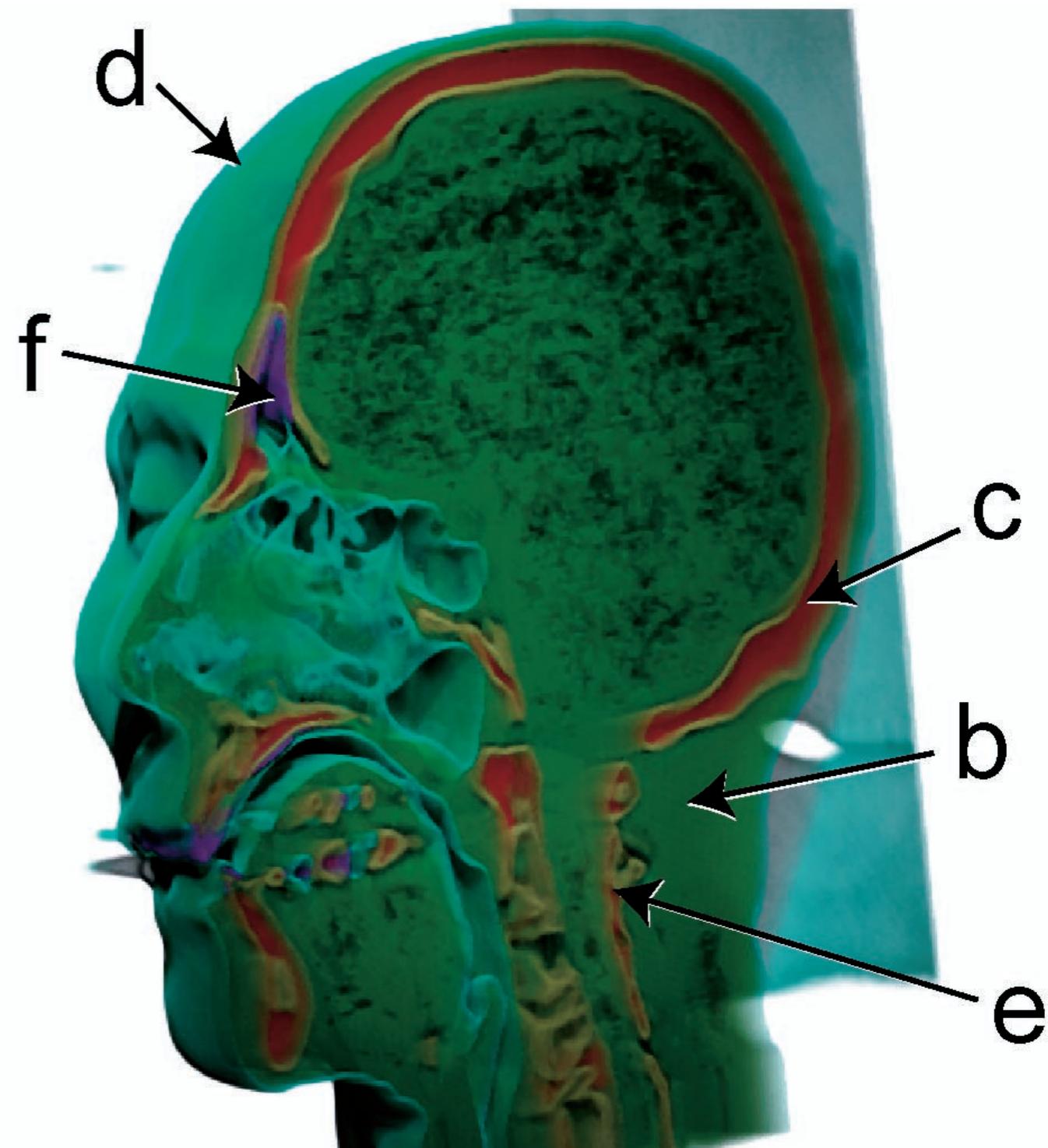
[Kindlmann & Durkin 1998]



(a)

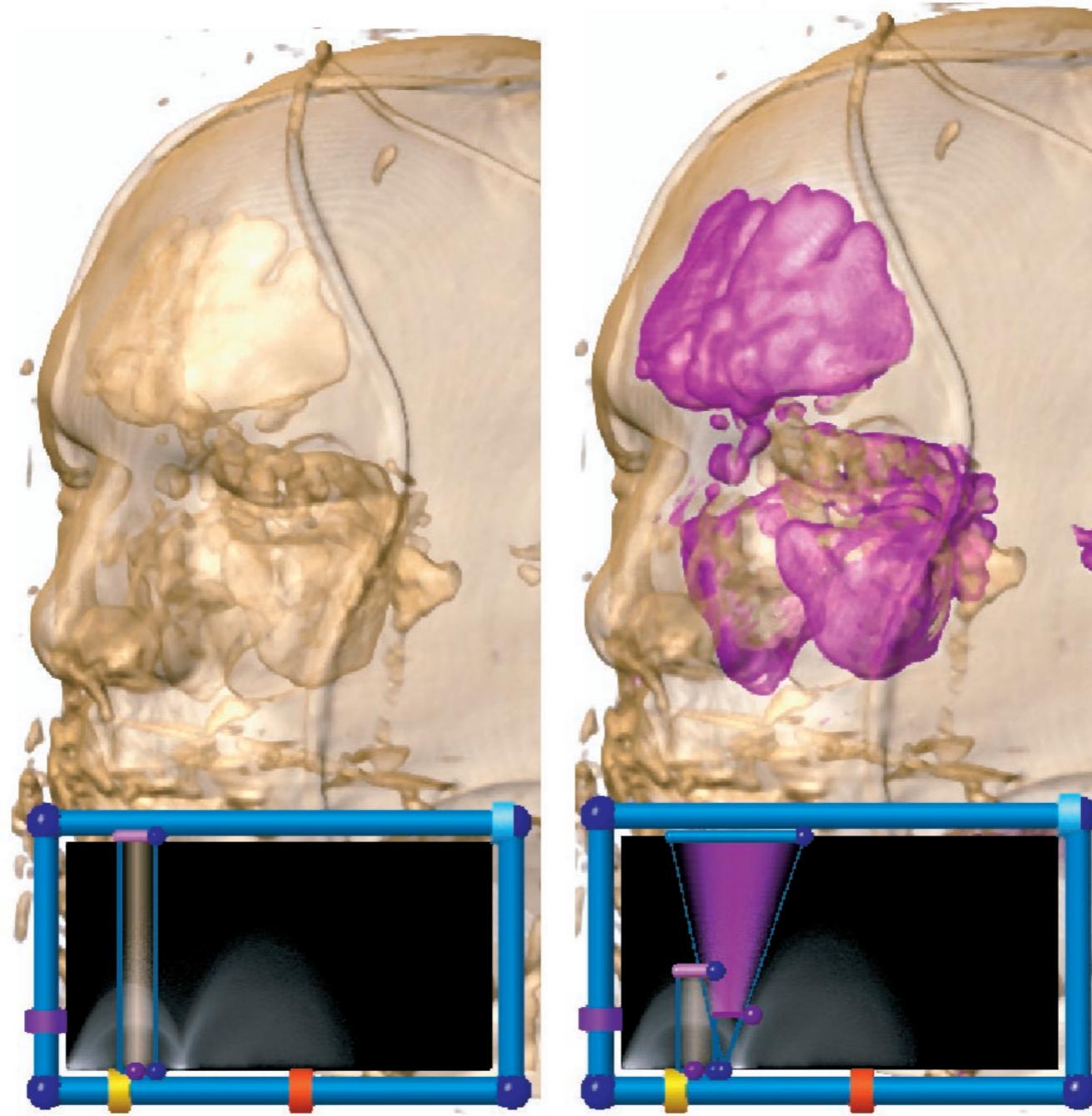


(b)

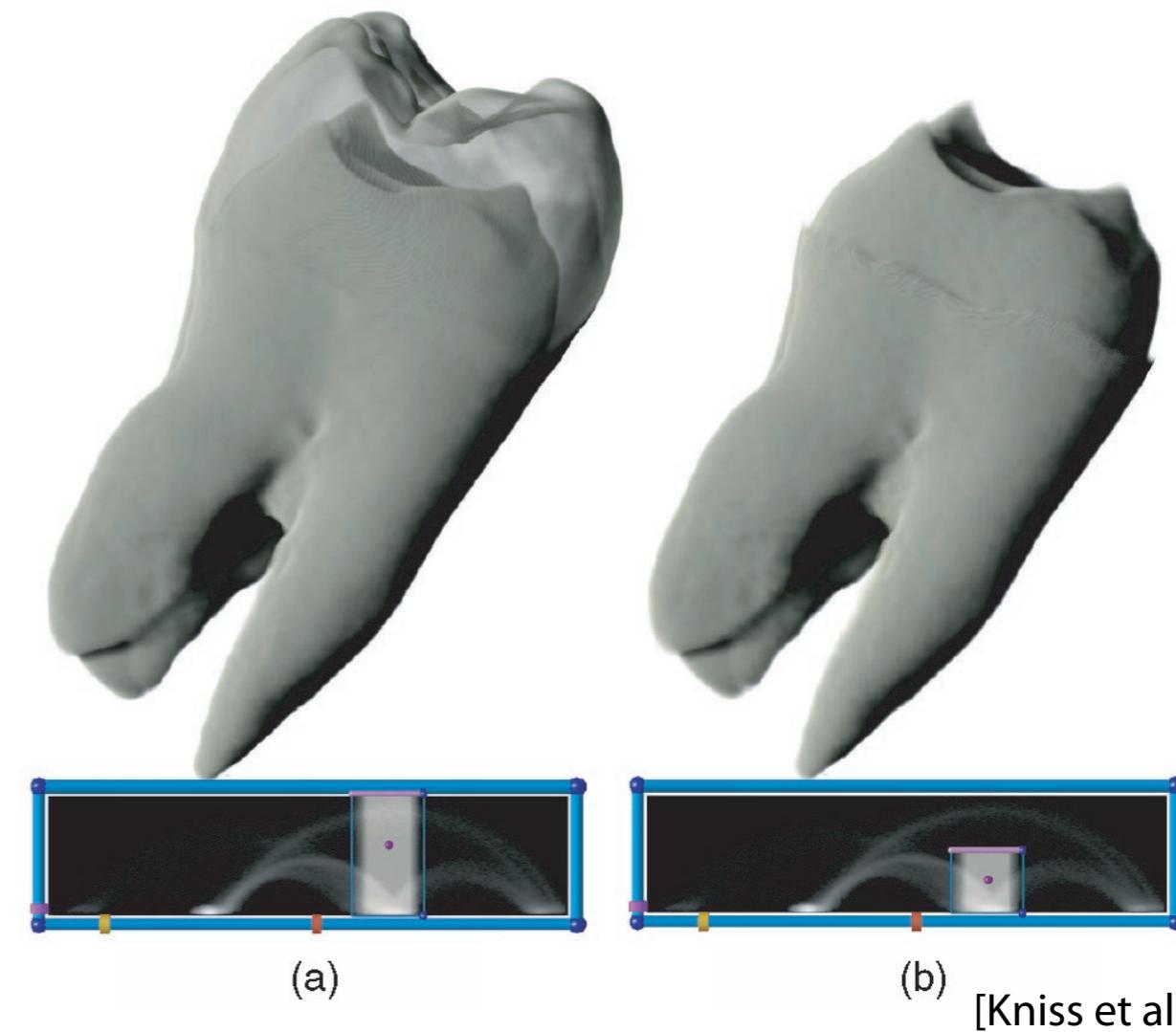
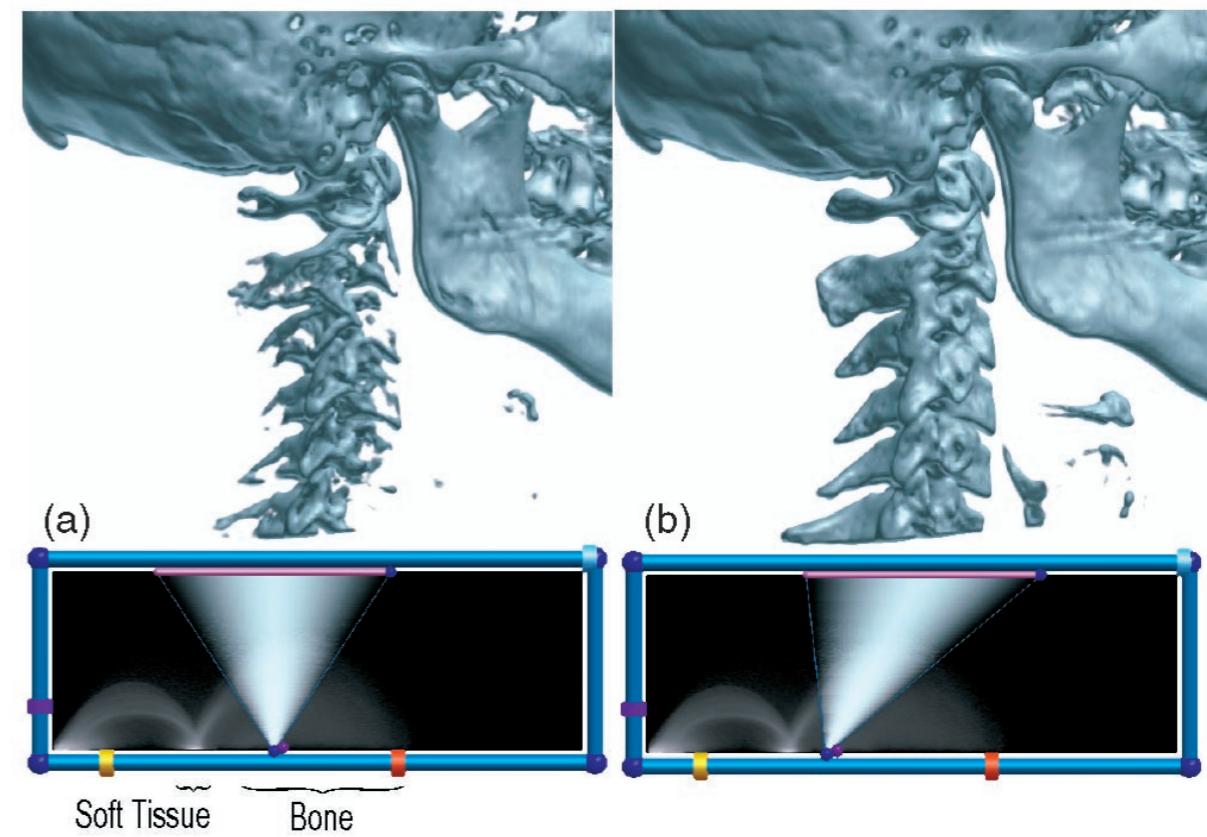
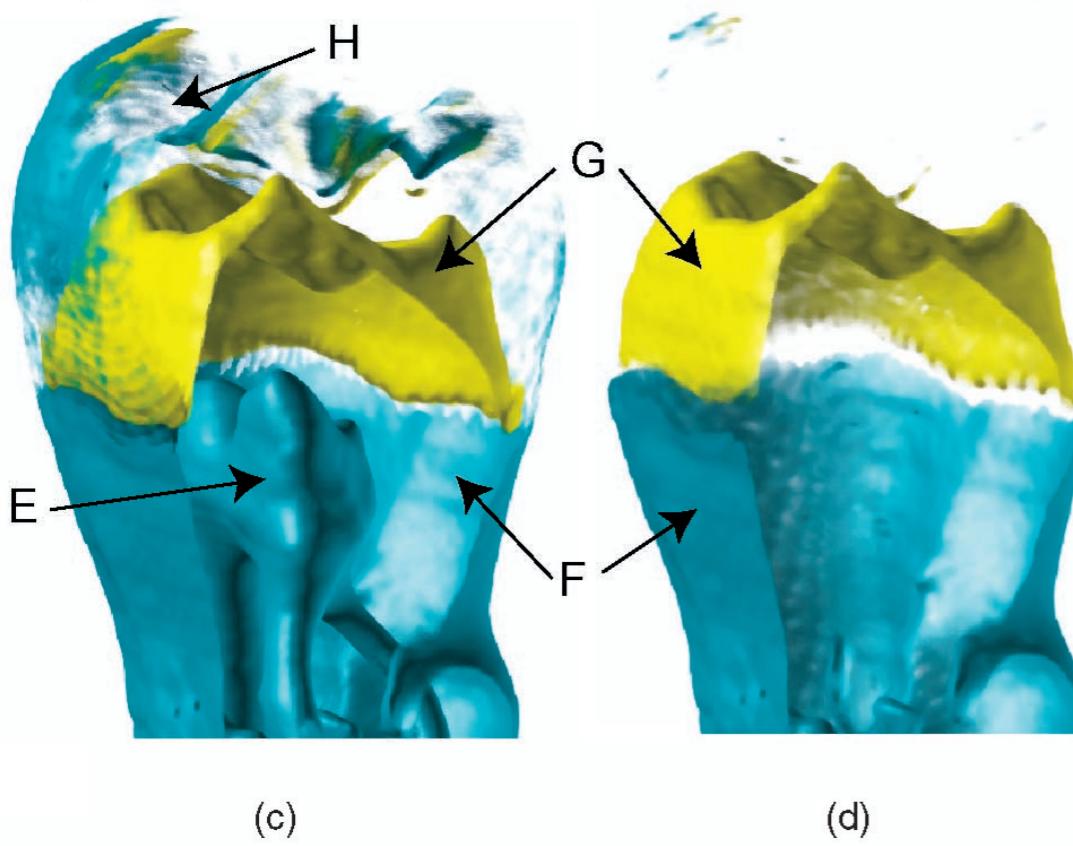
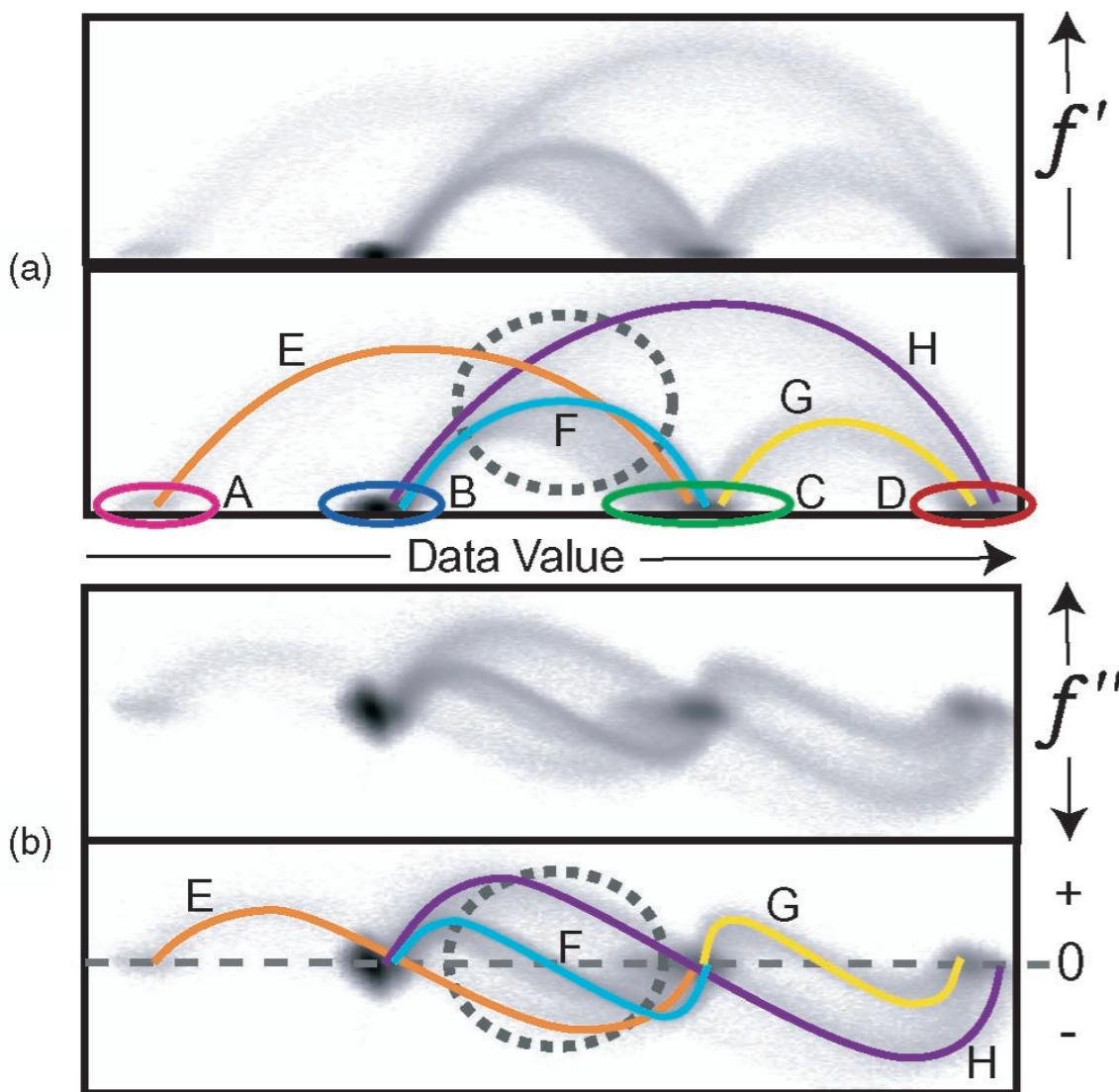


(c)

[Kniss et al. 2002]



[Kniss et al. 2002]



[Kniss et al. 2002]