Texture Mapping

CS 4620 Lecture 12

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Recall first definition…

Texture mapping: a technique of defining surface properties (especially shading parameters) in such a way that they vary as a function of position on the surface.

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A refined definition

Texture mapping: a set of techniques for defining functions on surfaces, for a variety of uses.

- Let's look at some examples of more general uses of texture maps.

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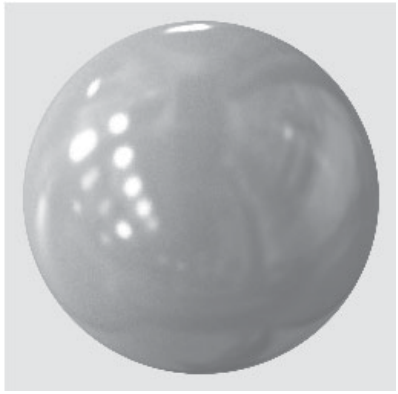
Reflection mapping

- Early (earliest?) non-decal use of textures
- Appearance of shiny objects
  - Phong highlights produce blurry highlights for glossy surfaces.
  - A polished (shiny) object reflects a sharp image of its environment.
- The whole key to a shiny-looking material is providing something for it to reflect.



(a)

(b)

[Dror, Willsky, & Adelson 2004]

Figure 2. (a). A shiny sphere rendered under photographically acquired real-world illumination. (b). The same sphere rendered under illumination by a point light source.

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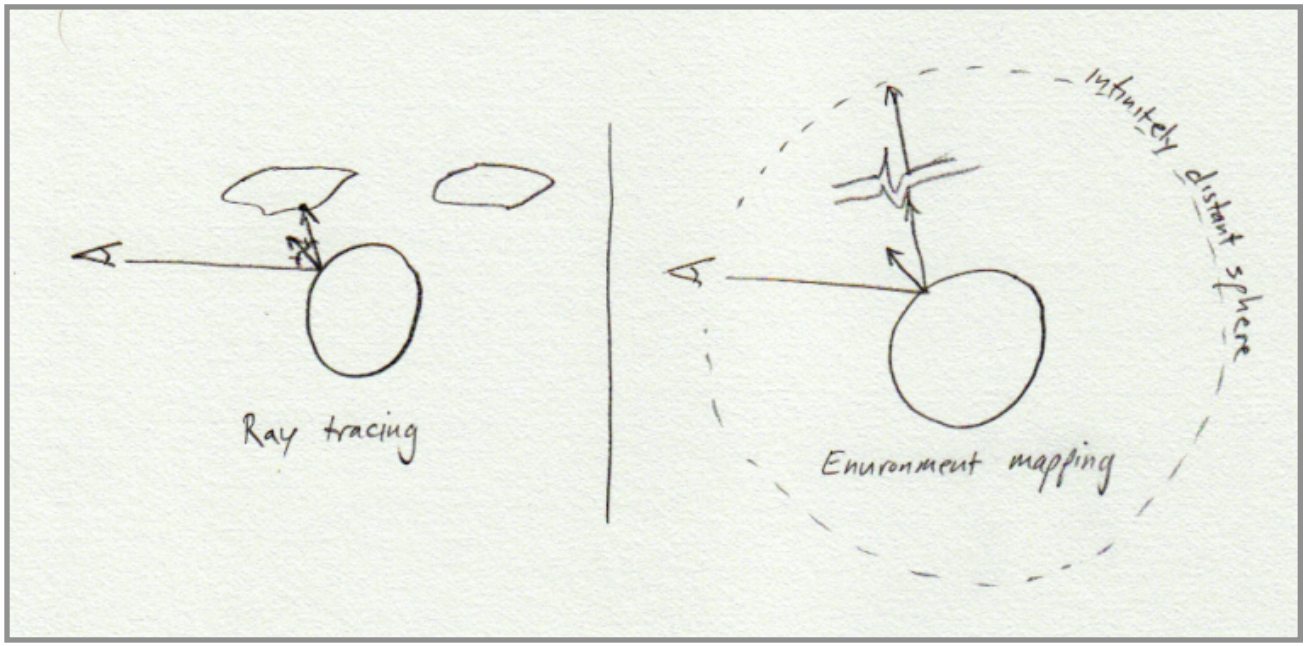
Reflection mapping

- From ray tracing we know what we'd like to compute
  - trace a recursive ray into the scene—too expensive
- If scene is infinitely far away, depends only on direction
  - a two-dimensional function



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Environment map

- A function from the sphere to colors, stored as a texture.

[Blinn & Newell 1976]

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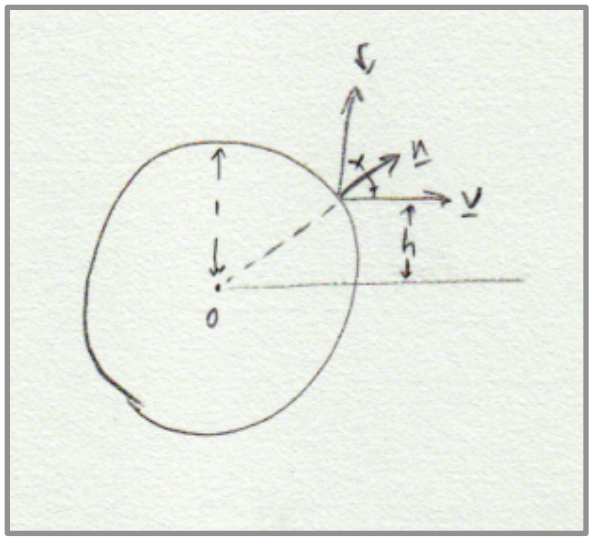
Spherical environment map



Hand with Reflecting Sphere. M. C. Escher, 1935. lithograph

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Environment Maps

[Paul Debevec]

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[CS467 slides]

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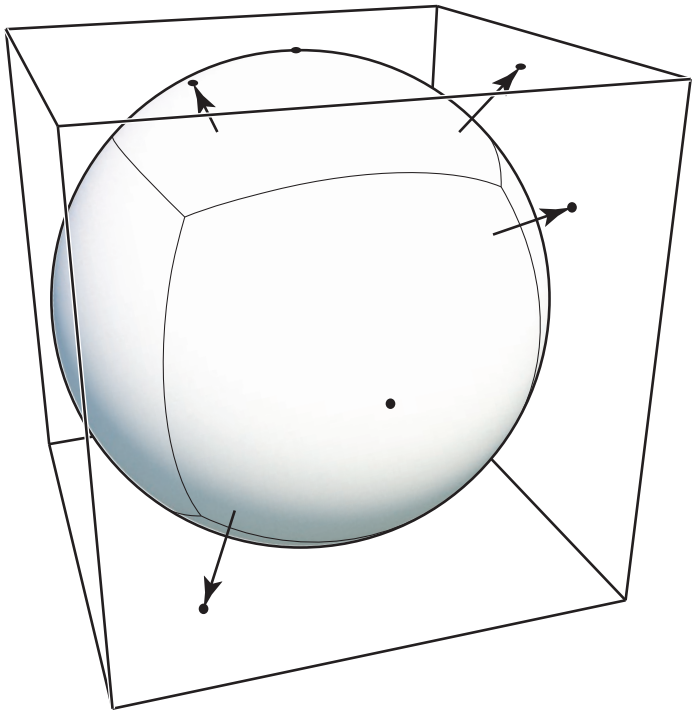
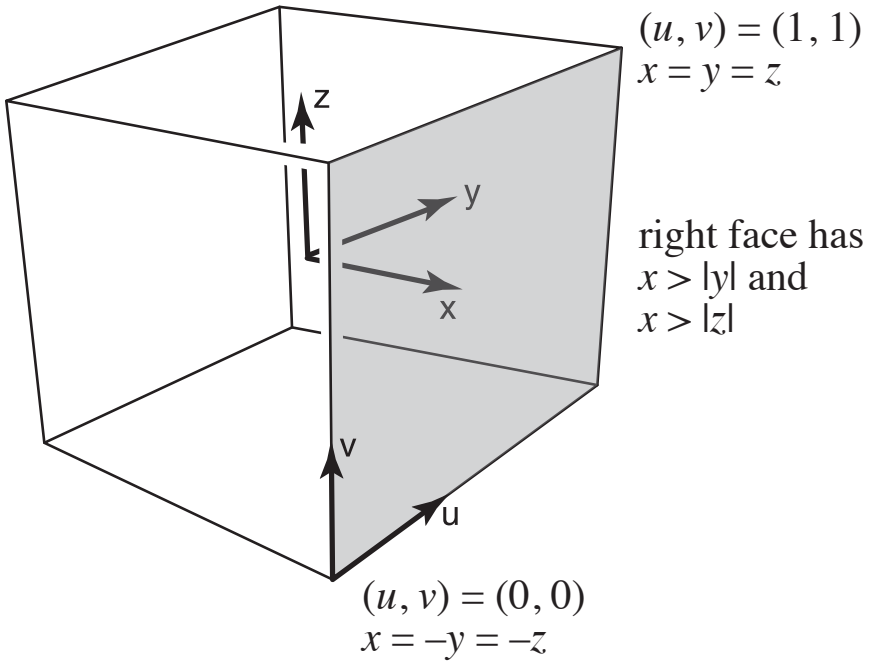
Cube map





a direction vector maps to the point on the cube that is along that direction.
The cube is textured with 6 square texture maps.

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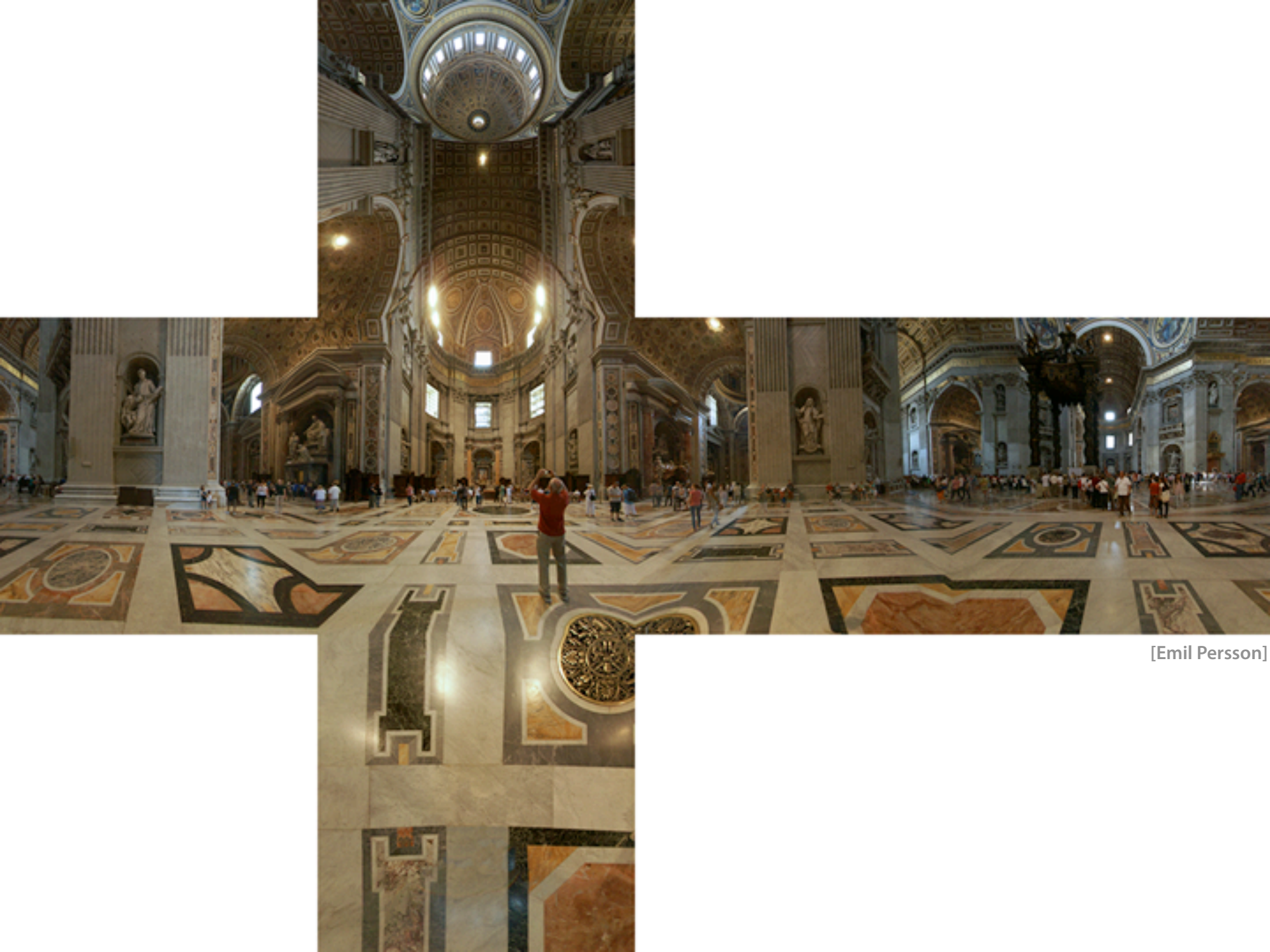
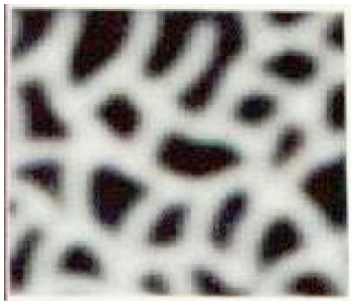
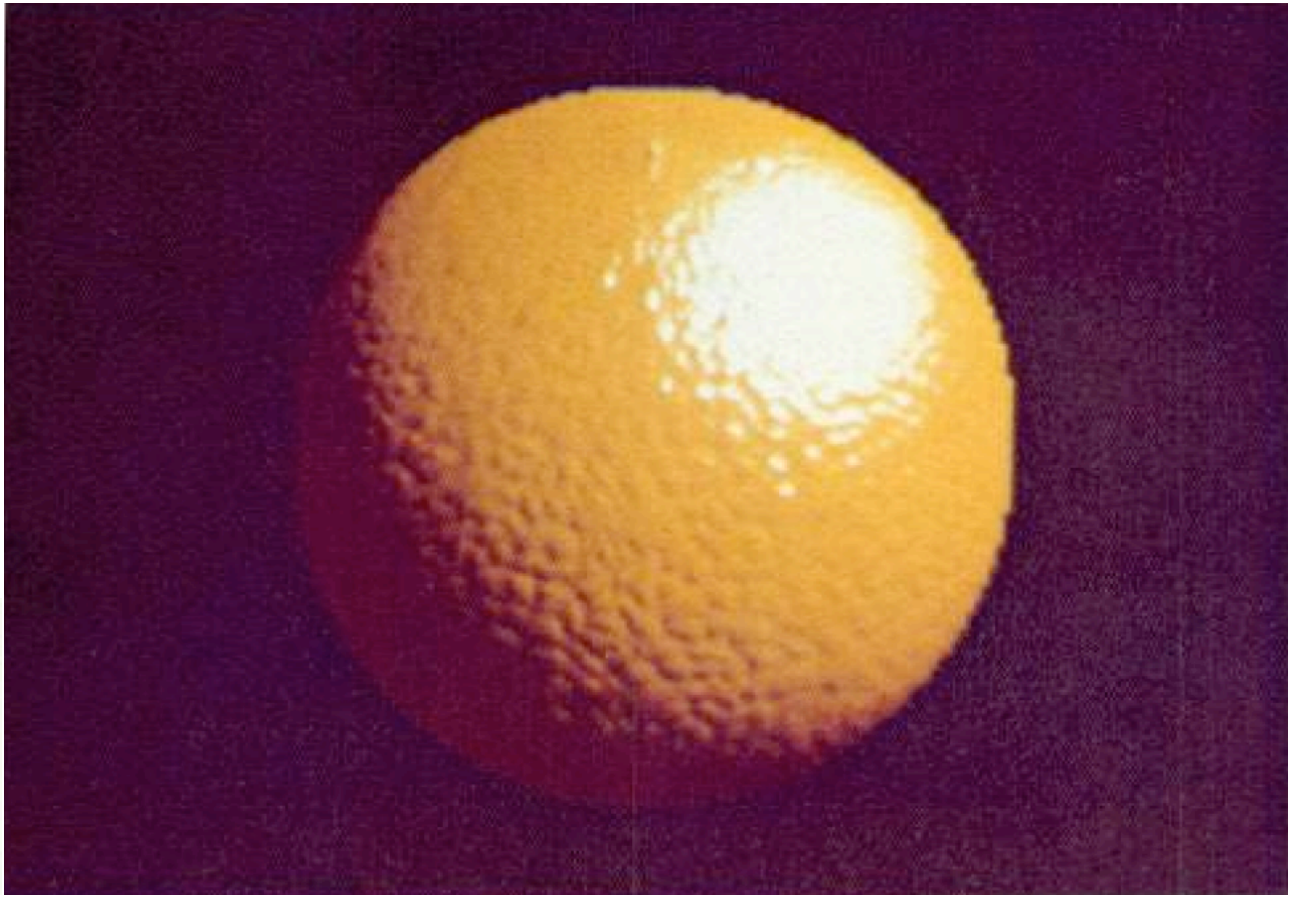


[Emil Persson]

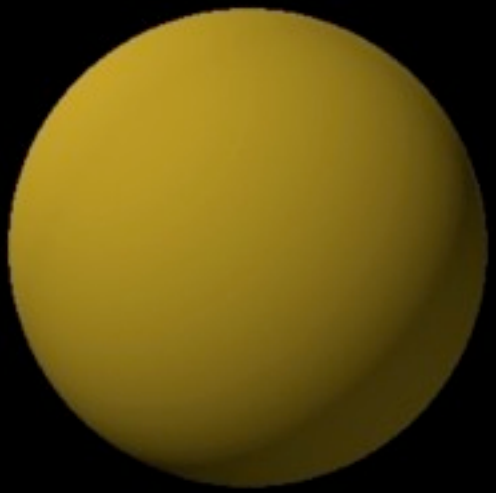
Bump mapping





[Blinn 1978]

Displacement mapping



Geometry

Displacement mapping

[CS467 slides]

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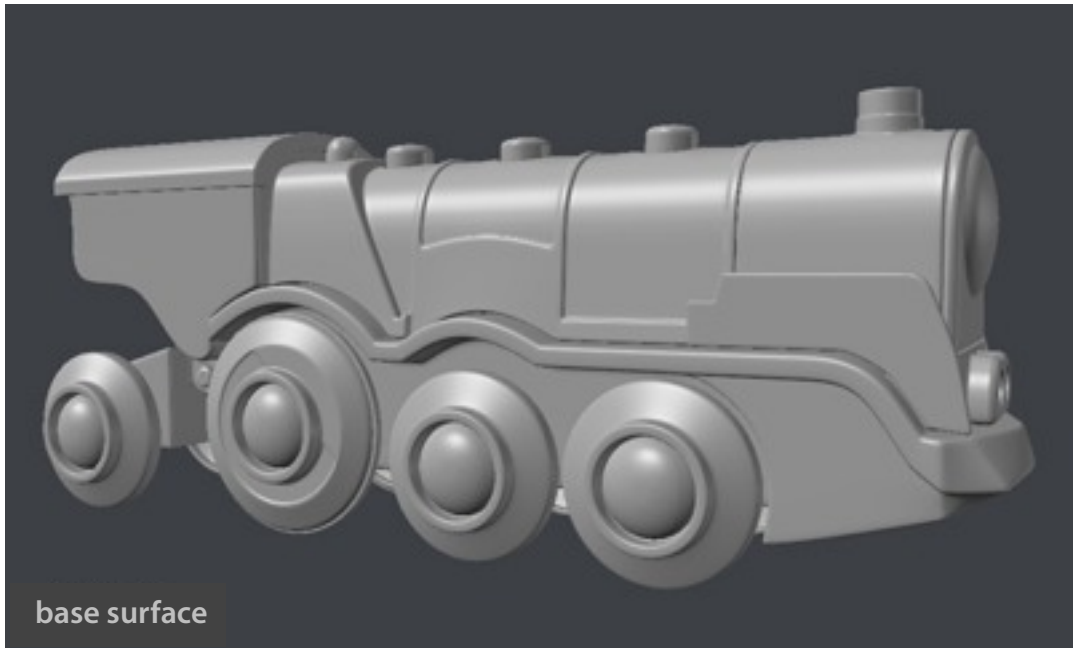
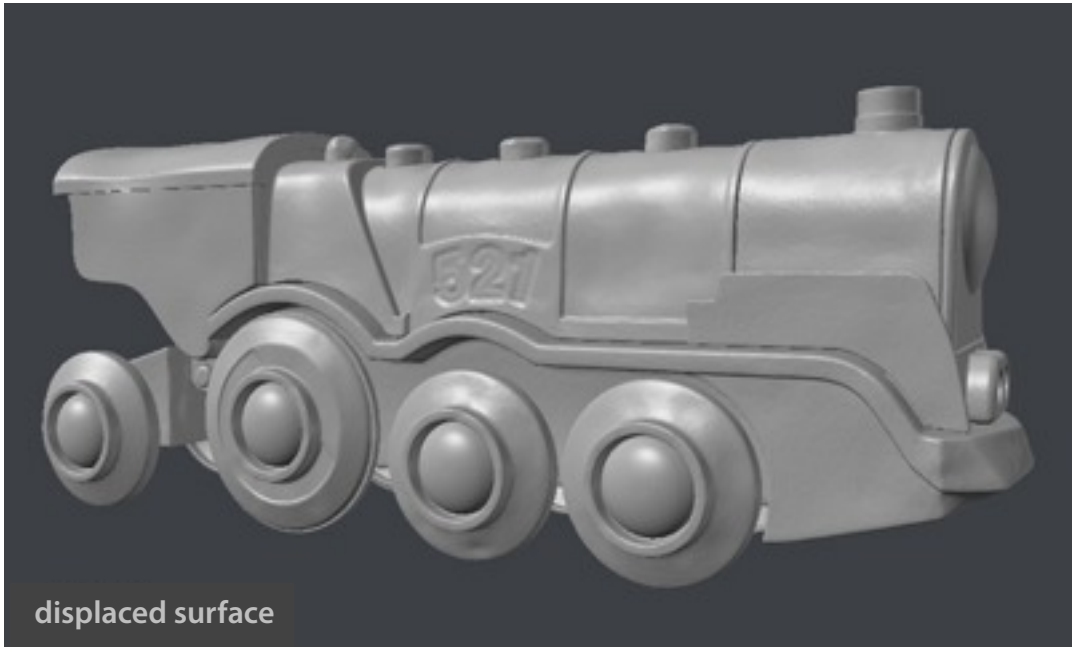


base surface

hand-painted displacement map (detail)

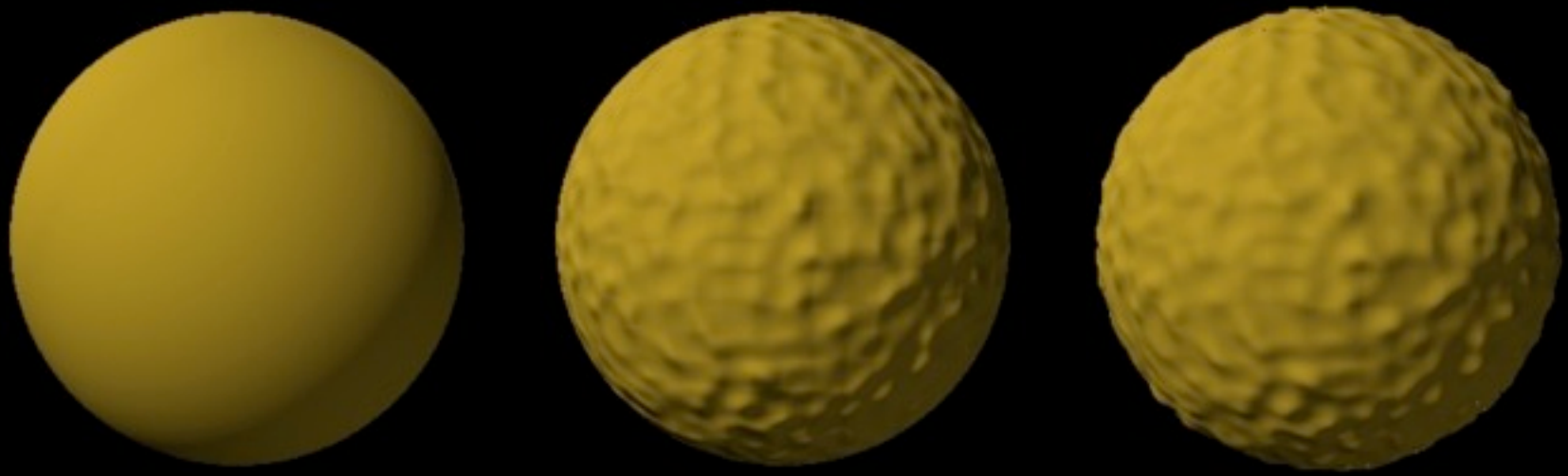


displaced surface

Paweł Filip
tolas.wordpress.com

521
fryrender
physically-based render engine
©2007 Paweł Filip

Displacement vs. bump mapping



Geometry

Bump mapping

Displacement mapping

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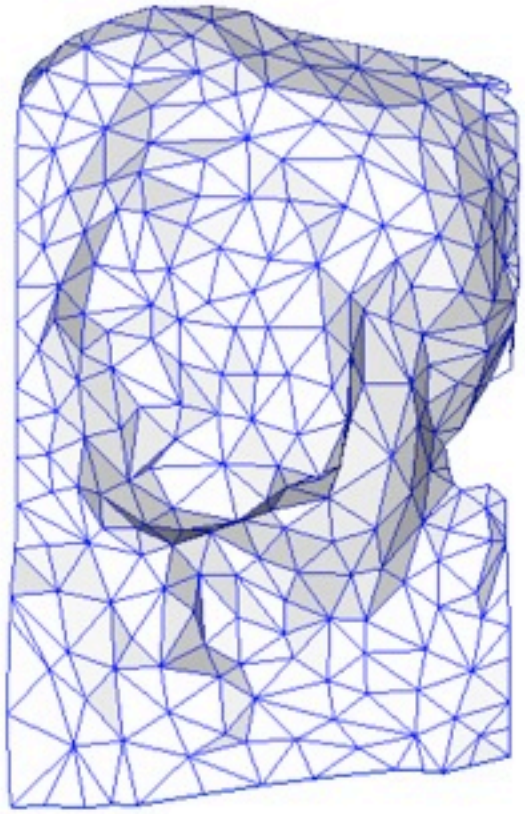
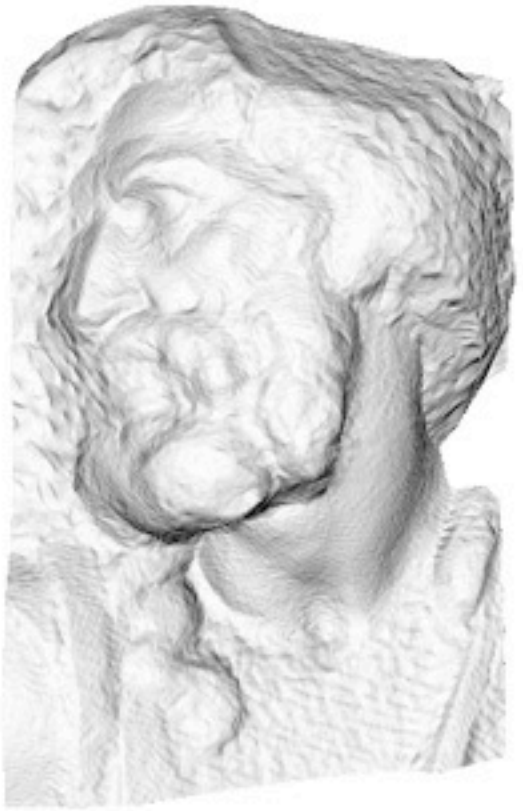
Normal mapping

original mesh
4M triangles



simplified mesh
500 triangles

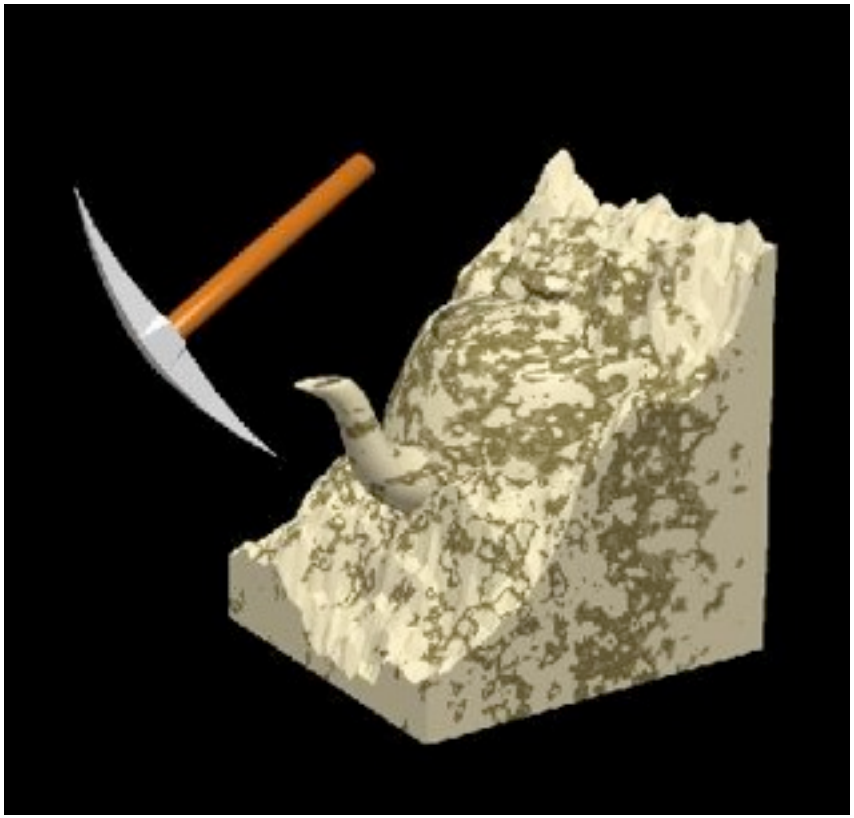


simplified mesh
and normal mapping
500 triangles

[Paolo Cignoni]

3D textures

- Texture is a function of (*u*, *v*, *w*)
  - can just evaluate texture at 3D surface point
  - good for solid materials
  - often defined procedurally



[Wolfe / SG97 Slide set]

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