CSE 167:
Introduction to Computer Graphics
Lecture #18: Bump Mapping

Jürgen P. Schulze, Ph.D.
University of California, San Diego
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Announcements

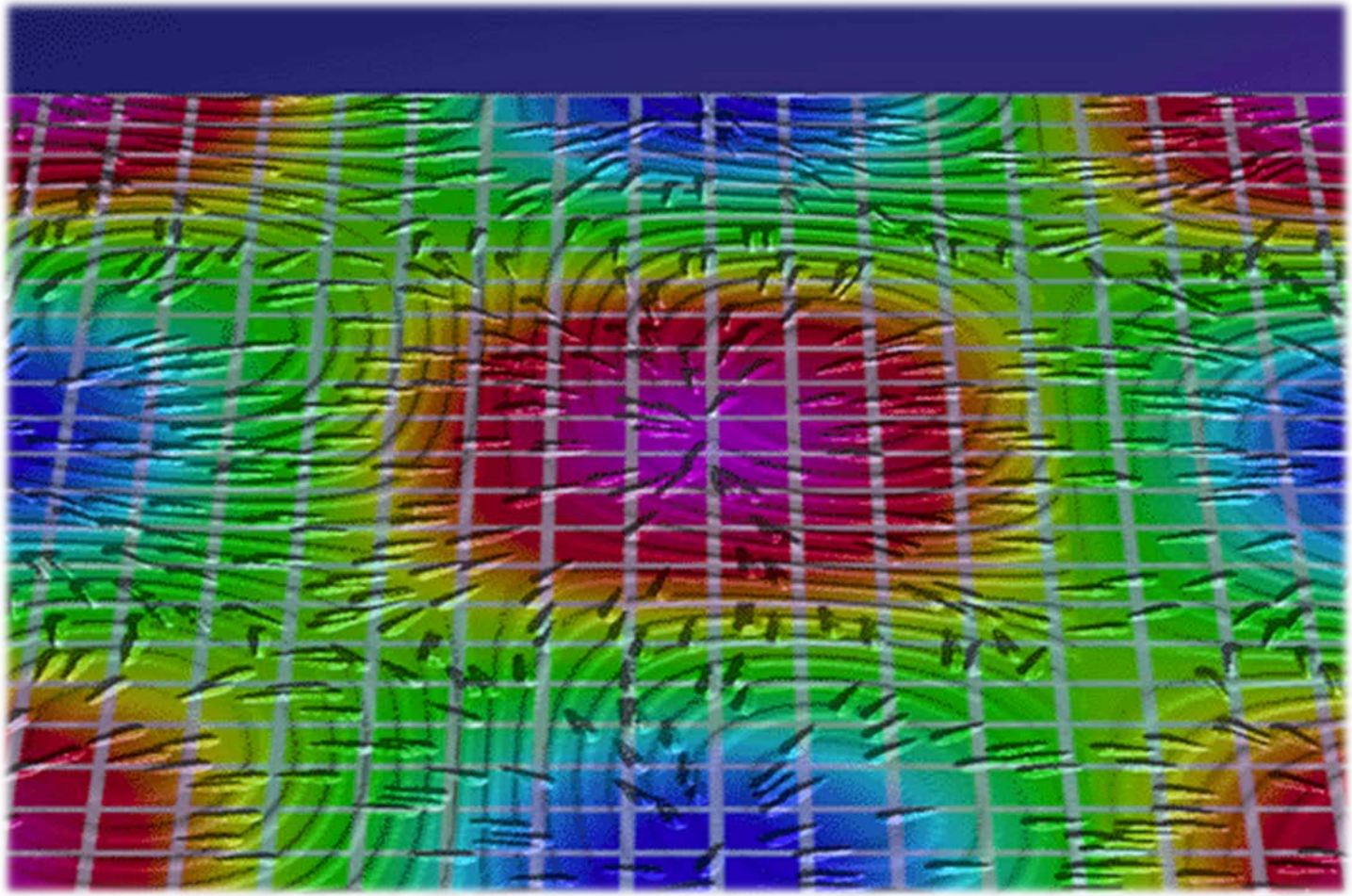
Bump Mapping

Bump Mapping

- Many textures are the result of small perturbations in the surface geometry
- Modeling these changes would result in an explosion in the number of geometric primitives.
- Bump mapping attempts to alter the lighting across a polygon to provide the illusion of texture.

[This chapter includes slides by Roger Crawfis]

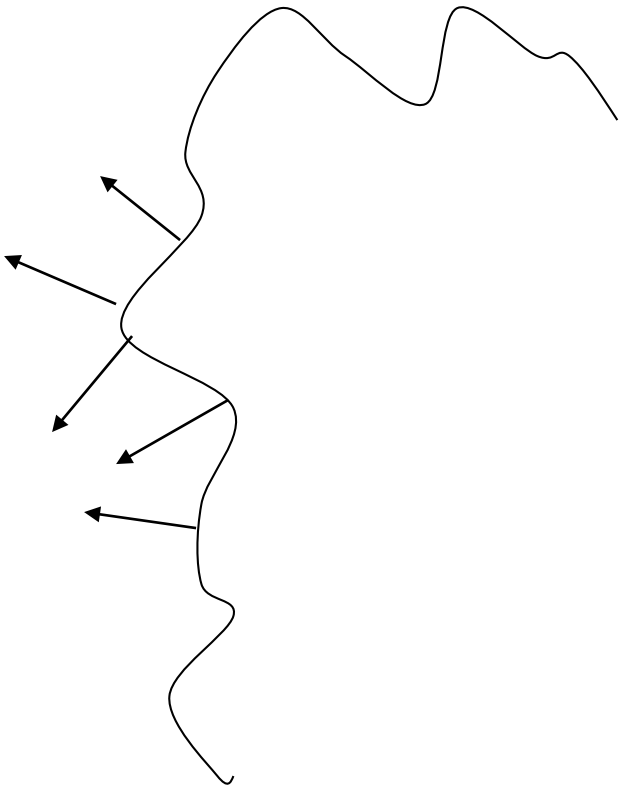
Bump Mapping Example



Crawfis 1991

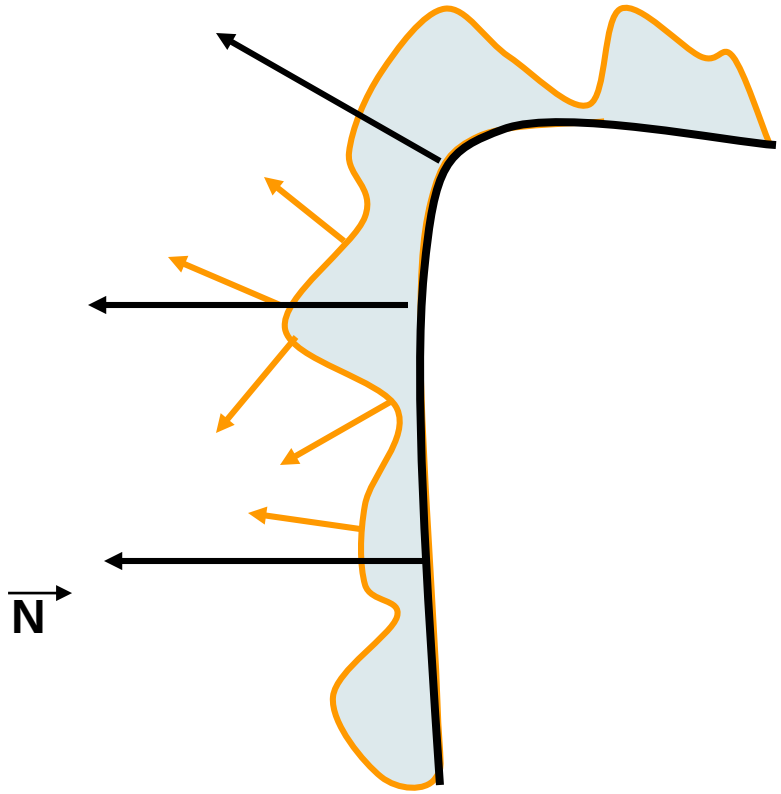
Bump Mapping

- Consider the lighting for a modeled surface.



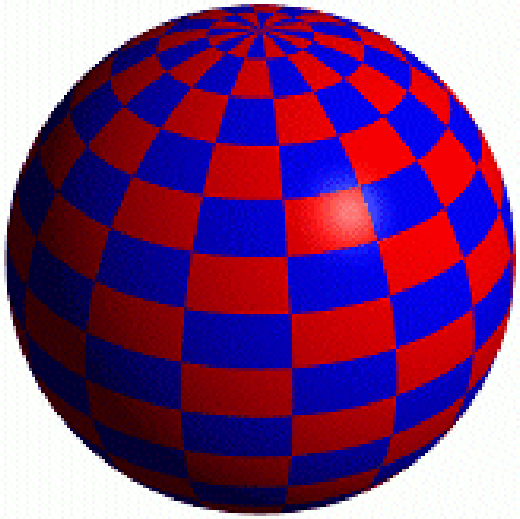
Bump Mapping

- We can model this as deviations from some base surface.
- The question is then how these deviations change the lighting.

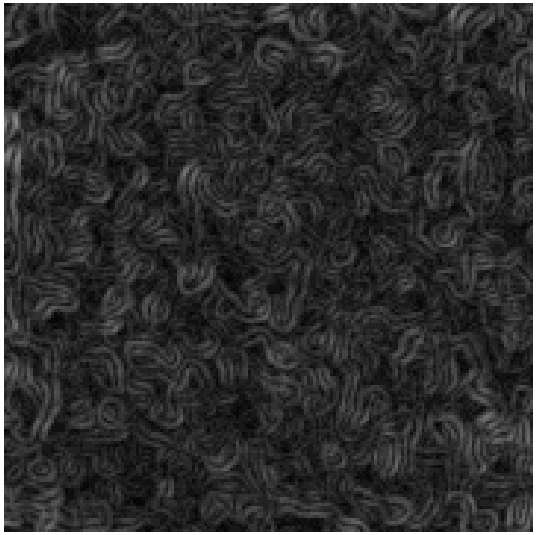


Bump Mapping

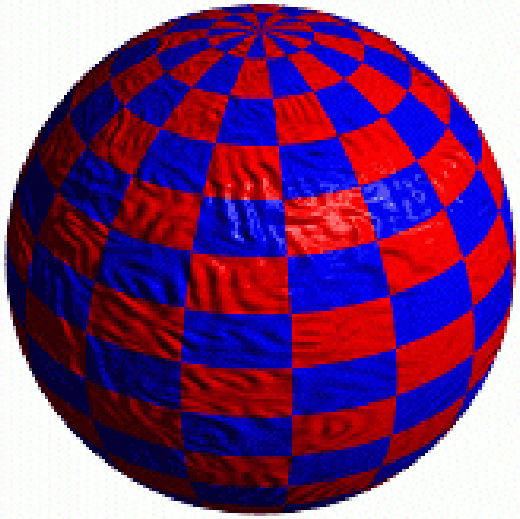
- Store in a texture and use textures to alter the surface normal
  - Does not change the shape of the surface
  - Just shaded as if it were a different shape



Sphere w/Diffuse Texture

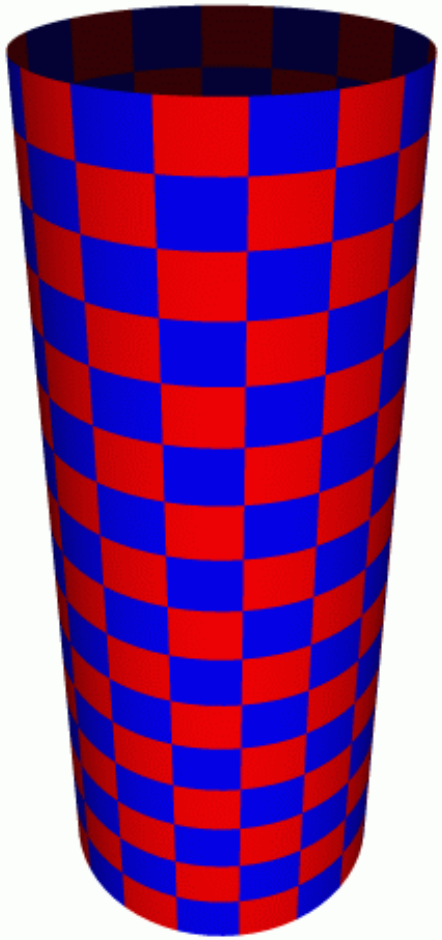


Swirly Bump Map

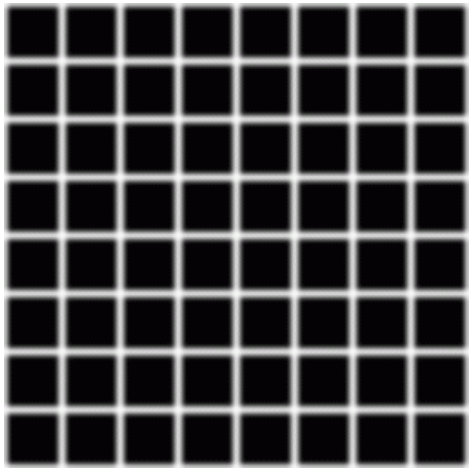


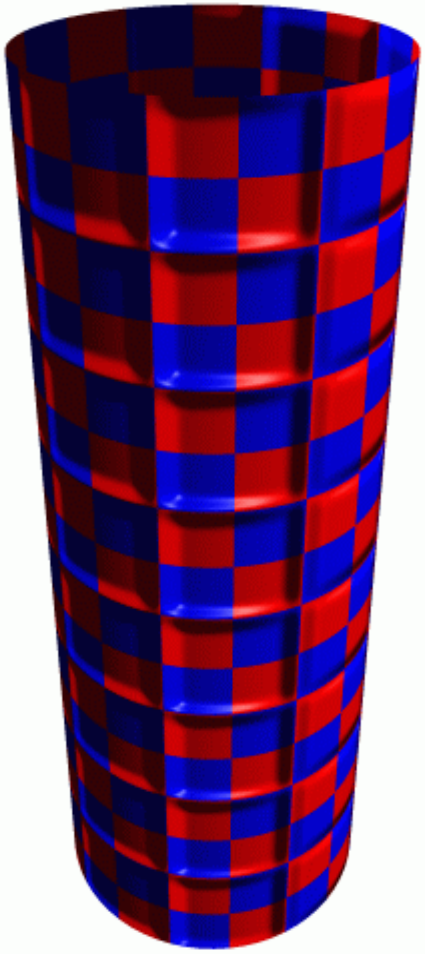
Sphere w/Diffuse Texture & Bump Map

Simple textures work great



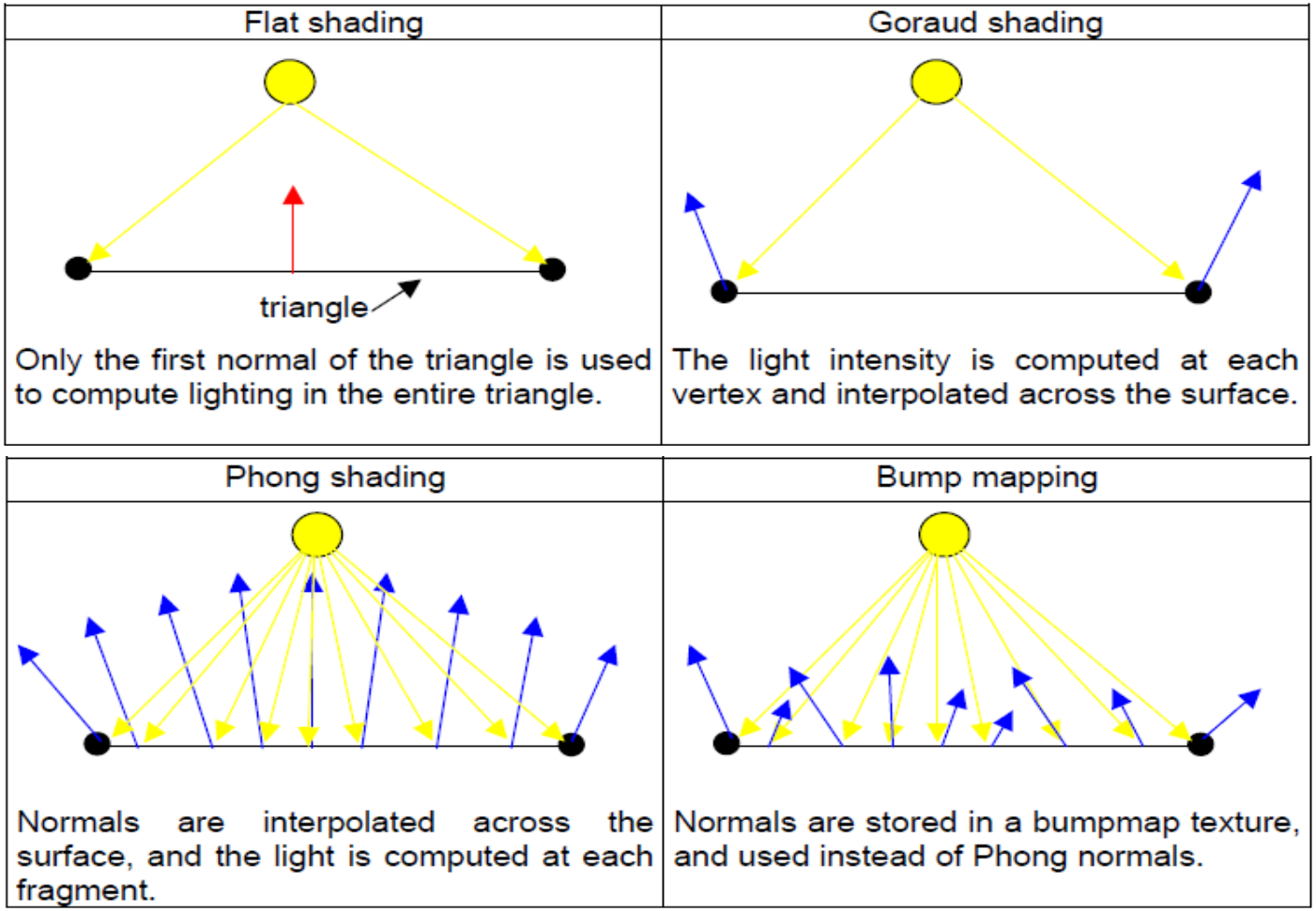
Cylinder w/Diffuse Texture Map





Cylinder w/Texture Map & Bump Map

Normal Mapping



Normal Mapping

Just texture mapped

Texture and normal maps

Notice: The geometry is unchanged. There's the same number of vertices and triangles. This effect is entirely from the normal map.

Normal Maps

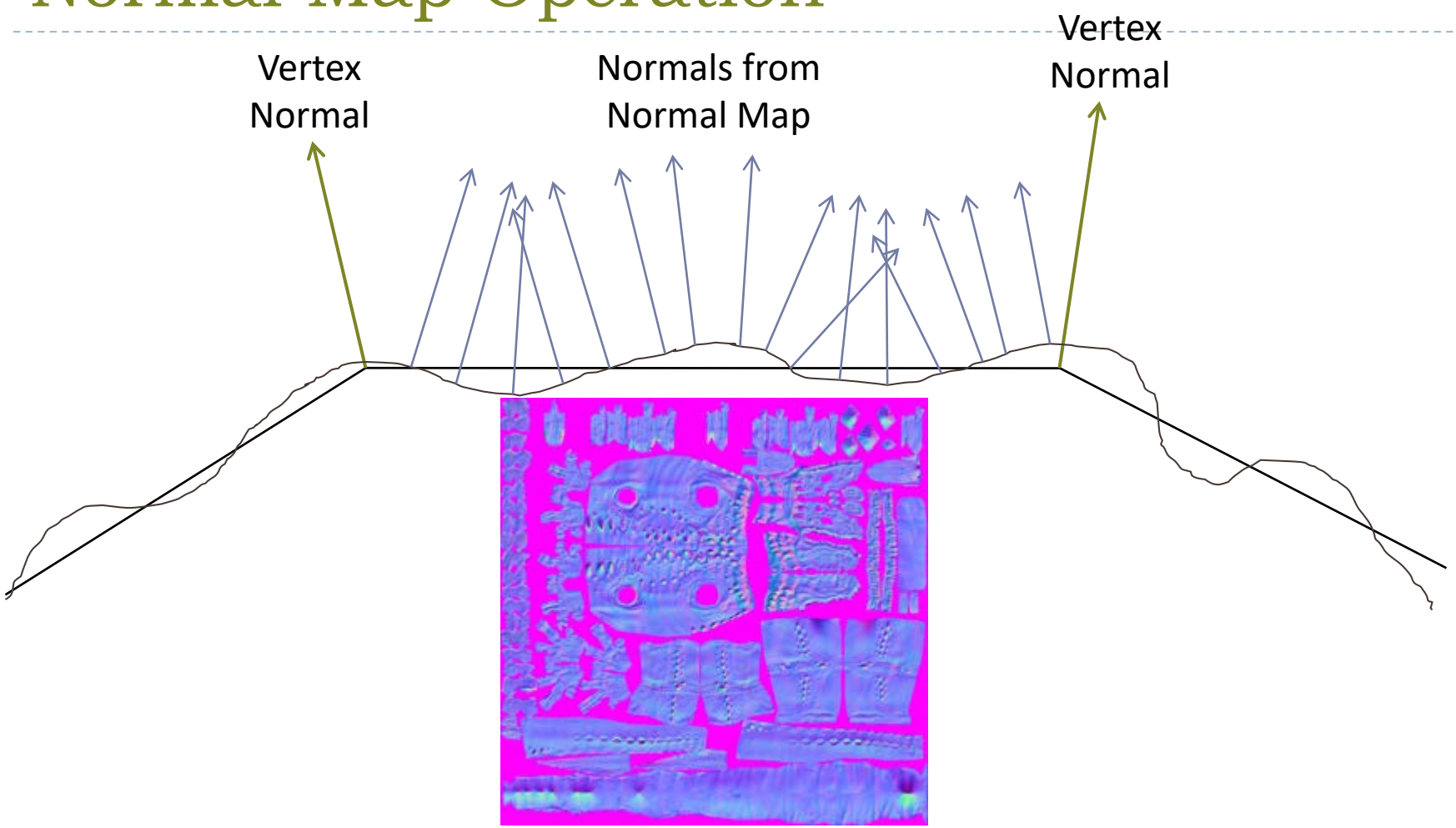
Diffuse Color Texture Map

<u>Normal Map</u>

Each pixel represents a normal vector relative to the surface at that point. -1 to 1 range is mapped to 0 to 1 for the texture so normals become colors.

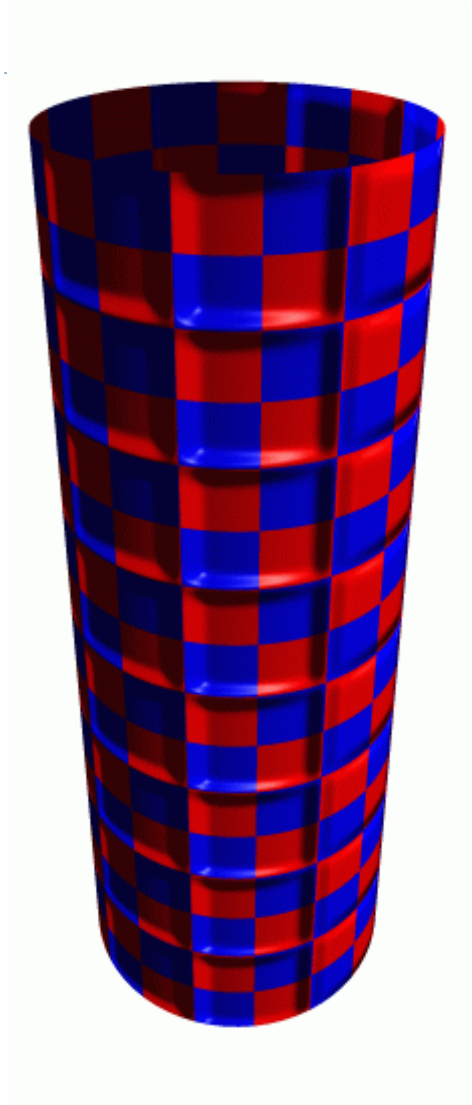
→ Inverse of Normal Coloring

Normal Map Operation



For each pixel, determine the normal from a texture image. Use that to compute the color.

What's Missing?

- There are no bumps on the silhouette of a bump or normal-mapped object

→ Displacement Mapping