Computer Graphics (CS 4731)
Texture Mapping

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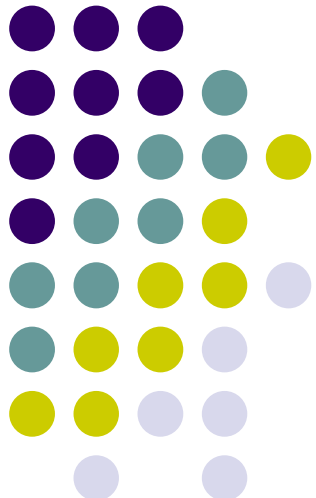
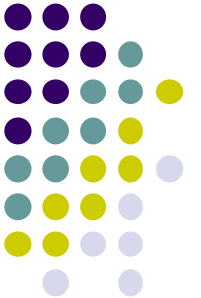
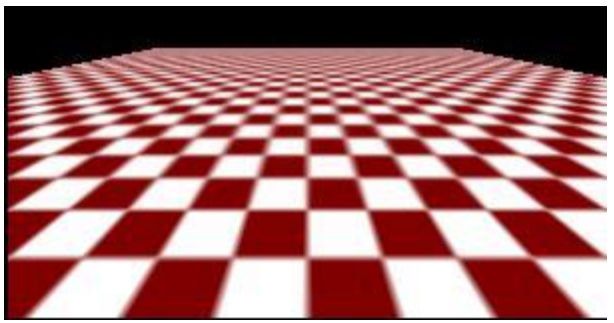


Some Slides Courtesy of Emmanuel Agu (WPI) and Matt Stoker (Utah)

The Limits of Geometric Modeling



- Although graphics cards can render over 10 million polygons per second
- Many phenomena even more detailed
  - Clouds
  - Grass
  - Terrain
  - Skin
- **Images:** Computationally inexpensive way to add details



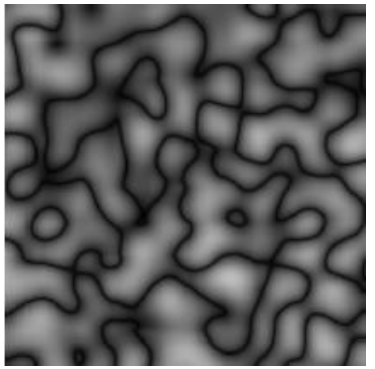
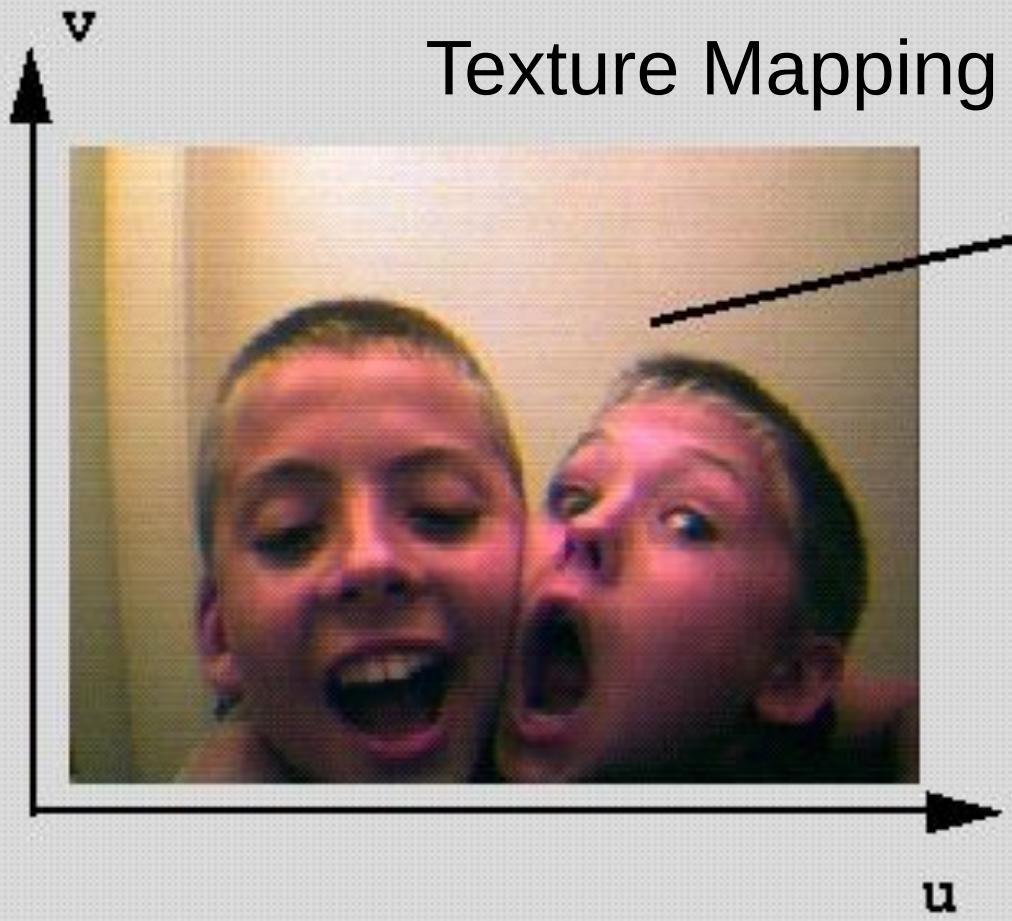
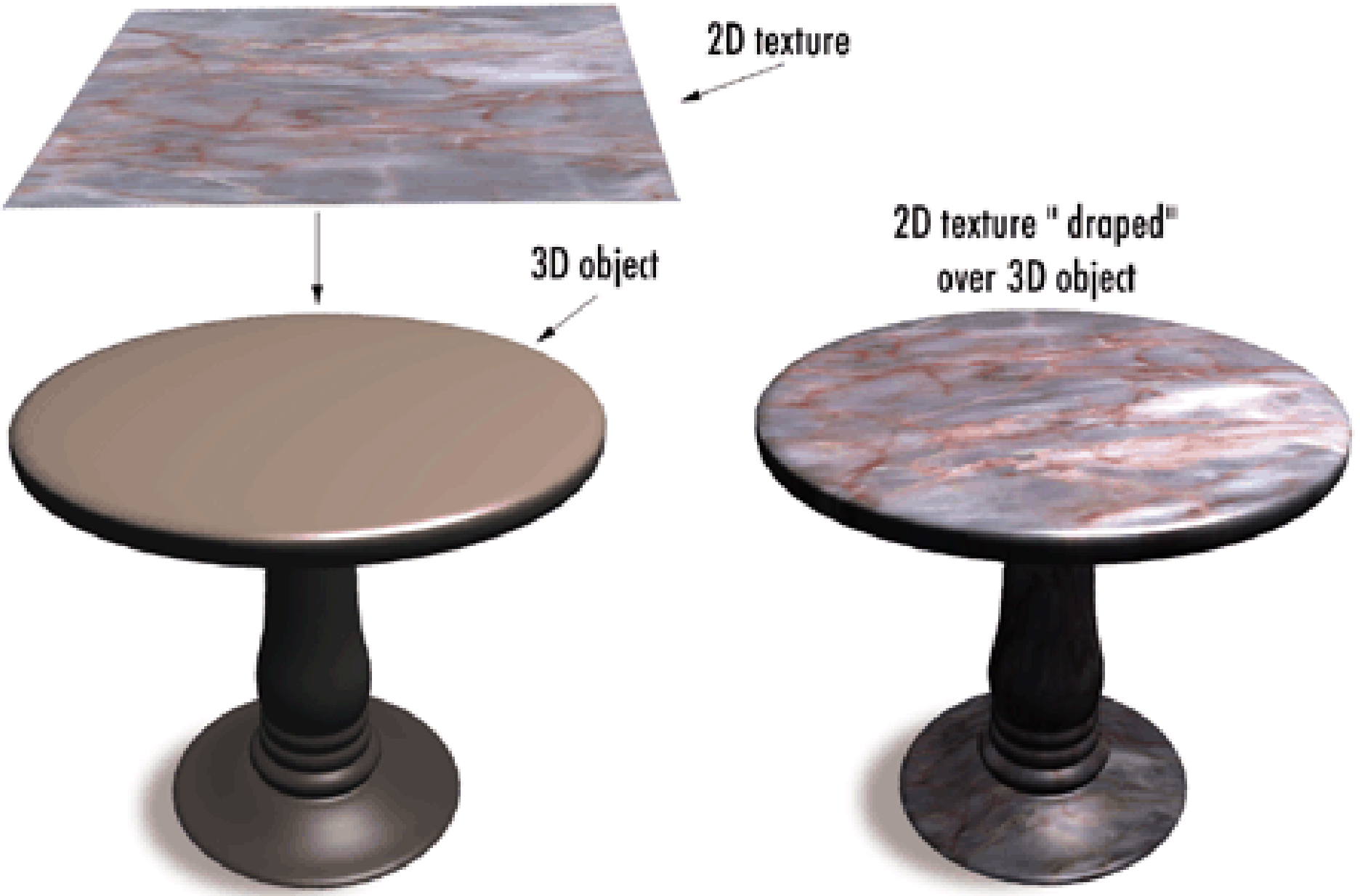


Image complexity does not affect the complexity of geometry processing (transformation, clipping…)

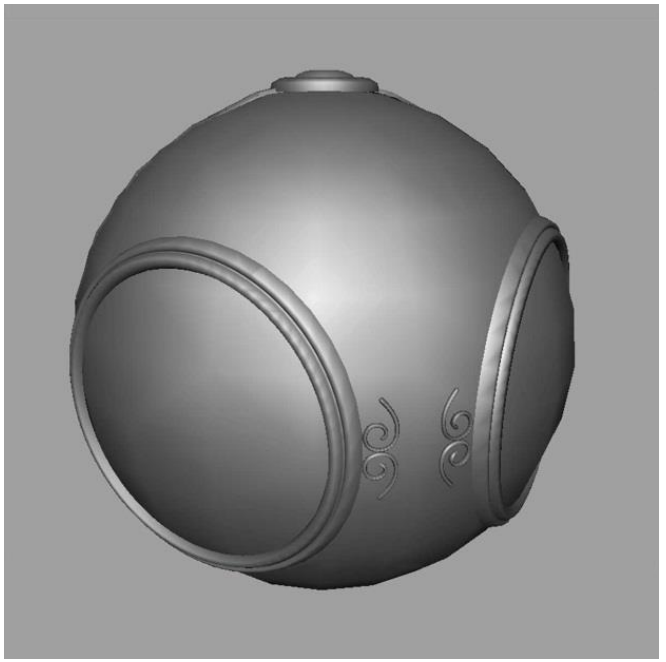
Textures in Games

Texture Mapping





Types of Texturing

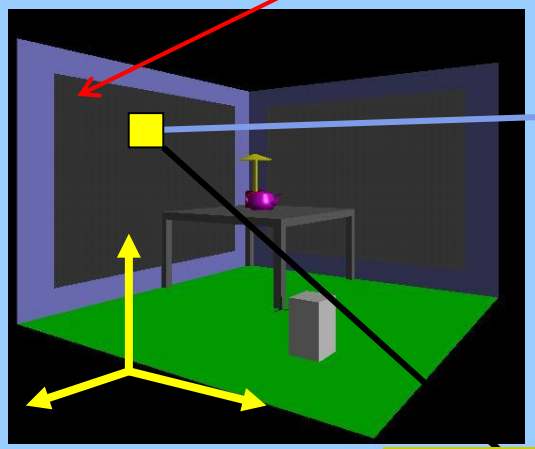


1. geometric model

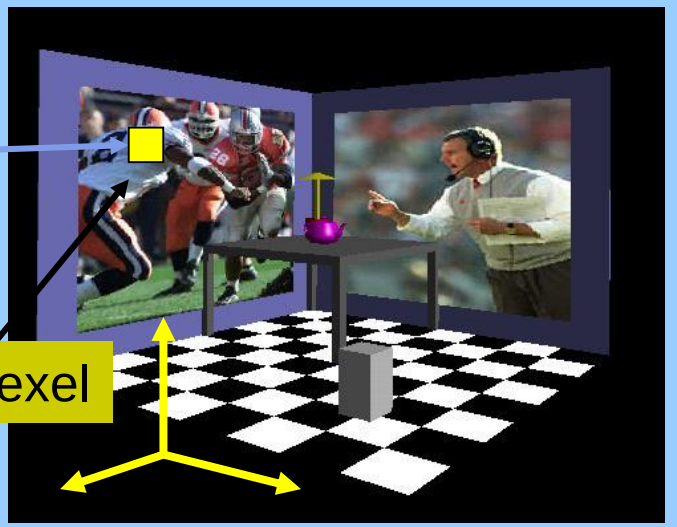
2. texture mapped
Paste image (marble)
onto polygon

Texture Mapping

1. Define texture position on geometry



2. projection



4. patch texel

3. texture lookup

3D geometry

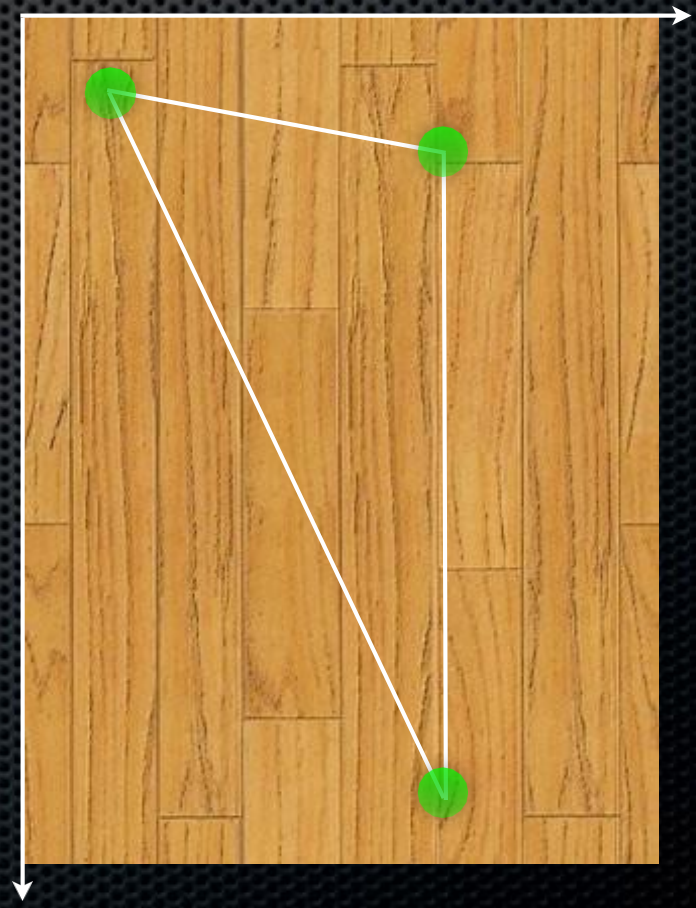
2D projection of 3D geometry

t

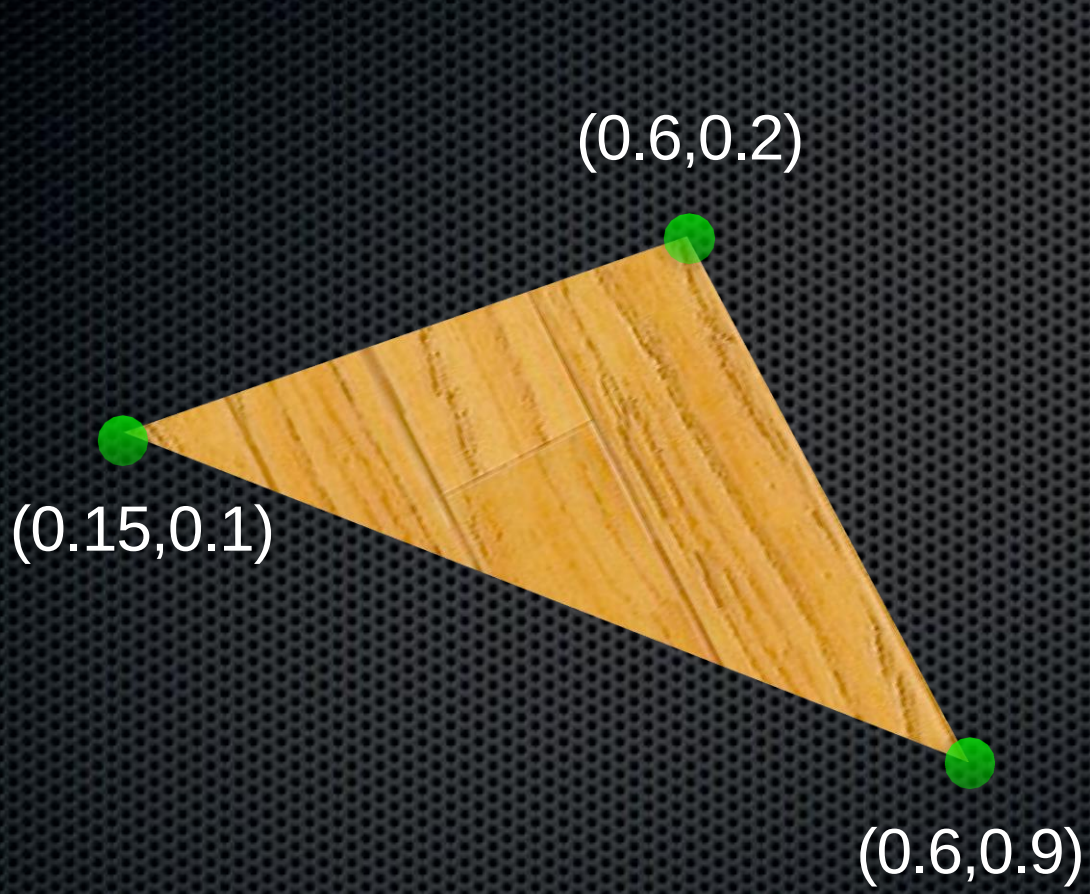
2D image

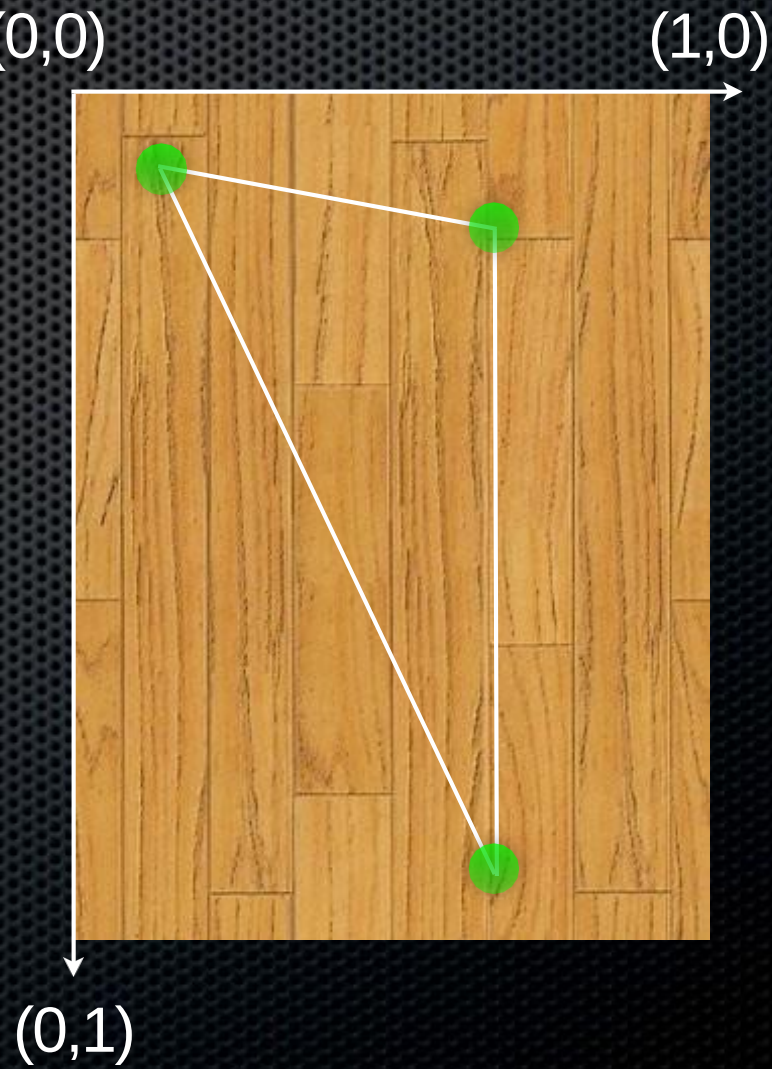
s

Texturing



Texture Coordinates



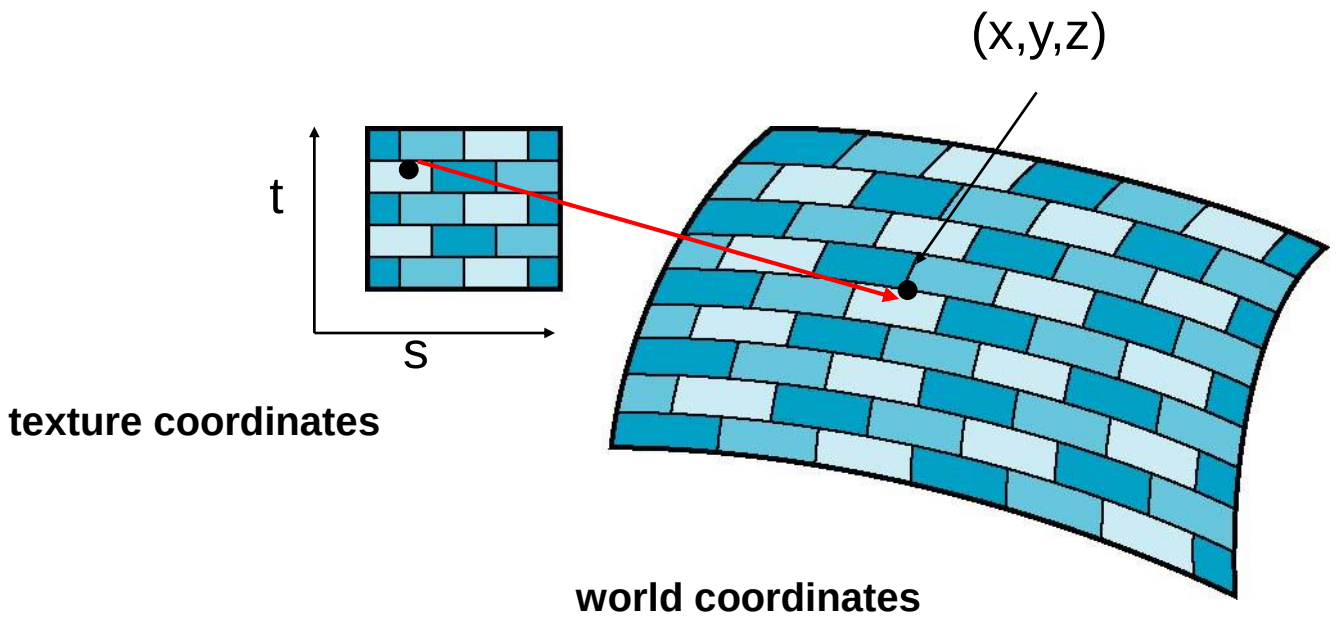


Texture Mapping

- Map? Each (x,y,z) point on object, has corresponding (s, t) point in texture

$$s = s(x,y,z)$$

$$t = t(x,y,z)$$



Color Interpolation

$\lambda_1 + \lambda_2 + \lambda_3 = 1$

and

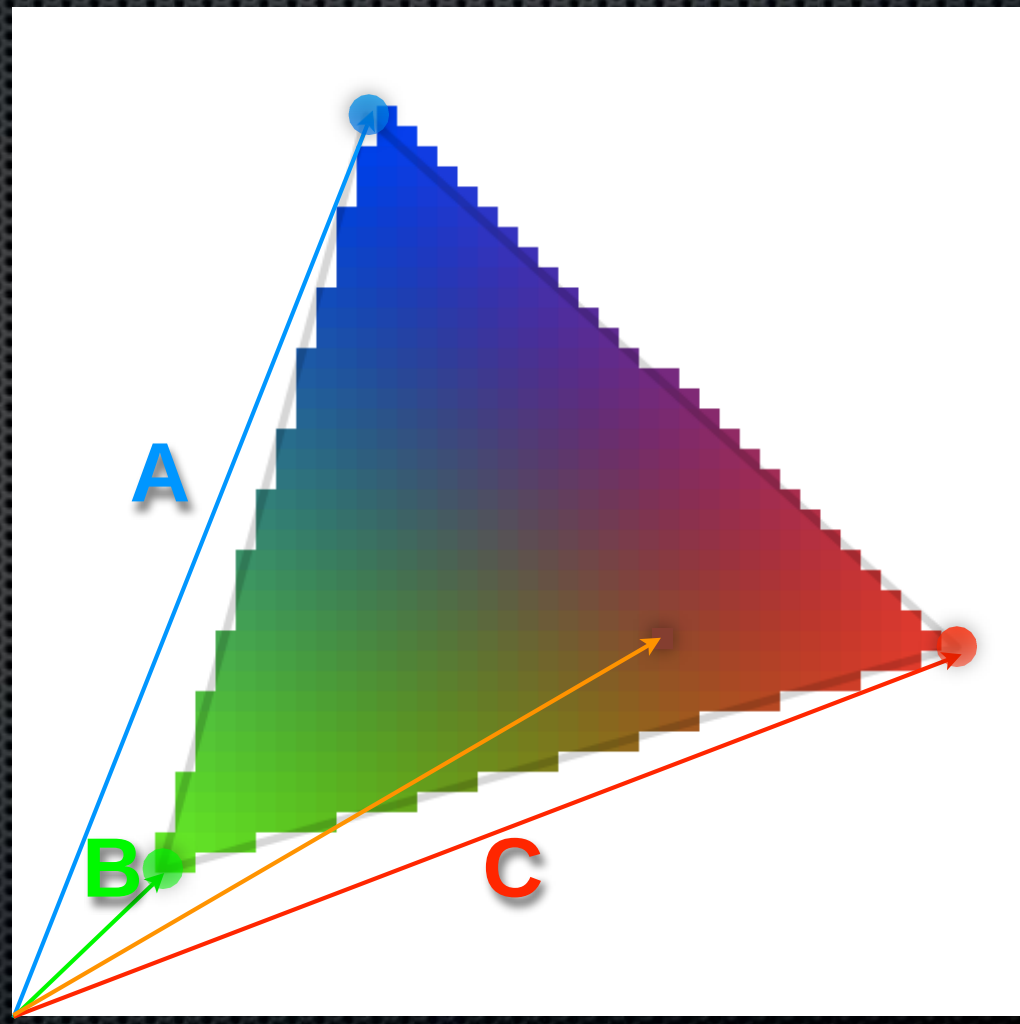
$0 \leq \lambda_x \leq 1$


• λ_1 +


• λ_2 +


• λ_3 +

=



Texture Coord Interpolation

$\lambda_1 + \lambda_2 + \lambda_3 = 1$

and

$0 \leq \lambda_x \leq 1$

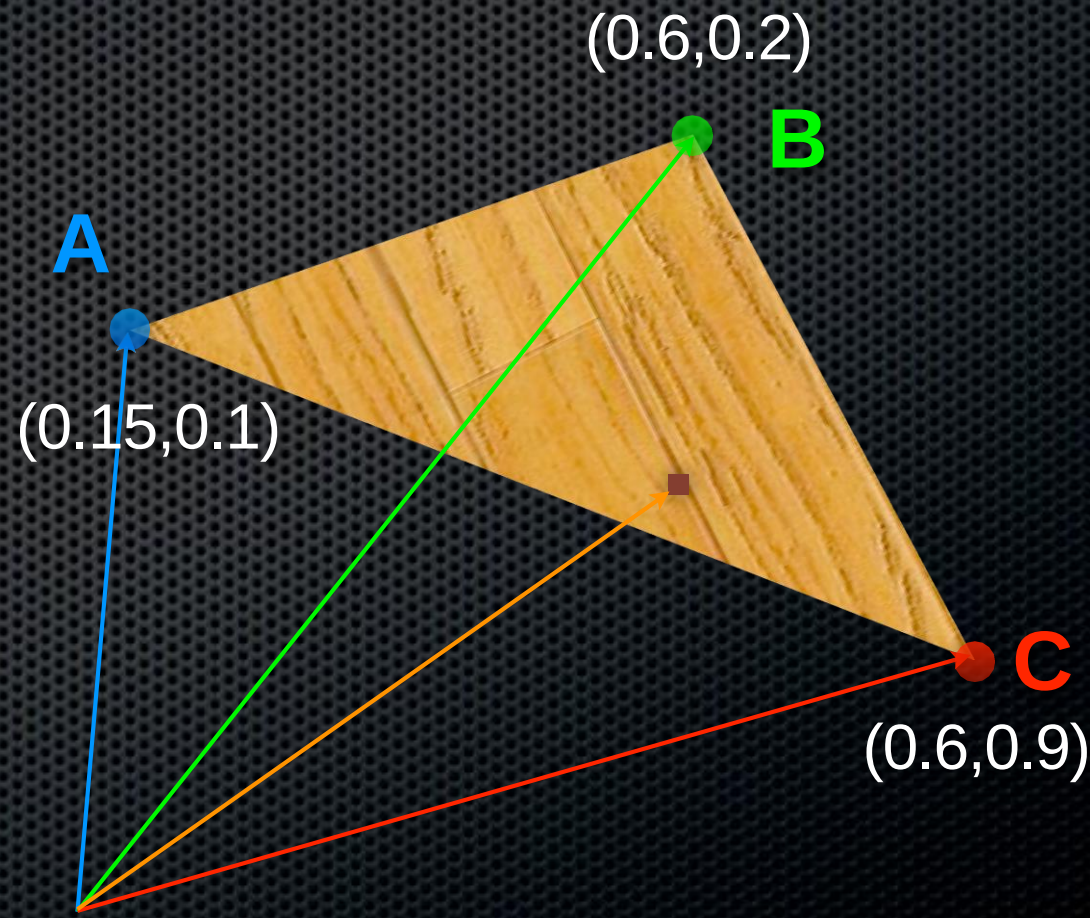
(0.15,0.1) • λ_1 +

(0.6,0.2) • λ_2 +

(0.6,0.9) • λ_3 +

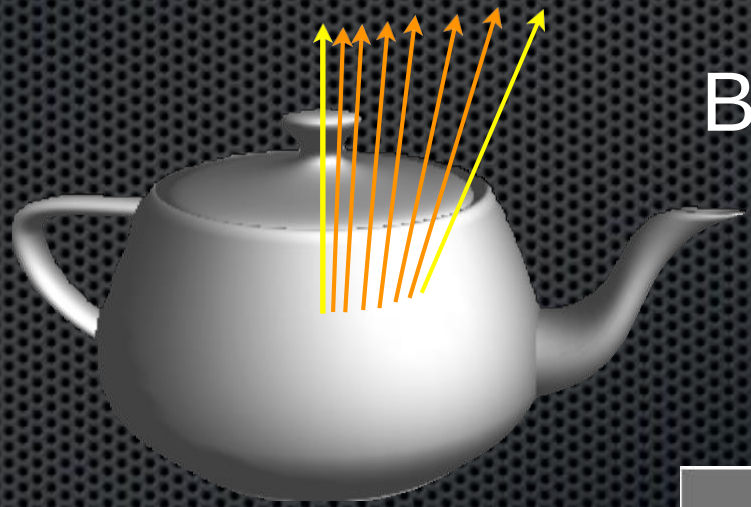
=

(0.5,0.6)



Phong Interpolation

Where to apply the lighting model?

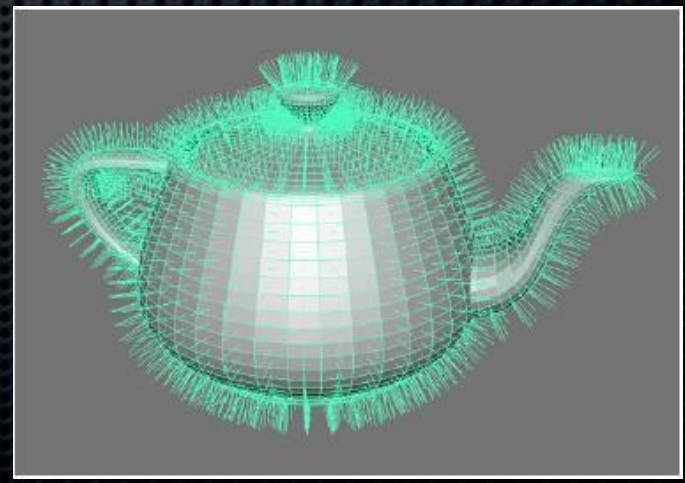


Bui Tuong Phong

Normals supplied per vertex

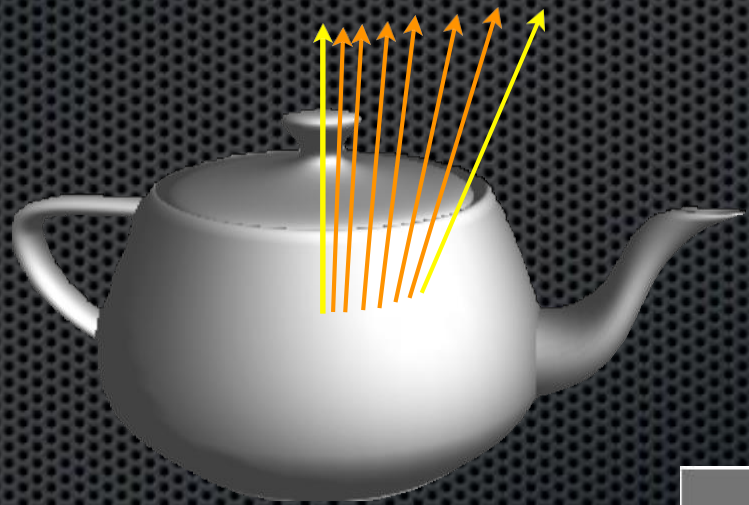
Normals interpolated across face

Color & lighting calculated per pixel



Bump Mapping

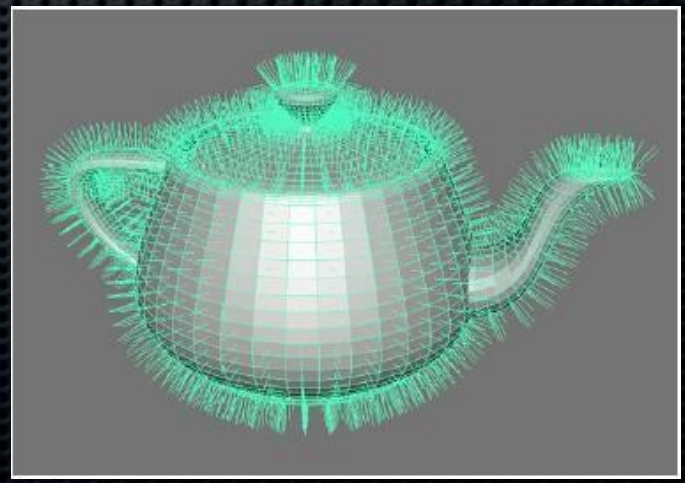
Where to apply the lighting model?



Normals supplied per pixel

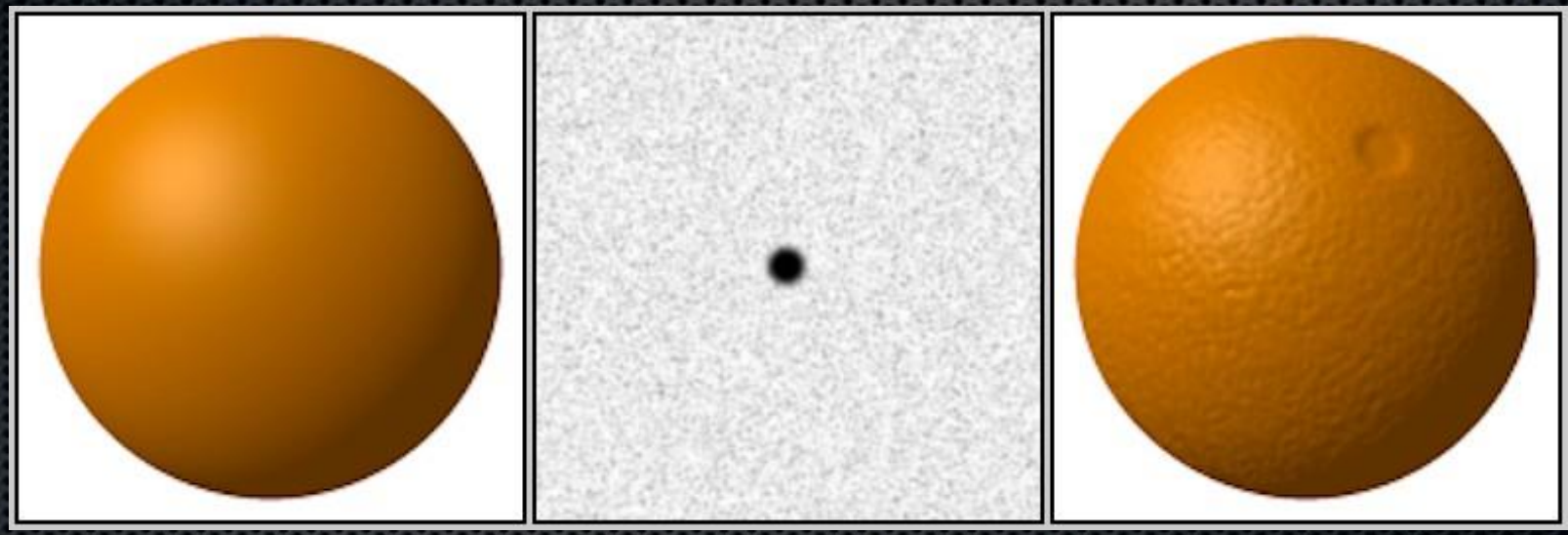
Normals obtained from bump map

Color & lighting calculated per pixel



Bump Mapping

Where to apply the lighting model?

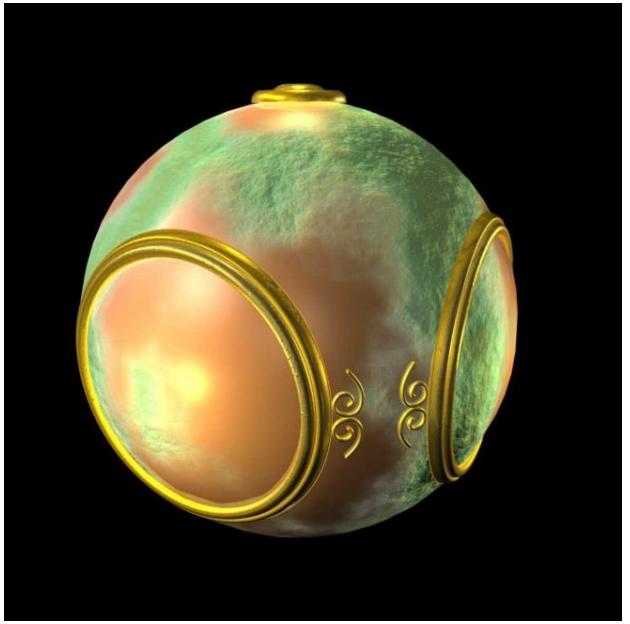


Normals supplied per pixel

Normals obtained from bump map

Color & lighting calculated per pixel

Types of Texturing



3. Bump mapping
Simulate surface roughness (dimples)

4. Environment mapping
Picture of sky/environment over object