

COMP3271 Computer Graphics

Texture Mapping

2019-20

Objectives

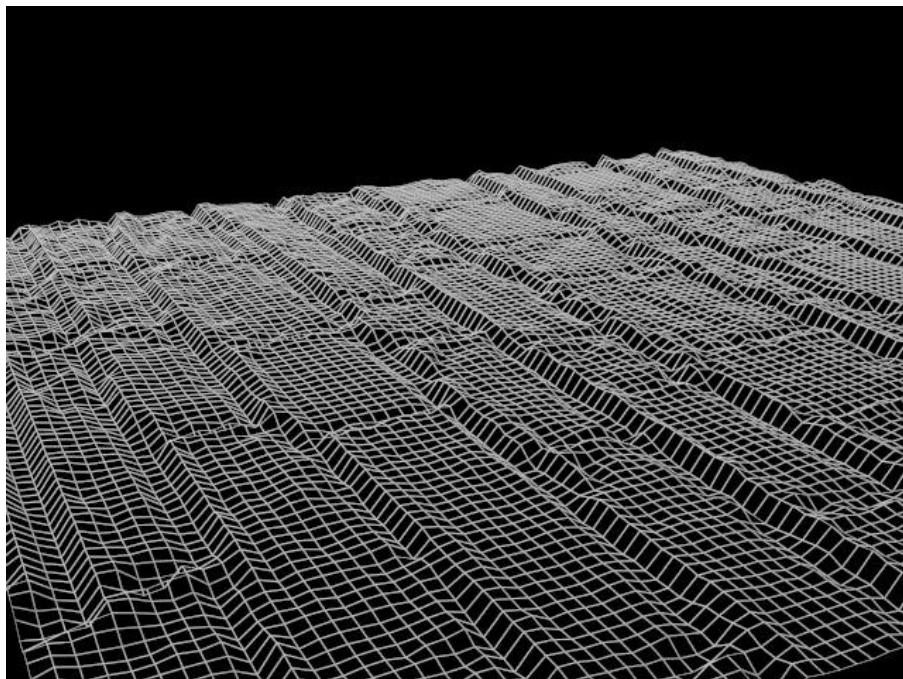
What texture mapping is for

Understand the basic texture mapping process

How Do We Model Intricate Surface Detail?

Approach #1: Explicit geometric representation

- actual polygons that model all the surface variations
- up to some finest level of detail
- may generate a *lot* of polygons

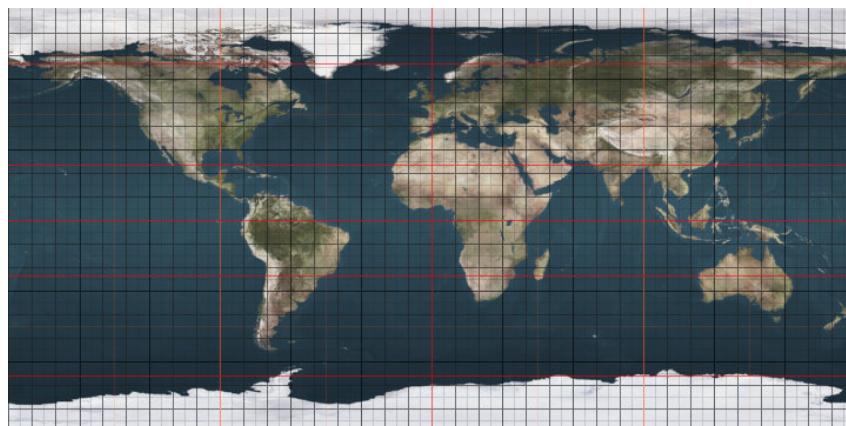


<https://ch.3dexport.com/3dmodel-3d-stone-wall-55616.htm>

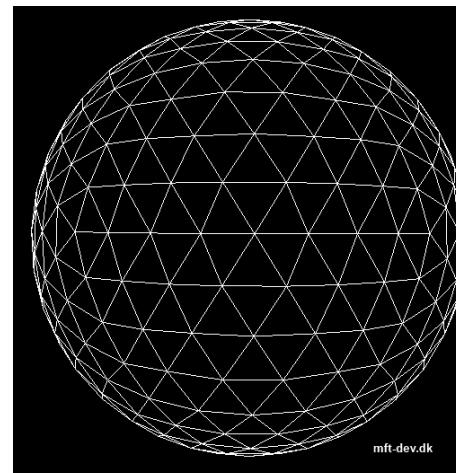
How Do We Model Intricate Surface Detail?

Approach #2: Geometry + texture images

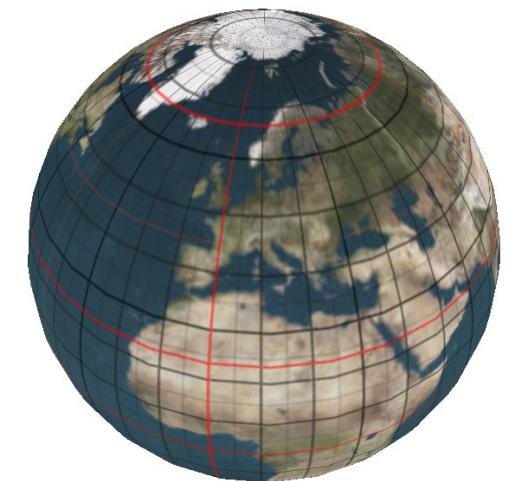
- geometry only describes the general shape of the object
- paste an image onto the surface to give the appearance with fine details



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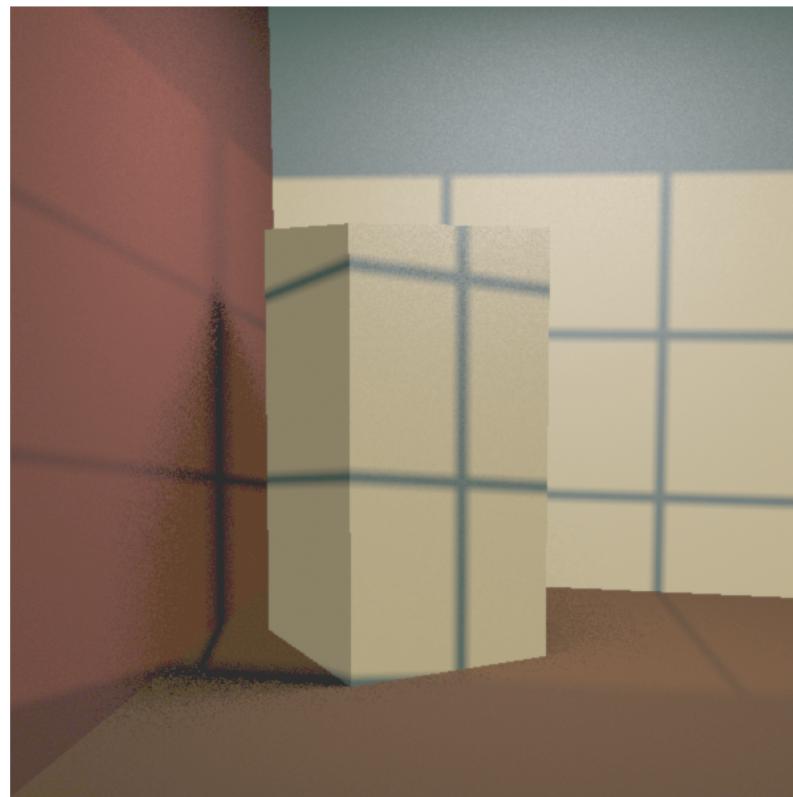
https://commons.wikimedia.org/wiki/File:OpenGL_Tutorial_Textured_Spheres.jpg

<https://mft-dev.dk/uv-mapping-sphere/>

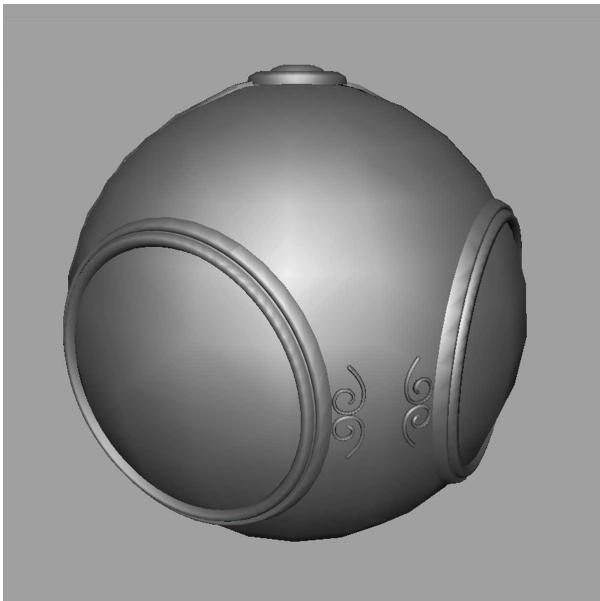
The Importance of Surface Texture

Objects in the real world have rich, detailed surface textures

- to produce as-realistic-as-possible scenes, we must replicate this detail
- uniformly colored surfaces only get us so far



Texture Mapping



geometric model



texture mapped

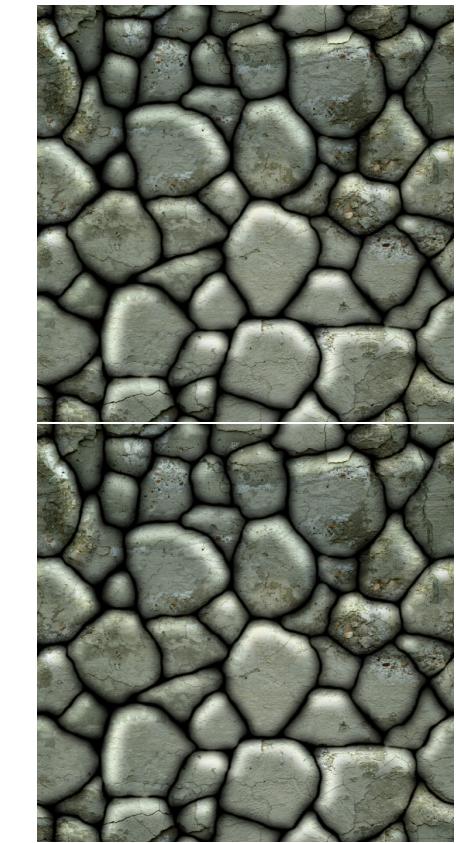
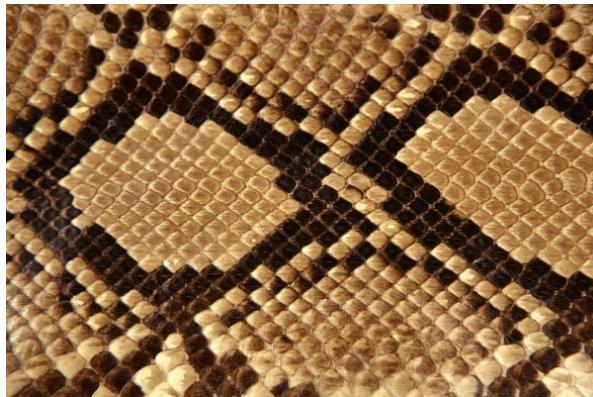


Often We Use Simple Patterns

Generally useful for skin, bricks, stucco, granite, ...

Typically need to repeat texture over the object

- must make sure there are no seams when texture is tiled



Or Given a Model and a Single Texture

Wrap the Texture onto the Model



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Sample model from www.cyberware.com

Framework for Texture Mapping

The texture itself is just a 2-D raster image

- acquired from reality, hand-painted, or procedurally generated

Establish a correspondence between surface points & texture



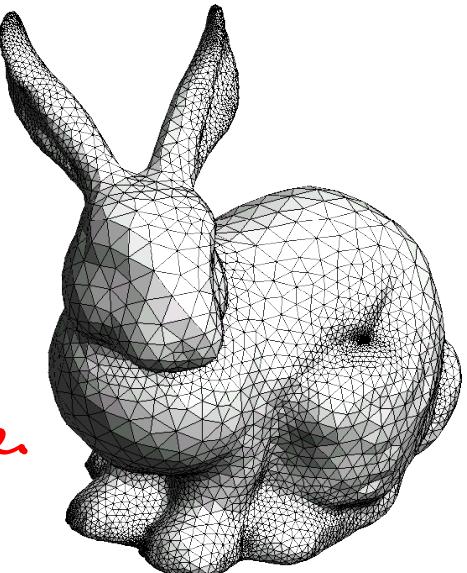
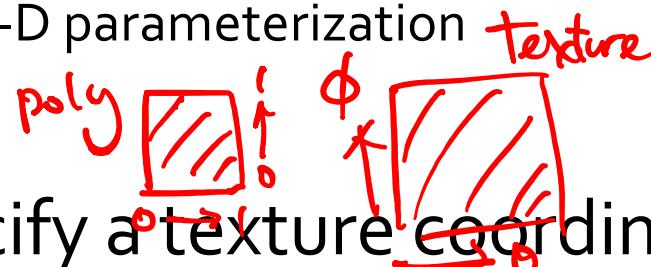
When shading a particular surface point

- look up the corresponding pixel in the texture image
- final color of surface point will be a function of this pixel

Texturing Polygonal Models

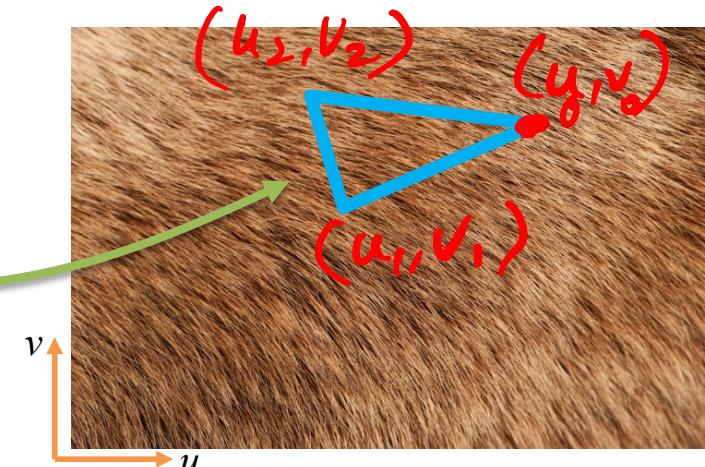
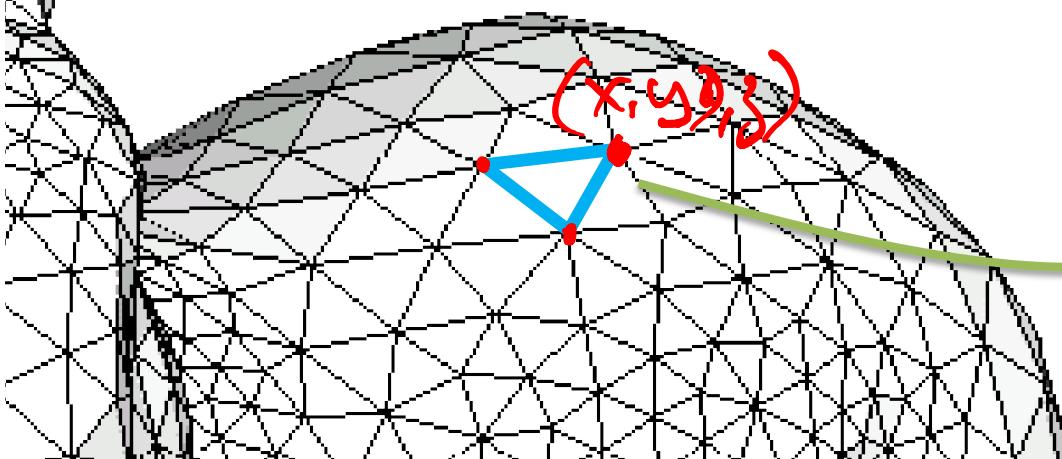
Polygonal models are not so easy

- they don't have a natural 2-D parameterization
- we need to create one

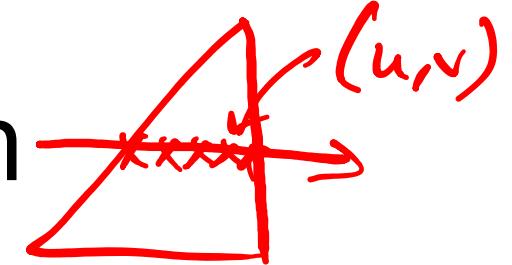


For each vertex, we specify a texture coordinate

- a (u, v) pair that maps that point into the texture image
- a triangle on the surface will be mapped to a triangle in texture
- can interpolate texture coordinates over the triangle
- note that the size of the triangle may be quite different

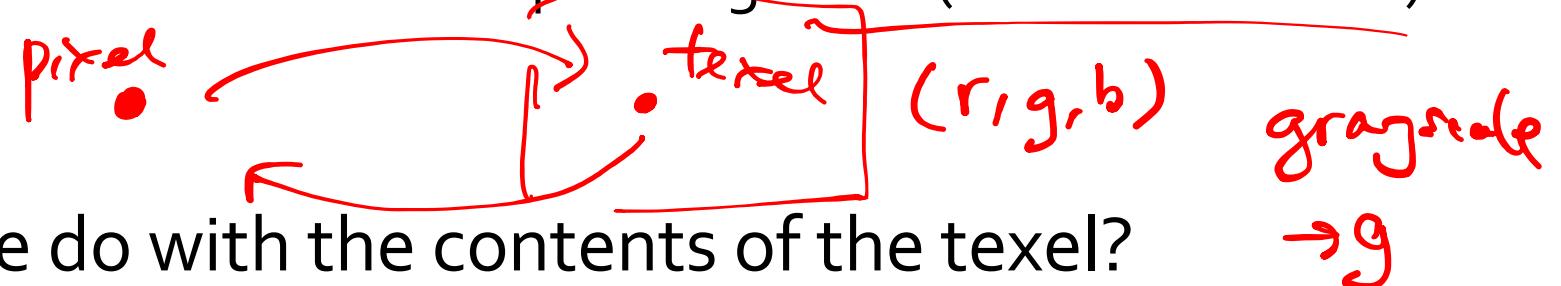


Texturing and Rasterization



During rasterization, we traverse the pixels of a triangle

- at each pixel we interpolate the correct texture coordinate
- and we retrieve the corresponding **texel** (texture element)



What do we do with the contents of the texel?

- color — use it to fill in the current pixel
- reflectance — coefficient for illumination equation (e.g., k_d)
- transparency — an alpha value
- and many others

$\cos \alpha$
Specular reflection