XIAMEN UNIVERSITY

COMPUTER GRAPHICS

Texture Mapping

Dr. Zhonggui Chen
School of Informatics, Xiamen University

http://graphics.xmu.edu.cn

Basics

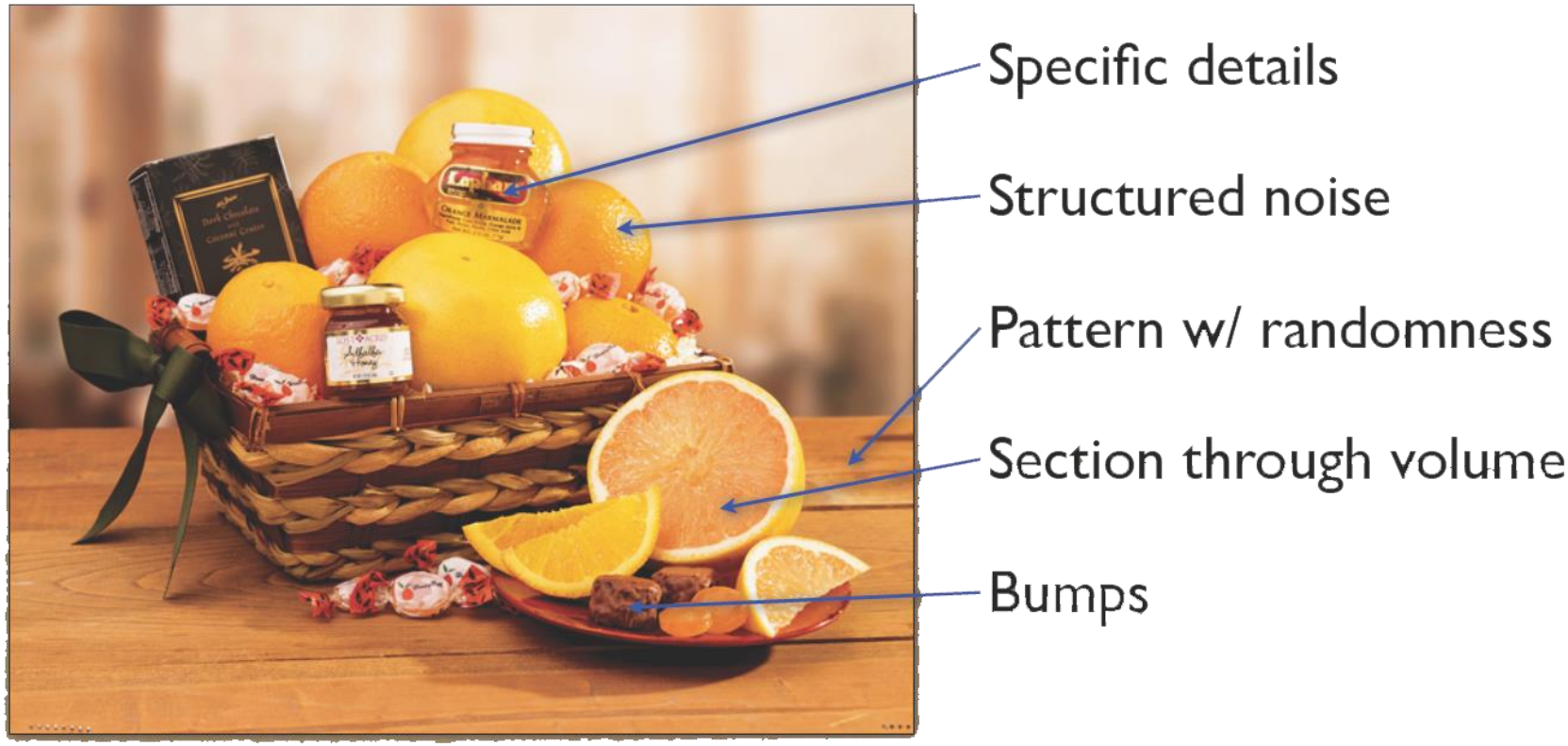
Spatial Variation

- All materials seen so far are the same everywhere



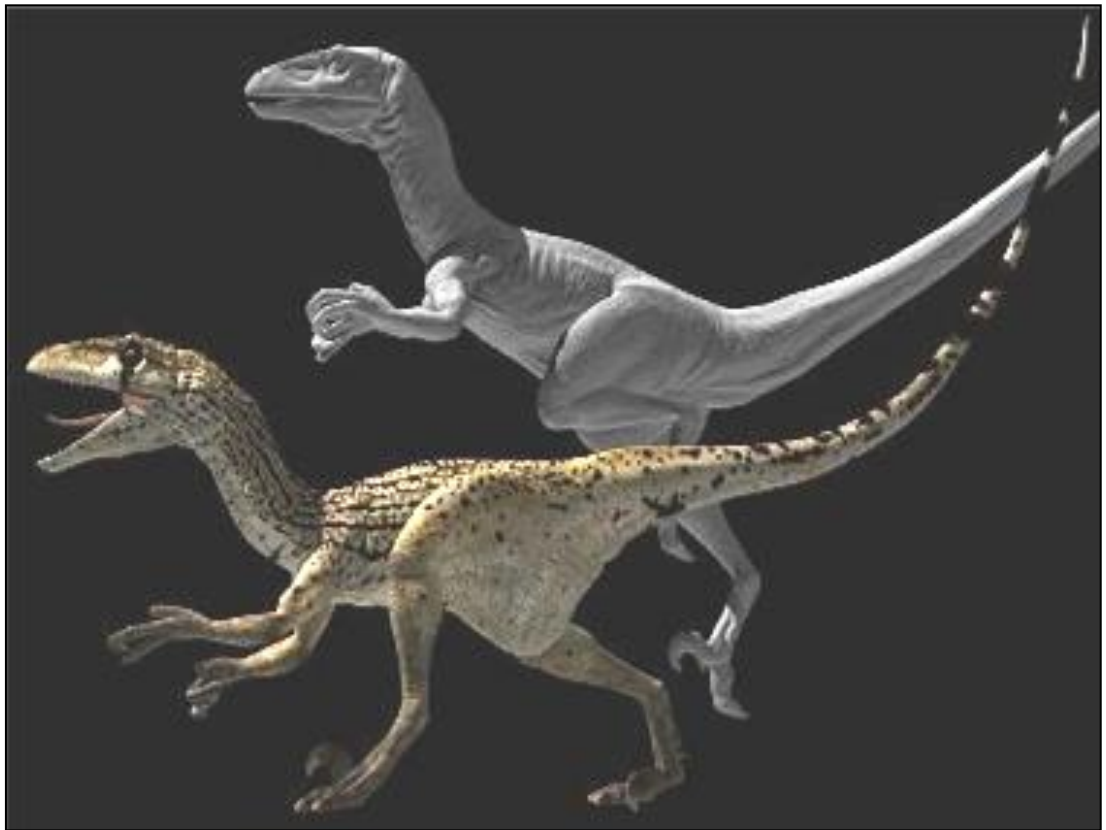
Surface Details

- Representing all details in an image with polygons would be cumbersome



2D Texture Mapping of Images

- Basic idea: use images instead of more polygons to represent fine scale color variation



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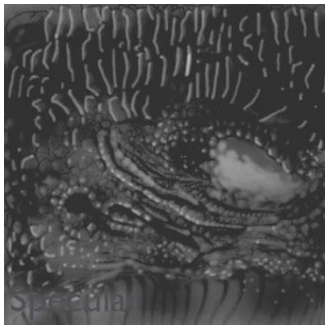
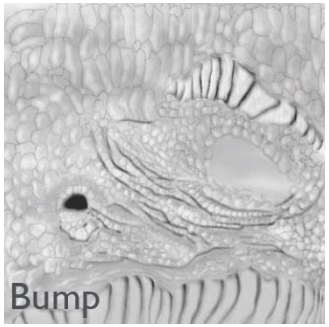
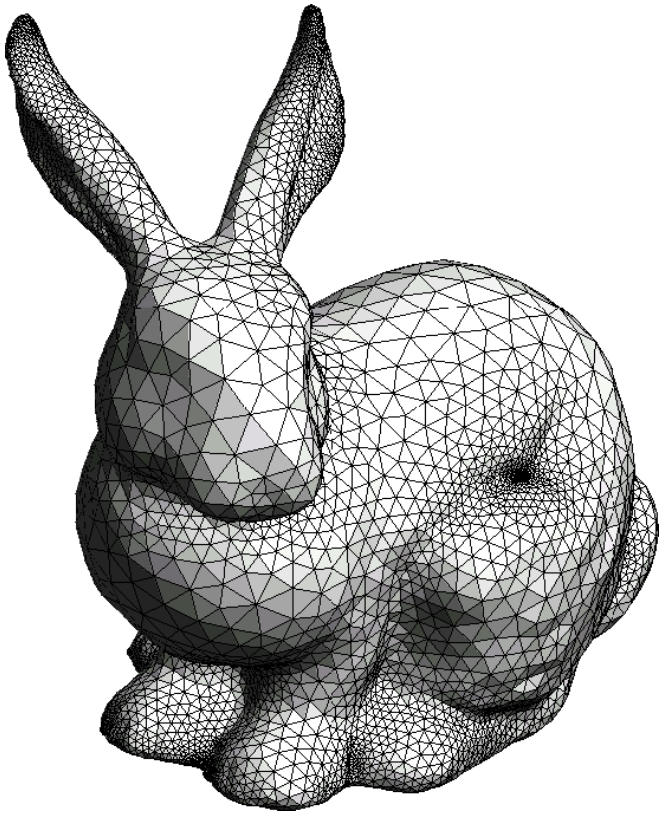




Texture Mapping

3D model



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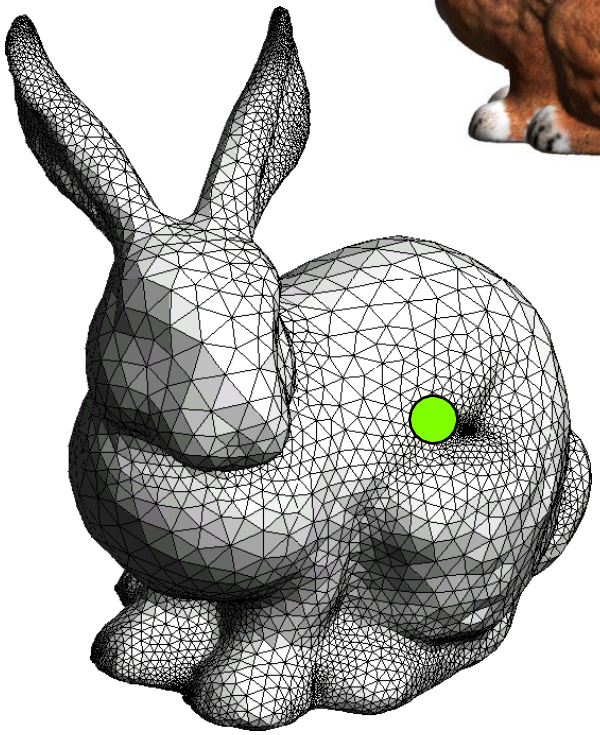
Texture mapped model

Texture Mapping

Texture mapped model



We need a function that associates each surface point with a 2D coordinate in the texture map

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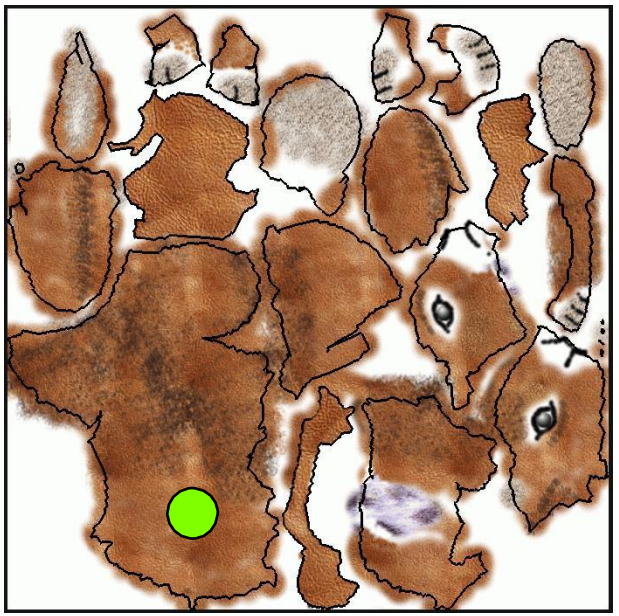
Texture map (2D image)

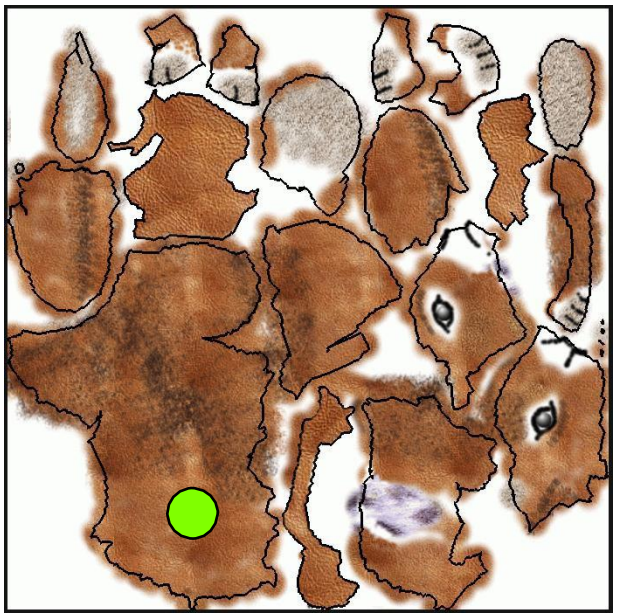


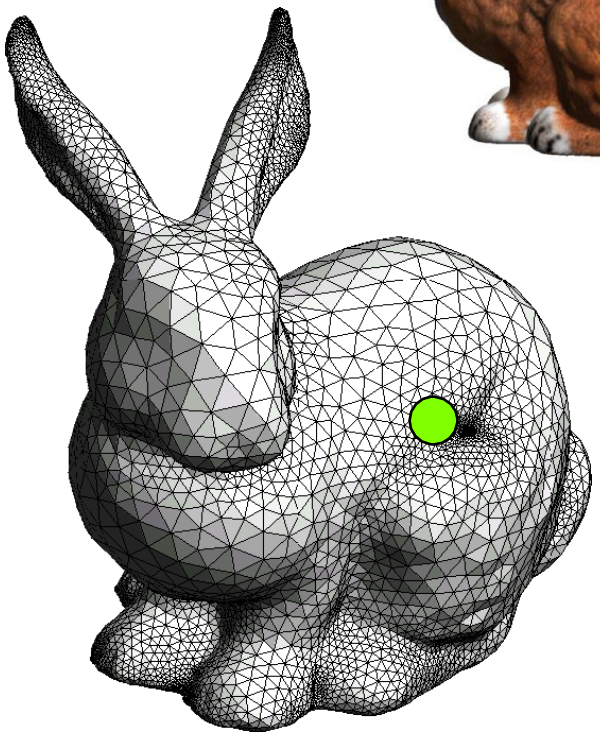
Texture Mapping

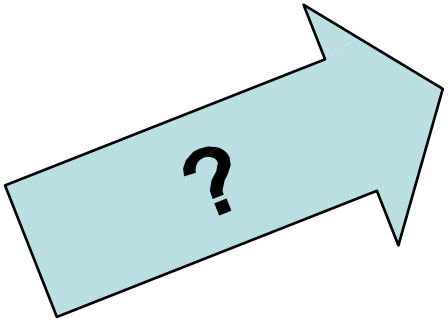
Texture mapped model

For each point rendered, look up color in texture map

Texture map (2D image)

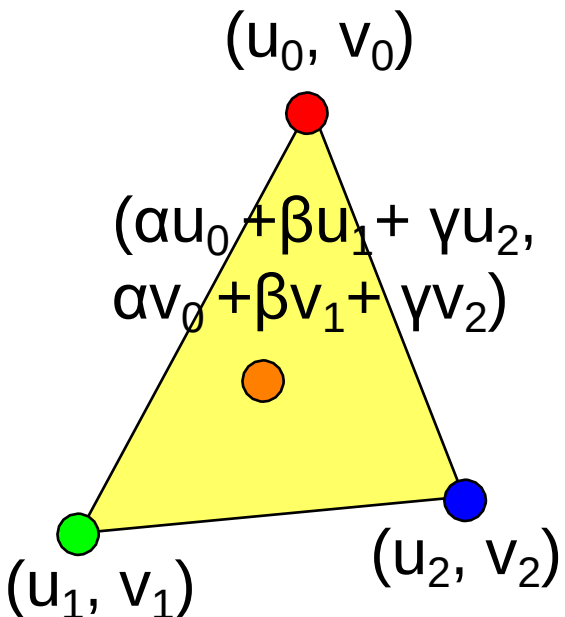


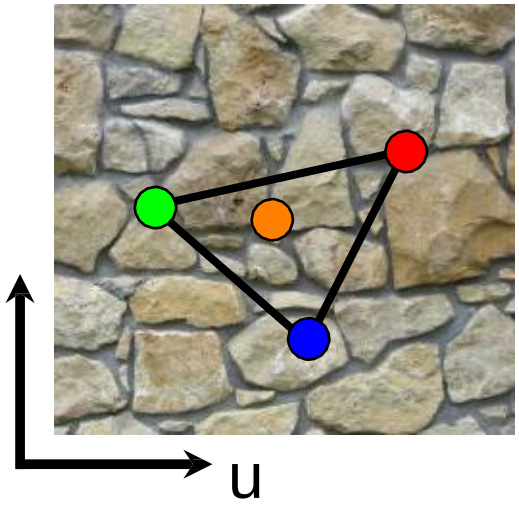




Texture Coordinates

- Each vertex P stores 2D (u, v) “texture coordinates” or “parameterization coordinates”
  - UVs determine the 2D location in the texture for the vertex
  - We will see how to specify them later
- Then we interpolate using barycentric interpolation





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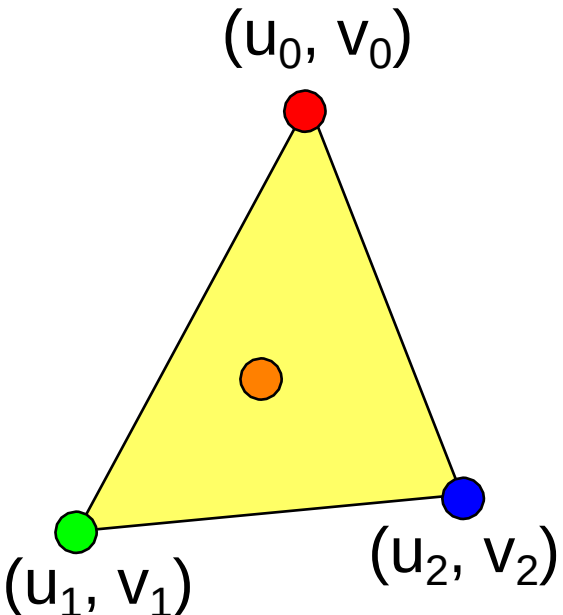
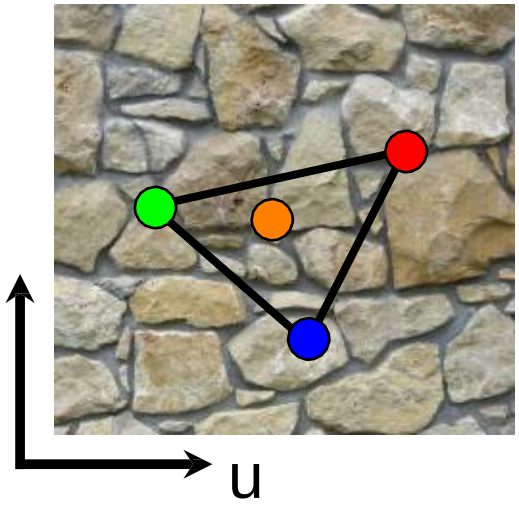
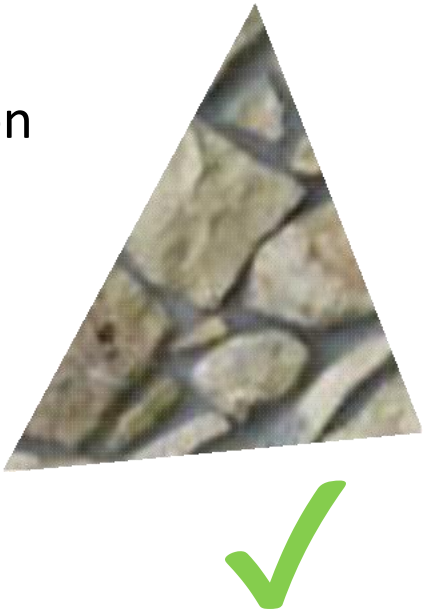
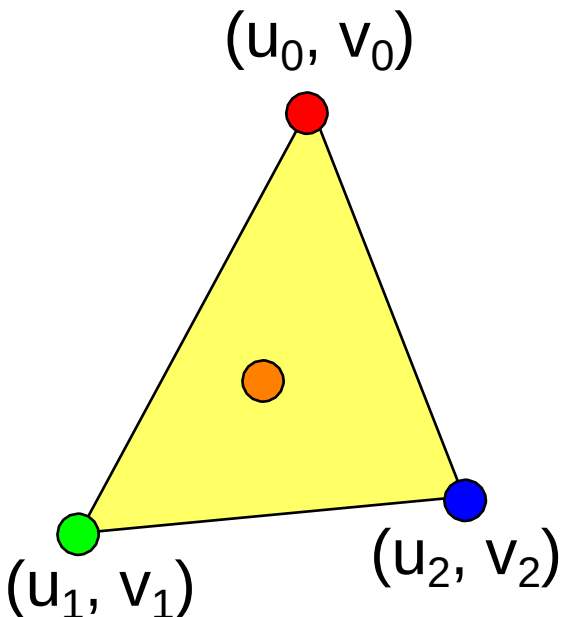


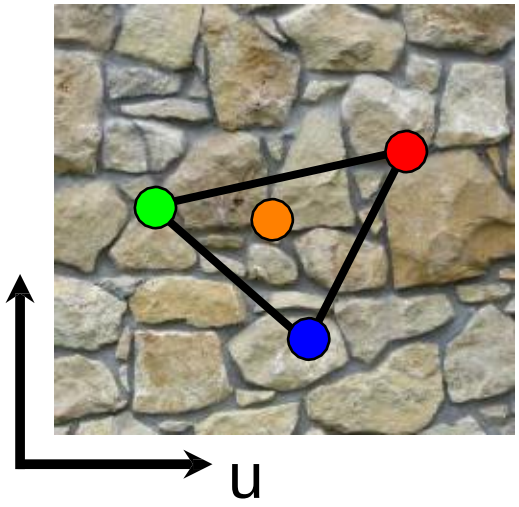




Texture Coordinates

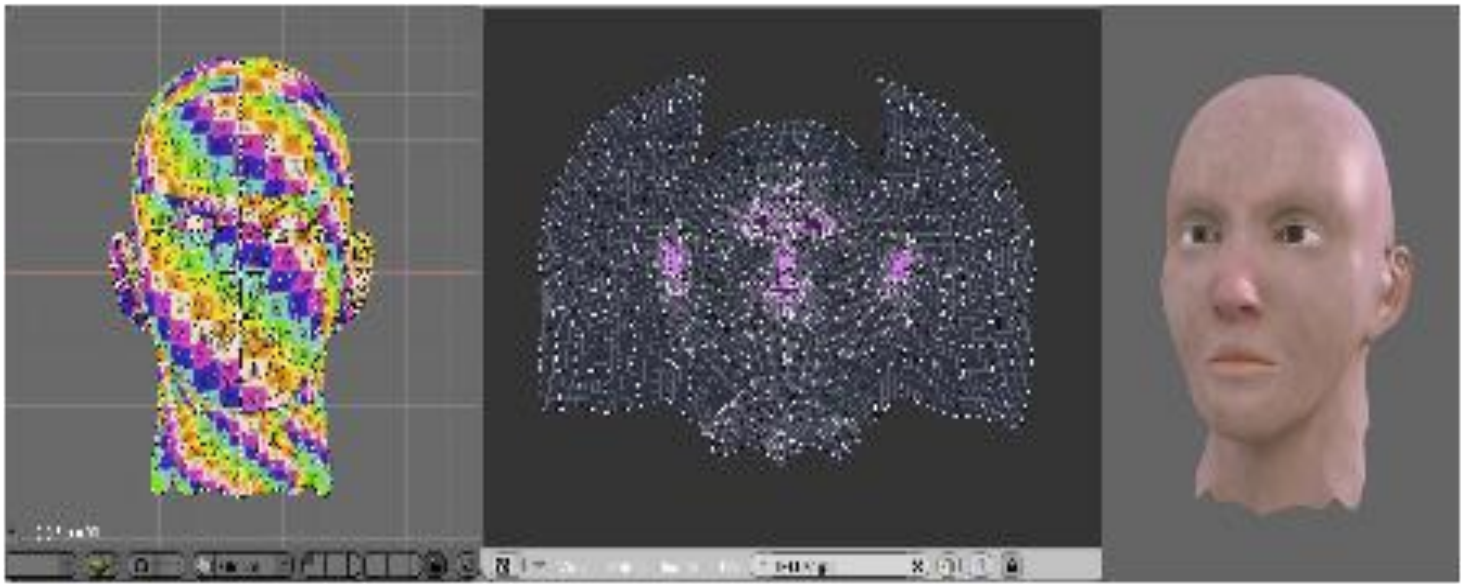
- Per-vertex (u, v) “texture coordinates” are specified:
  - Manually, provided by user (tedious!)
  - Mathematical mapping
  - Automatically using parameterization optimization





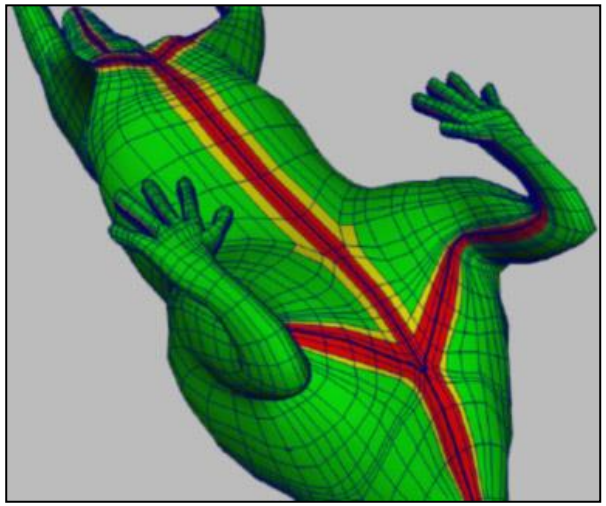
Texture Coordinates Optimization

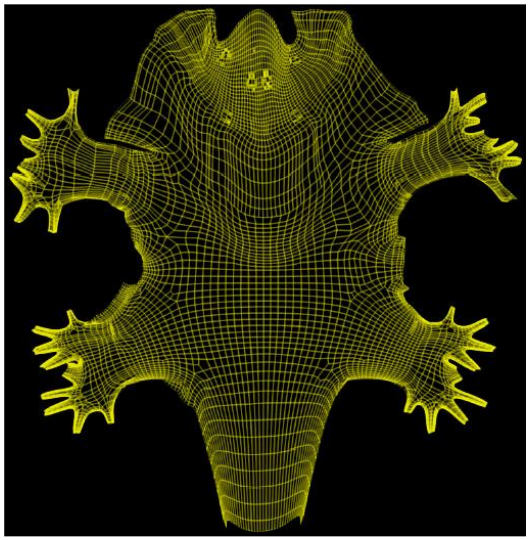
- Goal : “flatten” 3D object onto 2D UV coordinates
- For each vertex, find coordinates U,V such that
- distortion is minimized
  - distances in UV correspond to distances on 3D object.
  - angles of 3D triangle are the same as angles of triangle in UV plane
- Cuts are usually required (discontinuities)

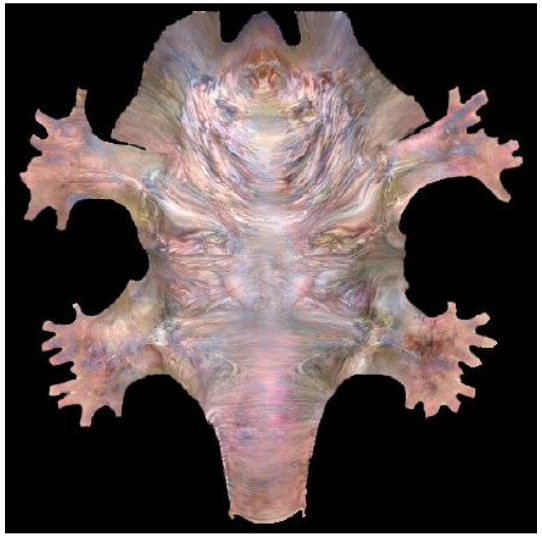


Option: it’s the artist’s problem

Option: unfold the surface



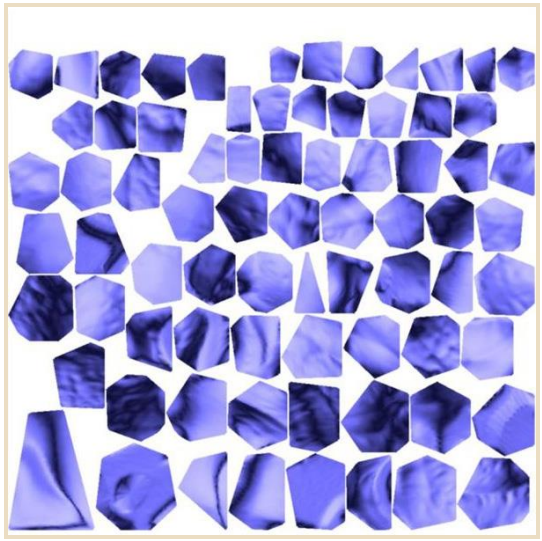




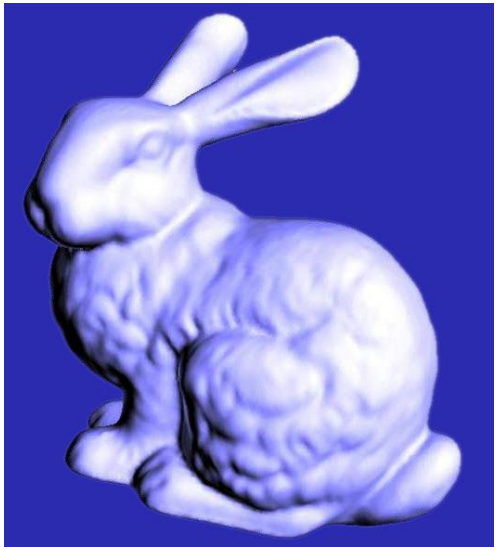
[Piponi2000]

Option: make an atlas

charts



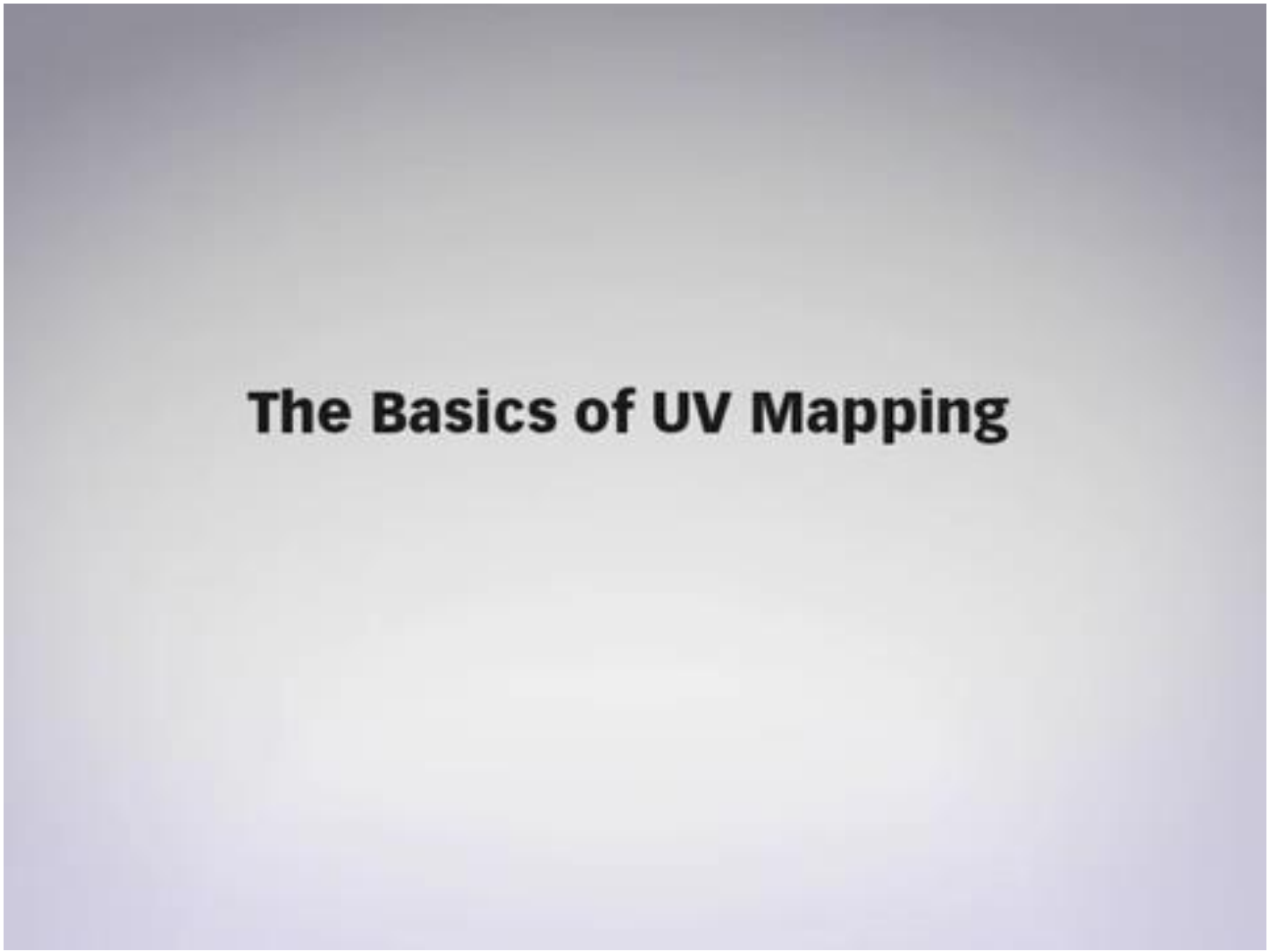
atlas



surface

[Sander2001]

Demo: texture mapping



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