Texture Mapping

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Textbook Appendix A4, Chapter 15

1

Today

- Texture mapping examples
- Conceptual foundations of texture mapping

2

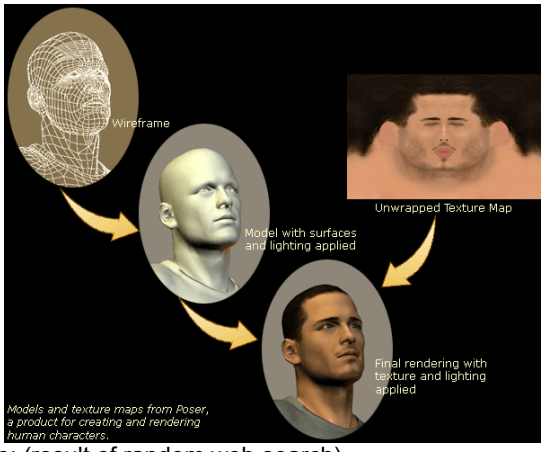
An example scene from Pixar's Bolt

Figure 12: *A final production still from "Bolt" using Ptex for all models. (© Walt Disney Animation Studios)*

http://ptex.us/ptexpaper.html

3

Another Example



Source: (result of random web search)
http://blog.gamerdna.com/2007/03/27/anatomy-of-an-mmorpg/

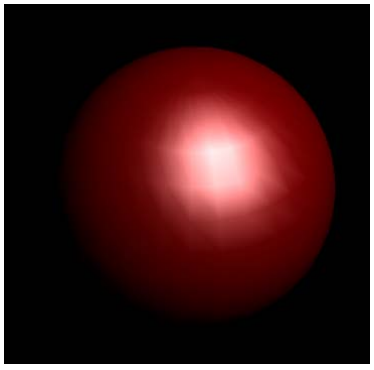
4

C³ Review: Shading

- Which one of the following factors may affect the colour of pixel?
  a) Light sources
  b) Surface material
  c) Viewer position
  d) Transport of light
  e) All of the above

C³ Review: Shading

- What is the shading technique used in the following picture?
  a) Phong Shading (per-fragment normal)
  b) Gouraud Shading (per-vertex normal)
  c) Global Illumination
  d) None of the above



Normal mapping

- The data from a texture can also be interpreted in more interesting ways.
- In normal mapping, the r,g,b values from a texture are interpreted as the three coordinates of the normal at the point.
- This normal data can then be used as part of some material simulation.

Slide courtesy of Min Kim, KAIST

7

Environment cube maps

- Textures can also be used to model the environment in the distance around the object being rendered.
- In this case, we typically use 6 square textures representing the faces of a large cube surrounding the scene.

Slide courtesy of Min Kim, KAIST

8

Projector texture mapping

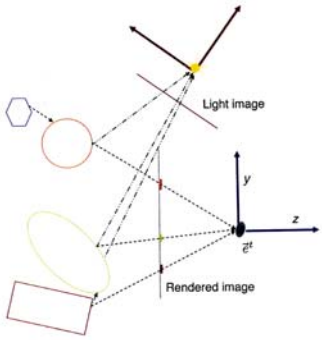
- There are times when we wish to glue our texture onto our triangles using a *projector* model, instead of the affine gluing model.
- For example, we may wish to simulate a slide projector illuminating some triangles in space.

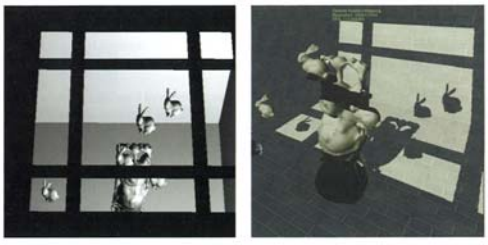
Slide courtesy of Min Kim, KAIST

9

Shadow mapping

- The idea is to first create and store a z-buffered image from the point of view of the light, and then compare what we see in our view to what the light saw in its view.





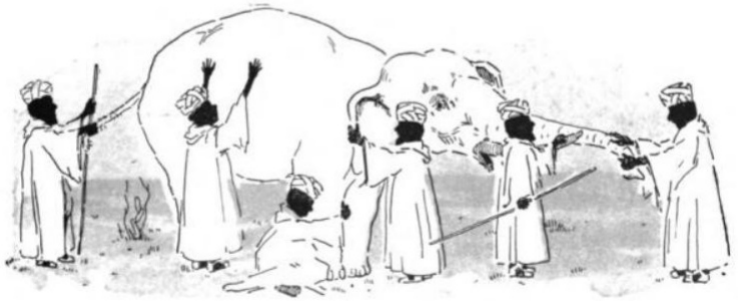
Slide courtesy of Min Kim, KAIST

10

Understanding Texture Mapping

What is texture mapping?

- Lots of different views….
  - Most common: it's gluing images onto objects



http://en.wikipedia.org/wiki/File:Blind_men_and_elephant3.jpg

Understanding Texture Mapping

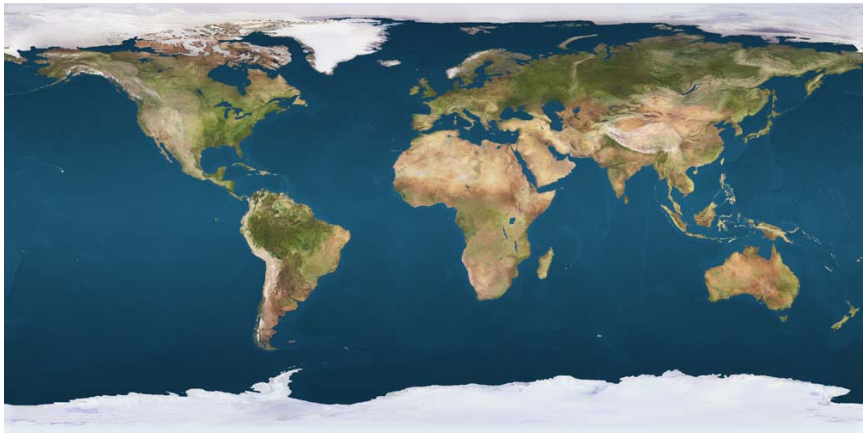
- Better view: An efficient way to model surface detail using discrete (sampled) data
- Need to understand two surprisingly subtle concepts
  - "Coordinates"
    Parameterization of surfaces
  - "Images"
    Sampled representations of continuous functions
    More details in Chapters 16-18. We'll be covering this at a high level.

13

An intuitive example
How to model the earth?

14

Earth (texture) Map



15

The simplest, intuitive scenario

Note Title 2014-03-05

Coordinates of Vancouver?

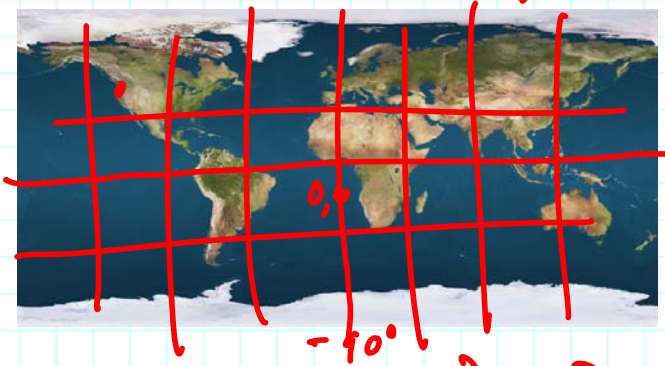
3D

Coordinate function

$\begin{pmatrix} u \\ v \end{pmatrix} = \phi(\tilde{p})$

u, v

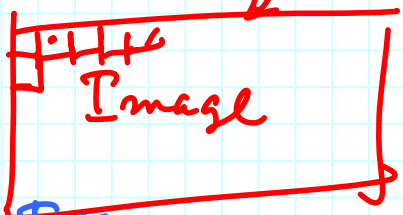
$(-123°, 49°)$



Continuous 2D "Map" or "Chart"

$I(u,v)$

Discretize



Discrete Image

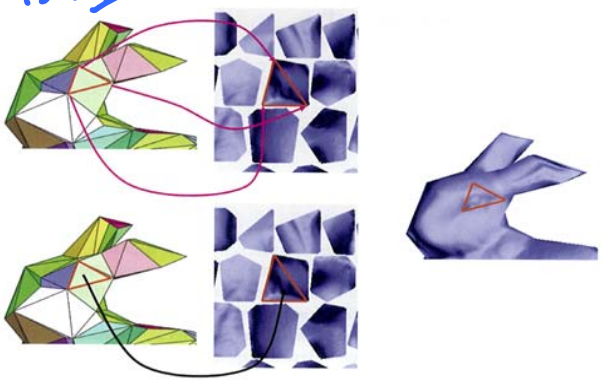
$I[i][j]$

§ Generalizations & Issues

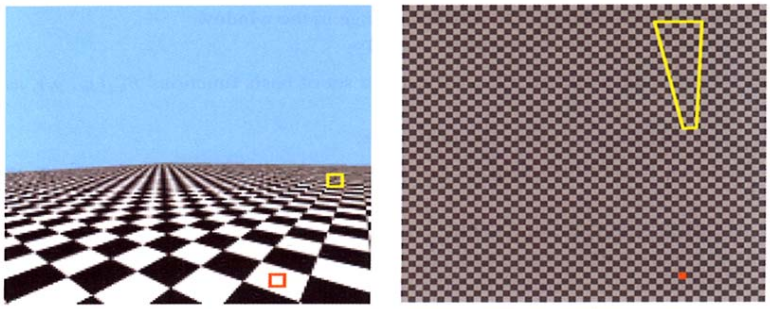
- Don't need a single chart, chart can be discontinuous (piecewise continuous) and local

  E.g. Pixar's Ptex – per face textures

  E.g. Book Fig 15.1



- Discretization of texture image can interfere with rasterized image



Book
Fig 18.1

Artifacts:

aliasing (aka "jaggies")

...

Need to "filter" the image appropriately