Texture Mapping

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Textbook Appendix A4, Chapter 15

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Today

- Announcement
  - My hard drive died this morning, and I've been focusing on recovering key files. Quiz 2 solution will be added to lecture notes and posted, hopefully by the evening
- Quiz 2 analysis
- Texture mapping examples
- Conceptual foundations of texture mapping

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Quiz 2 solutions

- Q1 14,3,9,12,4,5,8,17
  - Most got (a) wrong. See L18.
- Q2
  a. Sets rotation part of ViewMatrix (or equivalent description). Note: doesn't set the Projection matrix.
  b. Per fragment lighting, phong shading, etc. Generically saying that it's a varying variable is not enough
  c. See L19, p.5. Note that l and v should be normalized
  d. See L19, p.6
  e. Makes specular lobe narrower (not longer, or bigger). See L17.

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- Q3
  a. See L15, p.4. Partial credit for reproducing some parts of p.3, such as P_u matrix
  b. See L14, p.6
- Q4
- Q5. See L17, pages 3 and 4. 3 marks for computing B(l) and 3 marks for computing intensity

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- Q6 matrices are written with rows separated by semicolons, as in Matlab
  a. S = [2 0 0; 0 1 0; 0 0 1]   p = $[2\ 1\ 1]^T$
  b. l = 1/sqrt(2) $[1\ 1\ 0]^T$. Since the sun is far away, the light vector is constant, even after scaling the object.
  c. The key point here is to use the inverse-transpose of S to transform the normal. Answer=1/sqrt(5) $[1\ 2\ 0]^T$
  d. Apply diffuse formula from L17, p3 to above. Answer = 3/sqrt(10)

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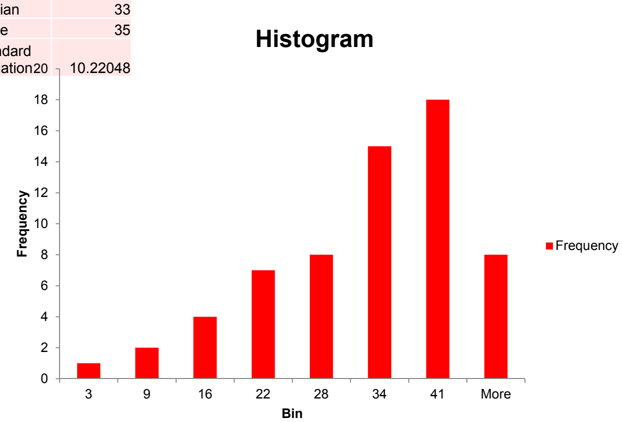
Raw scores

Mean	29.73016
Standard Error	1.28766
Median	33
Mode	35
Standard Deviation	10.22048



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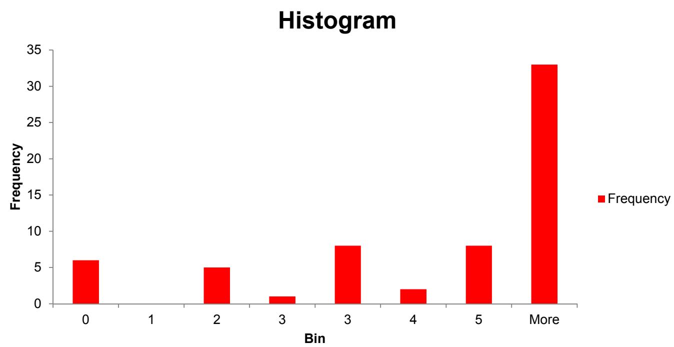
Q4: phong shading



Straightforward question, 33/63 got 6/6 but surprisingly many did not

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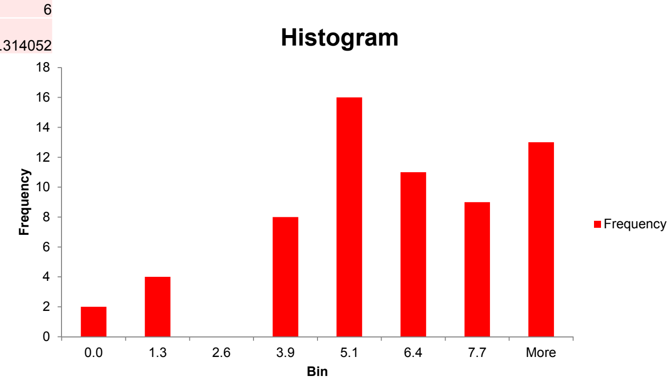
Q2

Mean	5.333333
Standard Error	0.291543
Median	6
Mode	6
Standard Deviation	2.314052



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Summary

- Performance not as good as in previous quiz
- Q6 histogram indicates that straightforward questions were missed by many
- Since Q2 parts may have been a little ambiguous, will add 3 points for everyone.

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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

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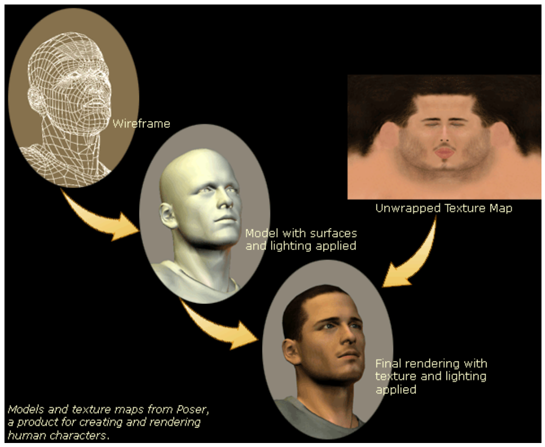
Another Example



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

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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

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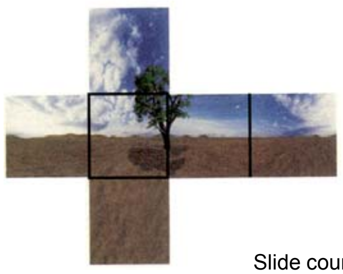
Environment cube maps

- 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

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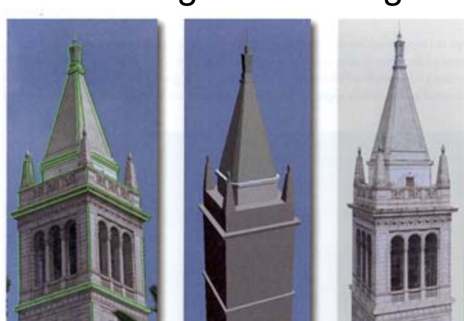
Projector texture mapping

- 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

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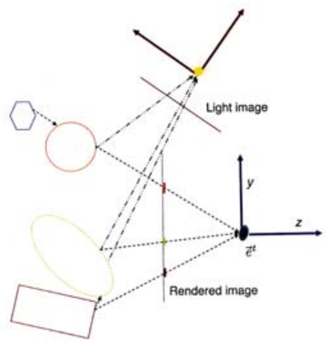
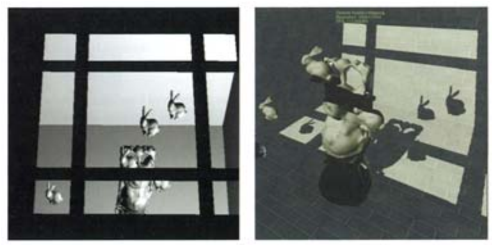
Shadow mapping

- 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

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Understanding Texture Mapping

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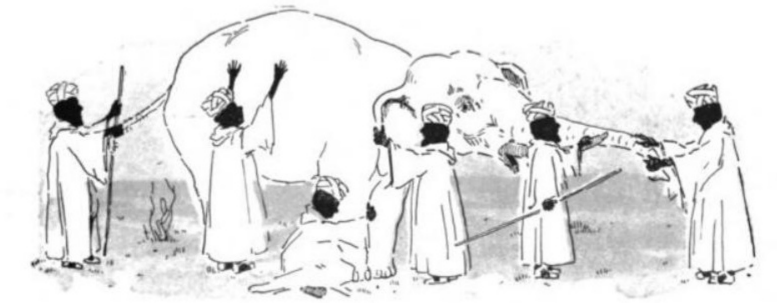
What is texture mapping?

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



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

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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.

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An intuitive example
How to model the earth?

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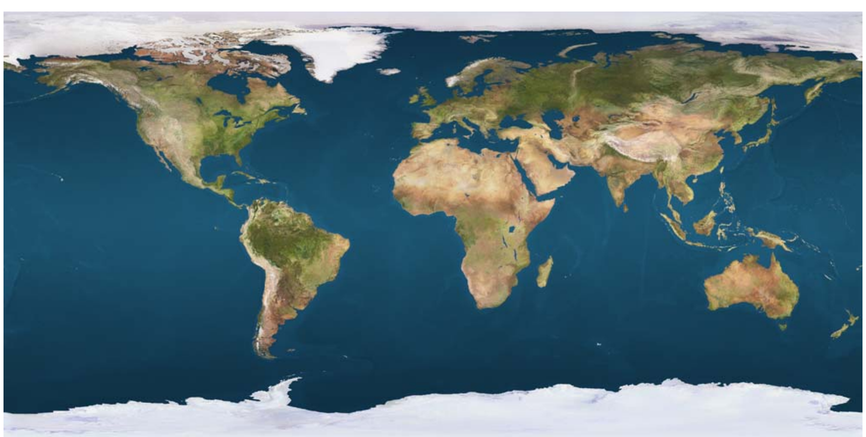
Earth (texture) Map



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Texture coordinates, simple case

Vancouver has coords (-123, 49)

Texture map

90

0

-90

-123

0

Texture Image

latitude & longitude are coordinat.

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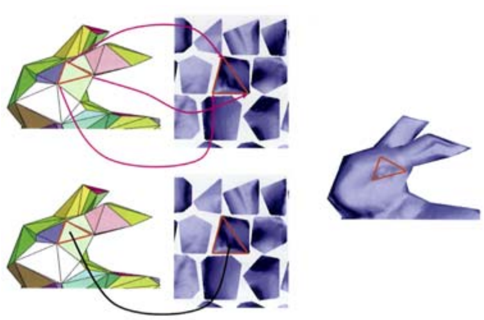
Texture mapping

- In basic texturing, we simply 'glue' part of an image onto a triangle by specifying texture coordinates at the three vertices.



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