CS451
Texturing 2

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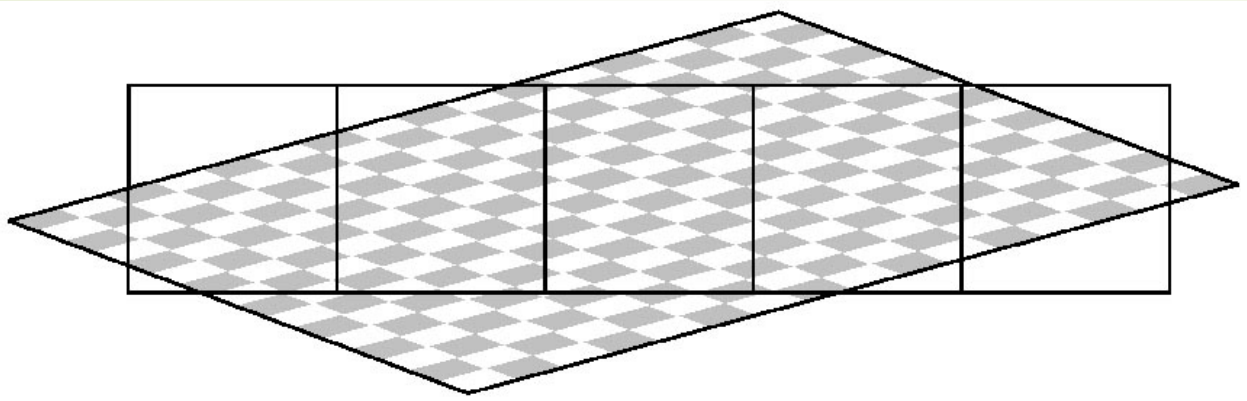
Based on Tomas Akenine-Möller's lecture note

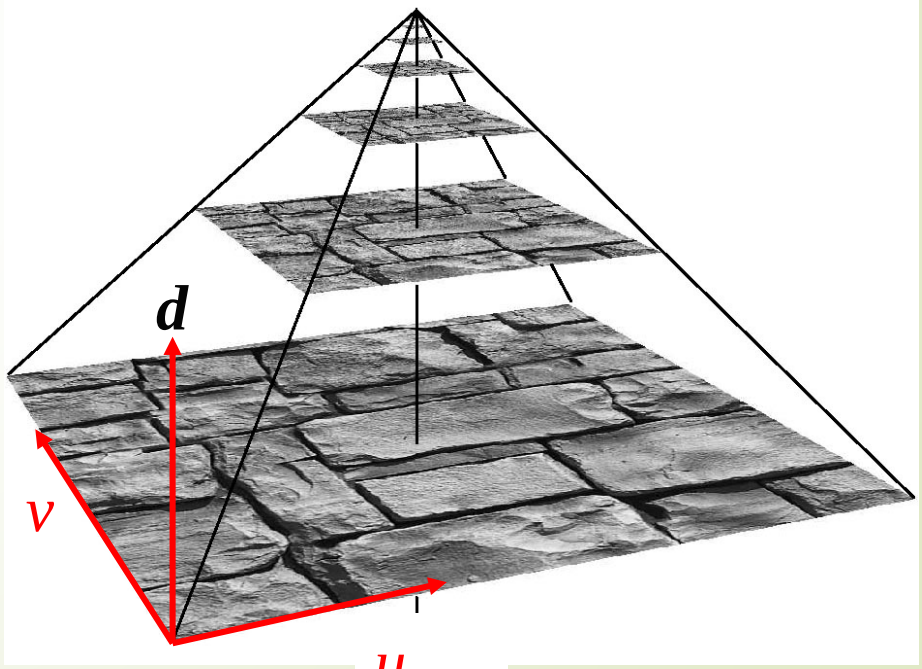
Texture minification
What does a pixel ”see”?



- Several texels can be covered by a single pixel
  - Nearest neighbor (using the center of the pixel)
  - Bilinear interporlation (again, using the center of the pixel)
  - Compute an average of all enclosed texels
    - Works better but can be slow

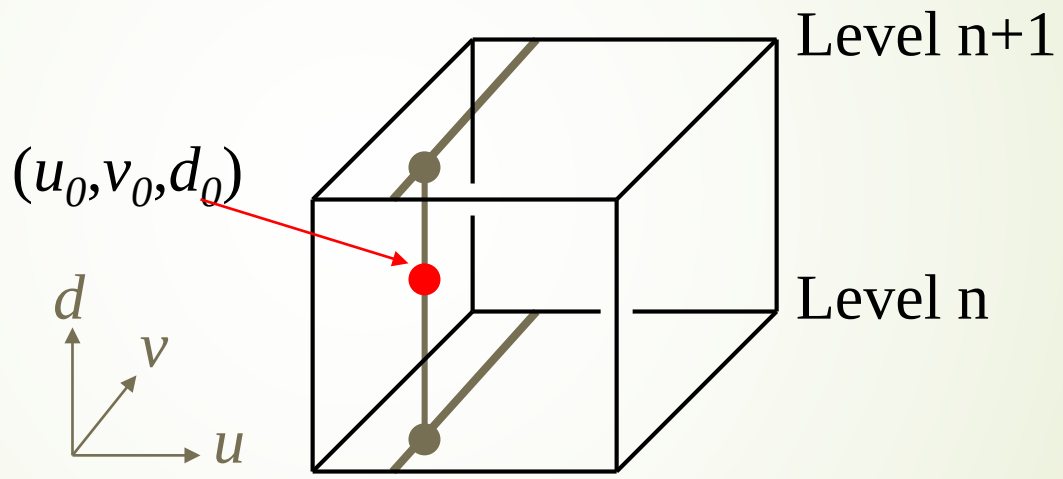
Mipmapping

- Image pyramid
- Half width and height when going upwards
- Average over 4 ”parent texels” to form ”child texel”
- Depending on amount of minification, determine which image to fetch from
- Compute d first, gives two images
  - Bilinear interpolation in each



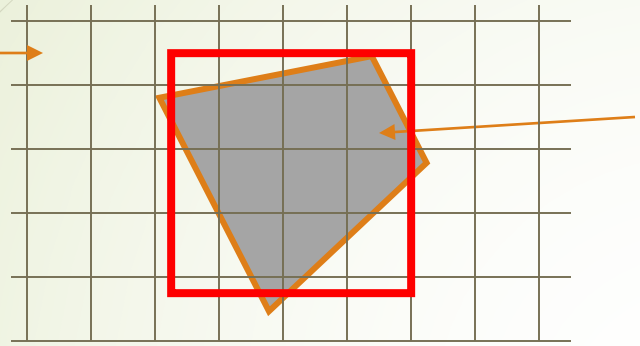
Mipmapping

- Interpolate between those bilinear values
  - Gives trilinear interpolation



- Constant time filtering: 8 texel accesses
- How to compute *d*?

Computing d for Mipmapping



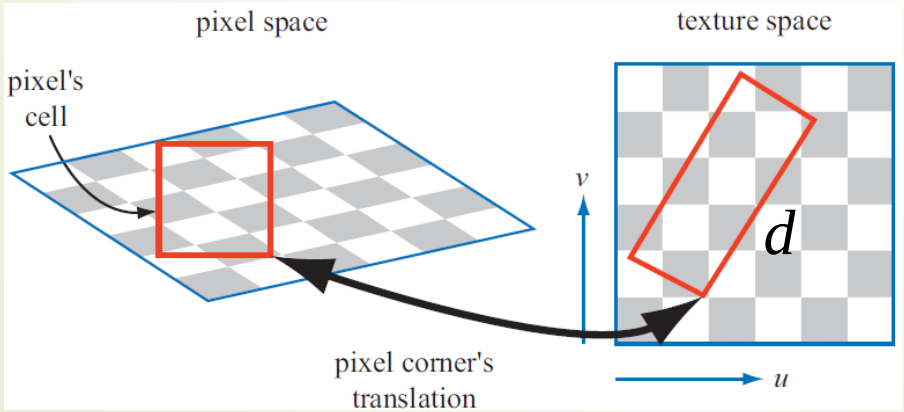
pixel projected
to texture space

$A = \text{approximative area of quadrilateral}$

$b = \sqrt{A}$

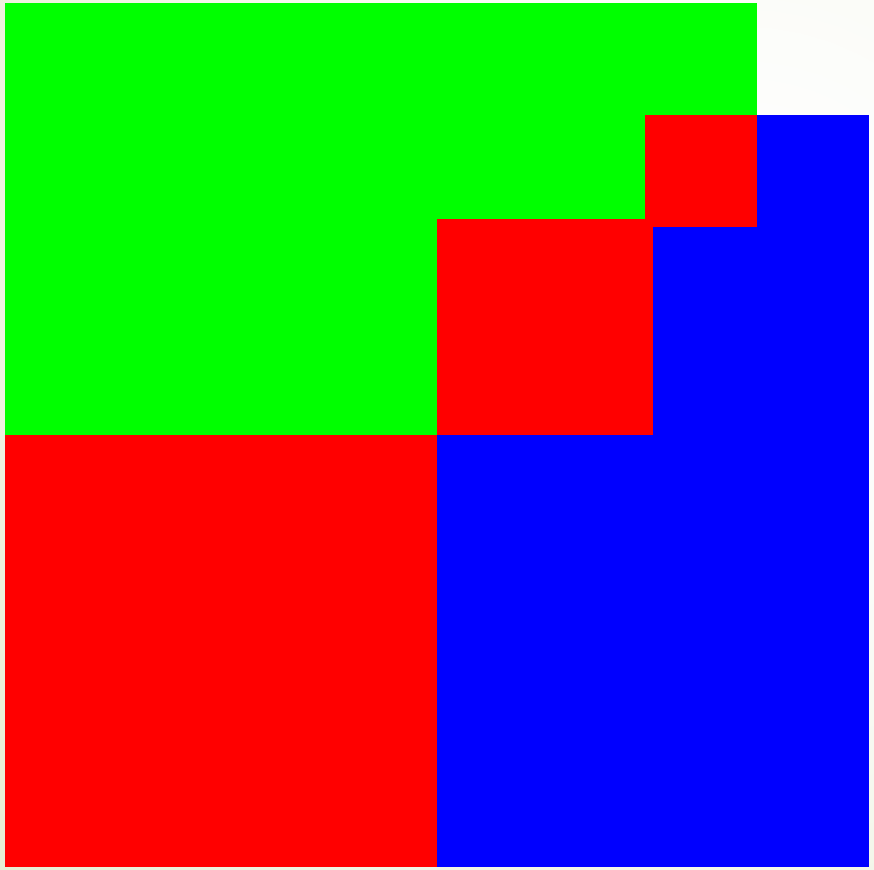
$d = \log_2 b$

Or use the length of the longer side the the projected quadrilateral



Mipmapping: Memory requirements

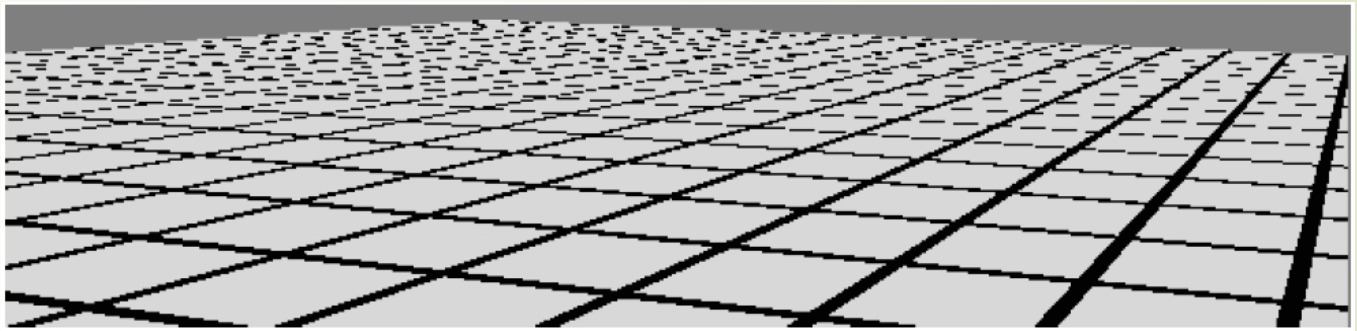
- Not twice the number of bytes...!



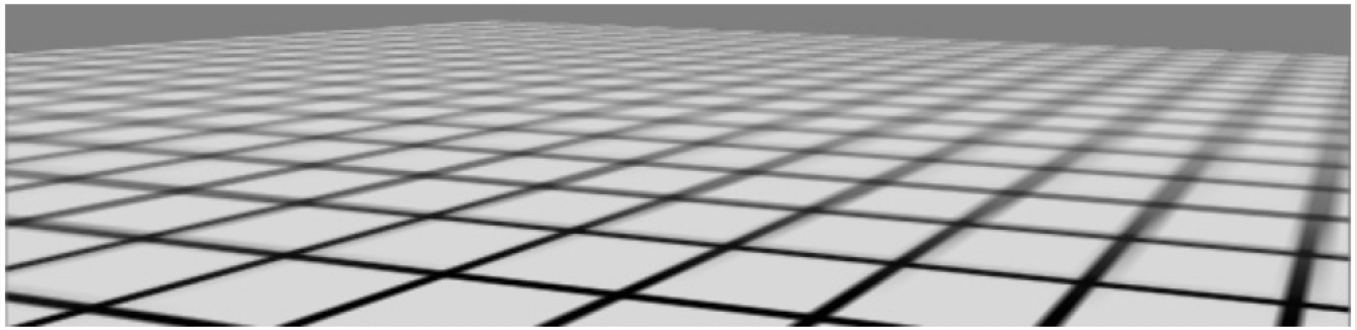
- Rather 33% more – not that much

Mipmap Gives Overblur!

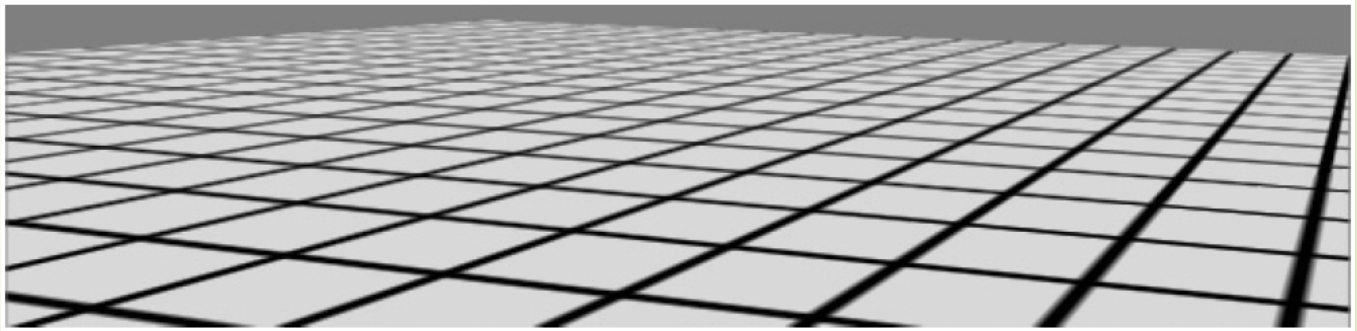
Nearest neighbor



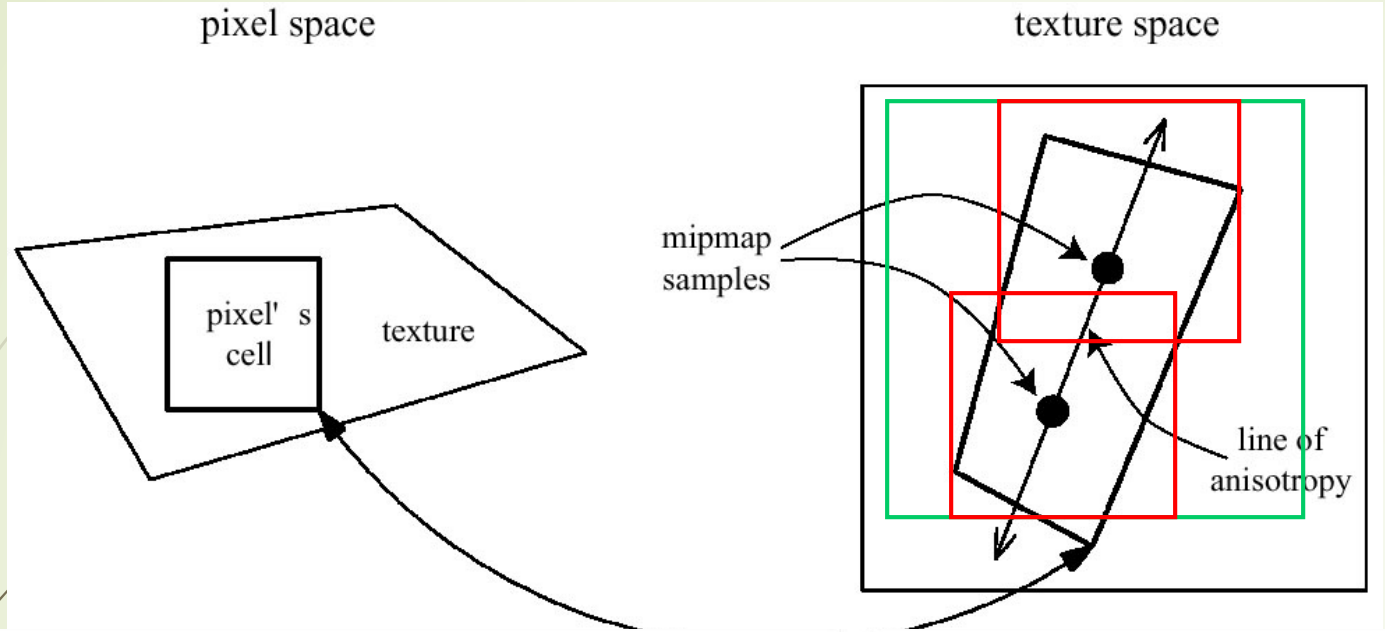
Mipmap



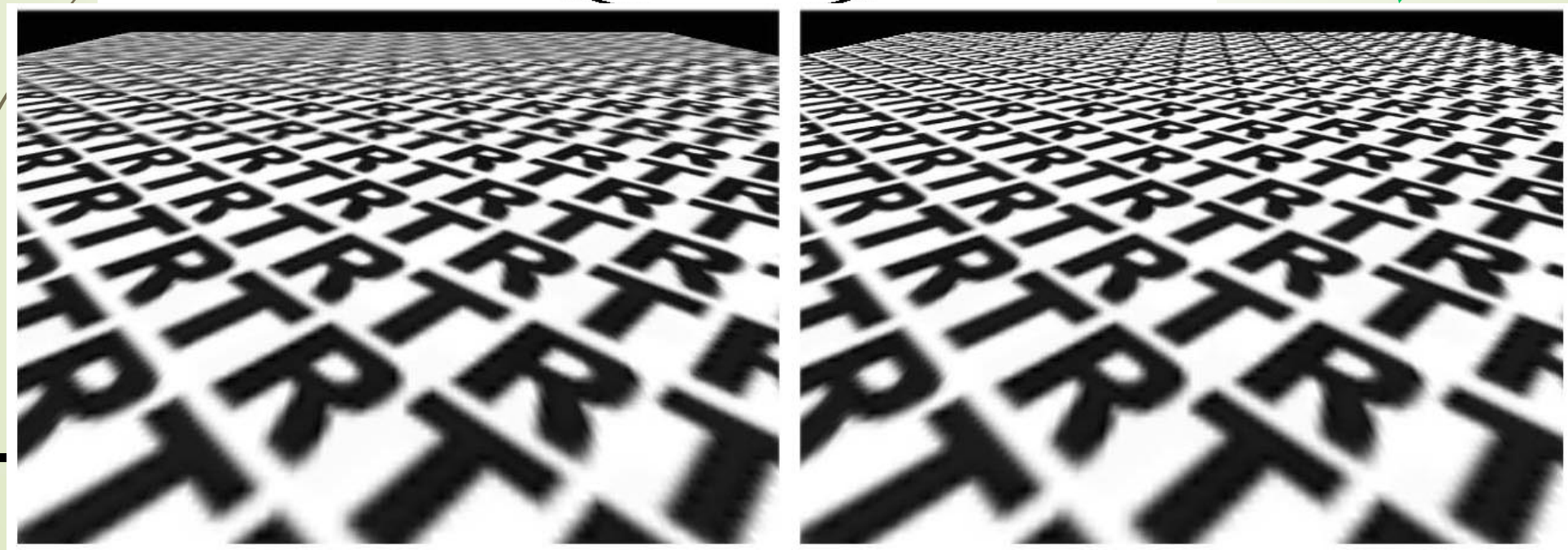
Mipmap with better precomputation



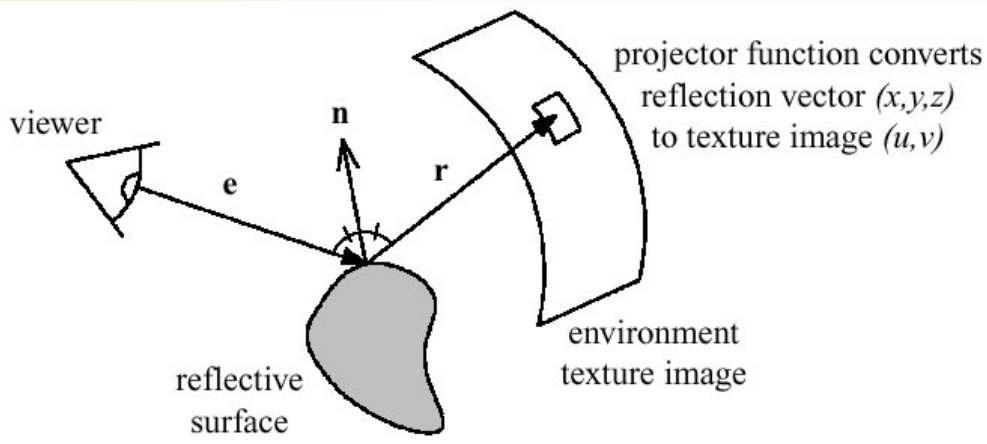
Anisotropic Texture Filtering



16 samples

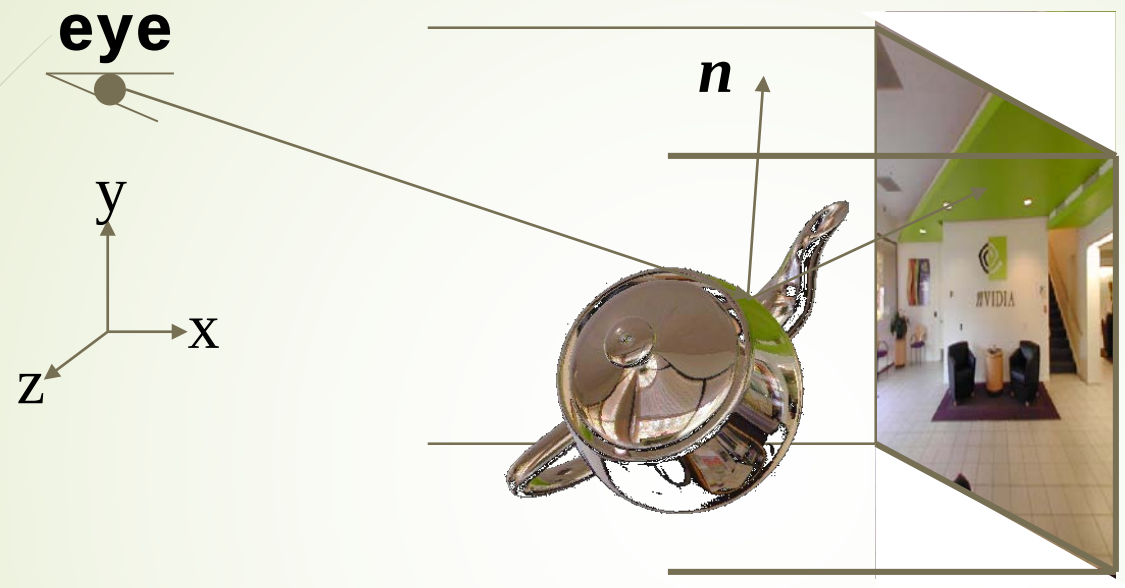


Environment mapping



- Assumes the environment is infinitely far away
- Sphere mapping treated in other course
  - Or see book
- Cube mapping is the norm nowadays
  - Advantages: no singularities as in sphere map
  - Much less distortion
  - Gives better result
  - Not dependent on a view position

Cube mapping



- Simple math: compute reflection vector, **r**
- Largest abs-value of component, determines which cube face.
  - Example: **r**=(5,-1,2) gives POS_X face
- Divide **r** by 5 gives (*u*,*v*)=(-1/5,2/5)
- If your hardware has this feature, then it does all the work