CS 563 Advanced Topics in Computer Graphics

Ambient Occlusion

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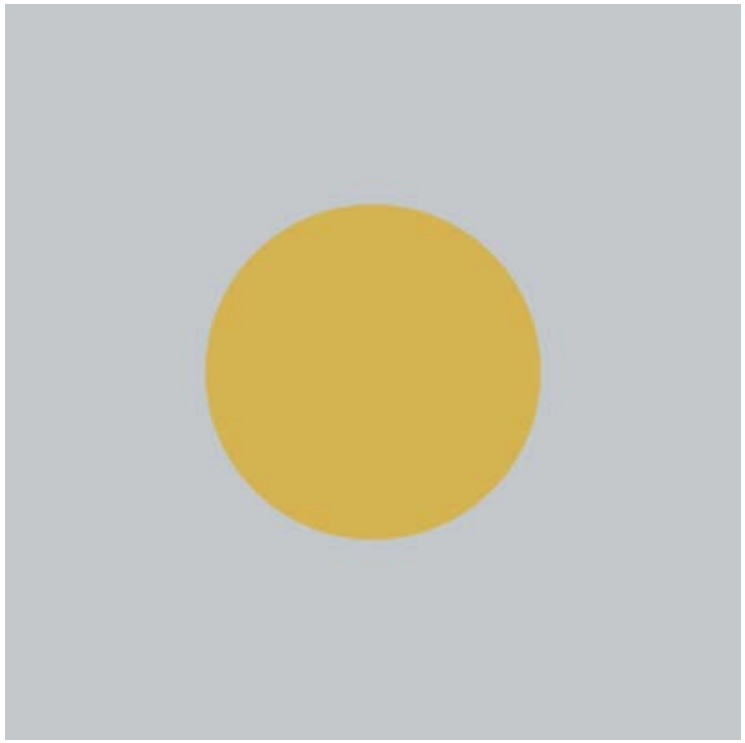
Ambient Occlusion

1. Extremely short chapter (~2 pages of usefull info)
2. Topics
    1. General Idea
    2. Math
    3. Implementation
    4. Results

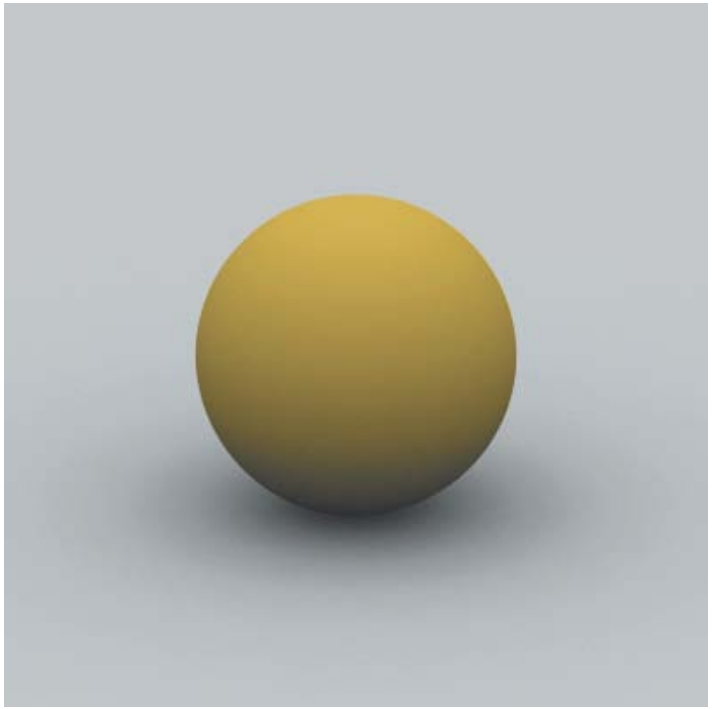
General Idea

- Ambient lightining used to be with a single color
- Got Images that looked like this
  - (without other lighting)



General Idea

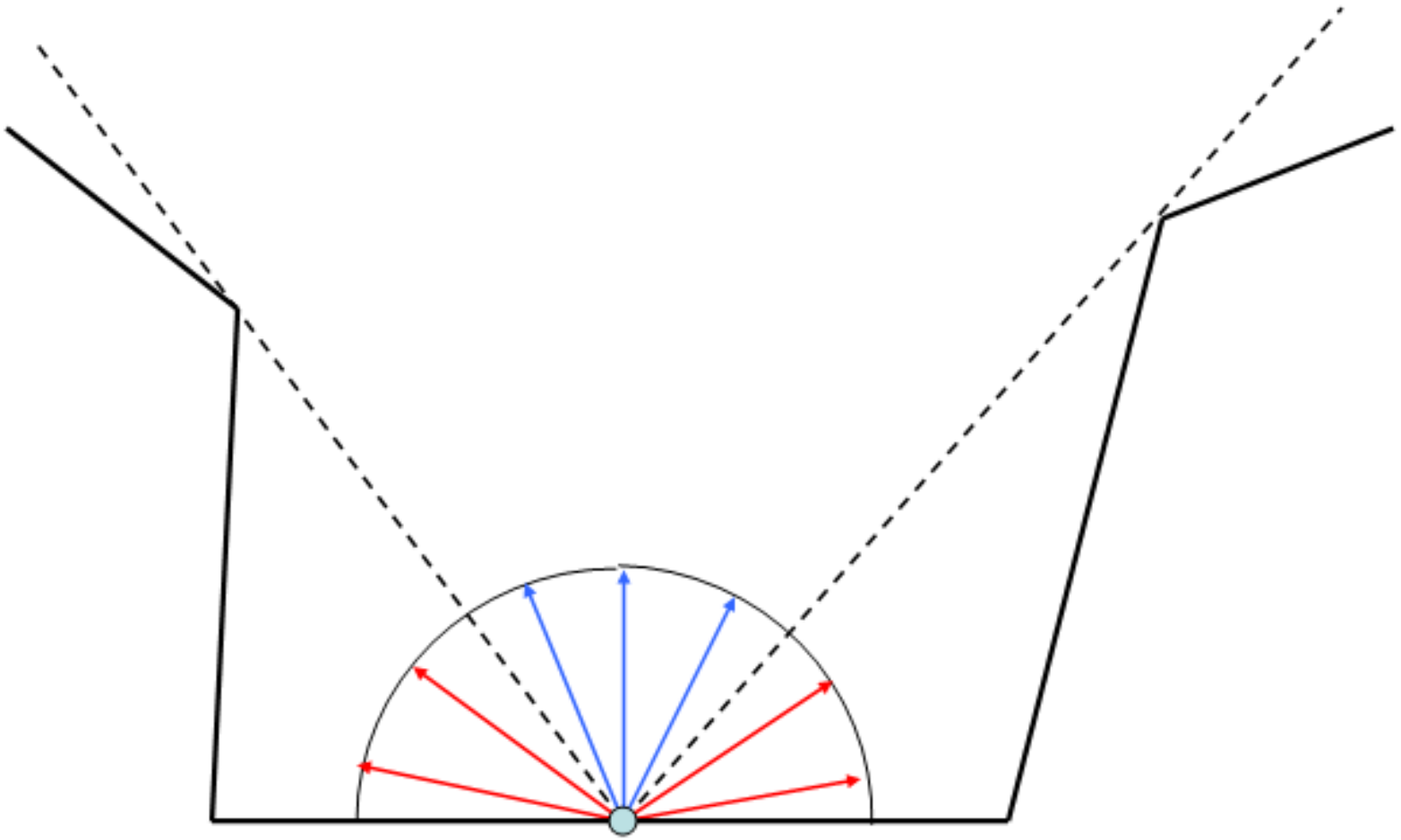
- Now we want to calculate the ambient light at a point from how much of the point is not blocked by other objects
- Now we will get something like this...



General Idea

- To do this, we
  - Sample the hemisphere over the point (p)
  - For each sample point (q) trace the ray (p->q)
  - Find the percentage of rays that do not hit any objects
  - Set the ambient illumination of the point proportional to this number

2D Visualization



- Image from http://www.cs.unc.edu/~coombe/research/ao/

Math

- Setting up orthonormal basis

$$w = n$$

$$v = w \times up / || w \times up||$$

$$u = v \times w$$

  - n is the normal vector at p

The vector we trace at point a sample point (x,y,z) is

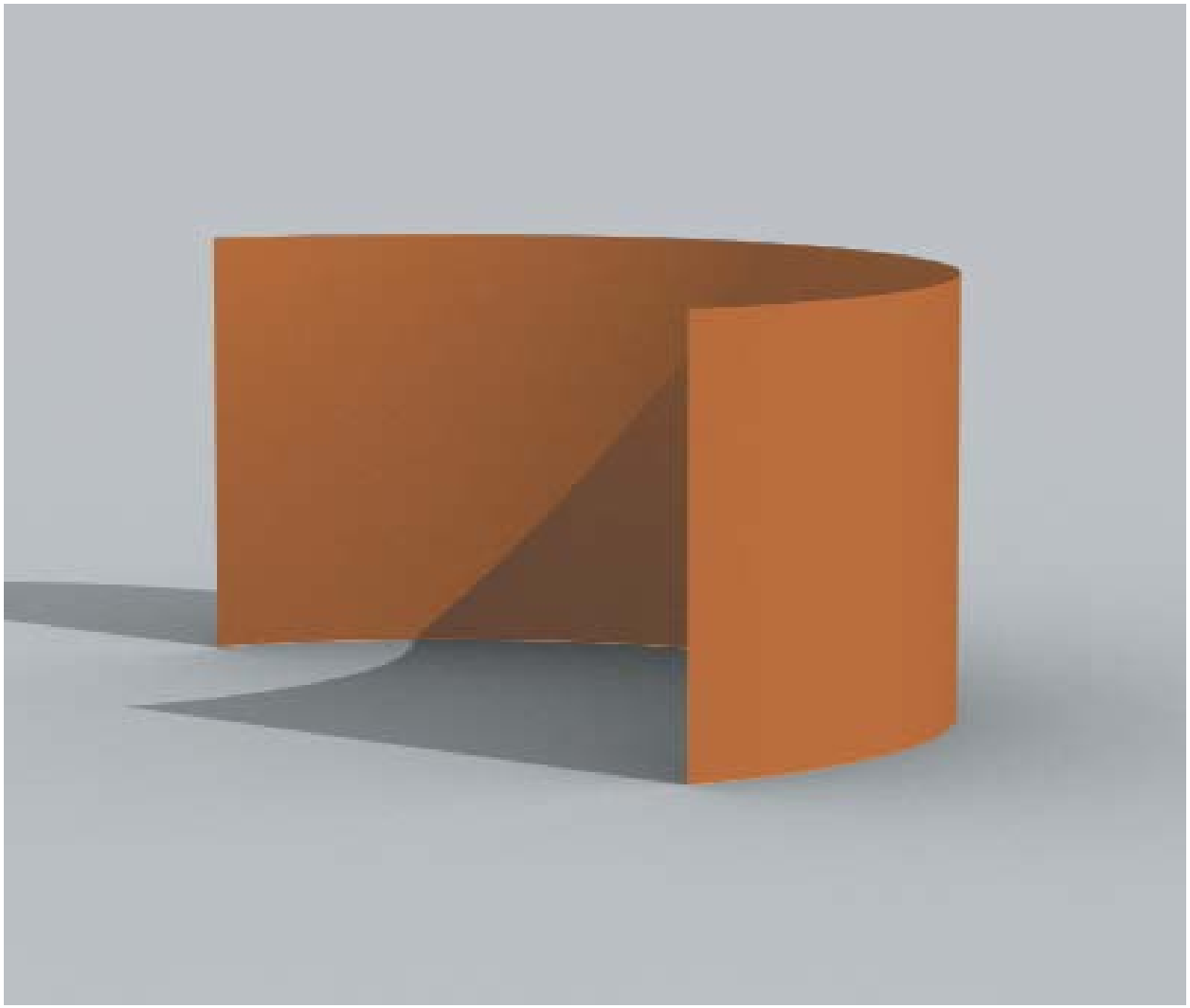
$$d = x*u + y*v + z*w$$

which starts at our hit point (p)

Implementation

1. Replace the constaint ambient light in chapter 14 with a function that computes the ambient light
2. Implement This function
    1. Use Chapter 7 to sample the points
    2. Set up the orthonormal basis
    3. Use same code from chapter 16 to trace the ray
    4. Return the percentage of rays that hit an object multiplied by the maximum ambient constant

Final Results - Direct and Ambient



References

- University of North Carolina at Chapel Hill
  - http://www.cs.unc.edu/~coombe/research/ao/
- Ray Tracing from the Ground Up
  - http://www.raytracegroundup.com/