More about sources

- Exitance of a source is
  - the internally generated power radiated per unit area on the radiating surface
- A source will have both
  - radiosity, because it reflects
  - exitance, because it emits

Radiosity leaving = Exitance + Radiosity due to incoming light

More about sources

What about multiple lights?

What about real, nearby, point sources?

What about extended sources?

More about sources

What about multiple lights?

The effect of lighting is additive. The effect of multiple lights is the sum of the effects over the individual lights.

What about real, nearby, point sources?

The effect of lighting falls off as $1/r^2$.

What about extended sources?

The effect of light is additive. We can approximate an extended source as a collection of small point sources.

Standard nearby point source model (Lambertian reflection)

$$\rho_d(x)\left(\frac{N(x) \bullet S(x)}{r(x)^2}\right)$$

- N is the illuminated surface normal
- rho is diffuse albedo
- S is source vector - a vector from x to the source, whose length is the intensity term
  - this works because a dot-product is basically a cosine
- r(x) is distance from surface point to source --- term occurs because source “looks smaller” as we move away--or, alternatively, its energy is spread out over a larger surface.

Standard distant point source model

- If the source is far away, this formula reduces to the same as the Lambertian formula from before:

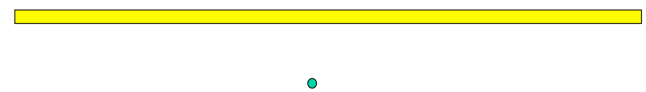
then $r(x) \cong R$

and $S(x) \cong S$

if we let $S_d = \left(S / R^2 \right)$

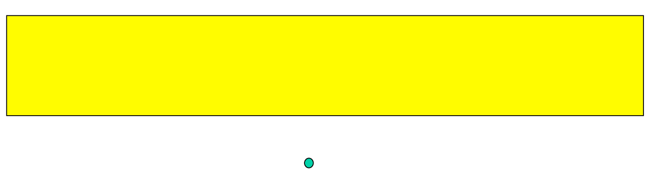
we get $\rho_d(x)\left(N(x) \bullet S_d\right)$

Line sources



Radiosity due to line source varies with inverse distance,
if the source is long enough (derivation is through integration
of the contributions along the line)

General extended sources



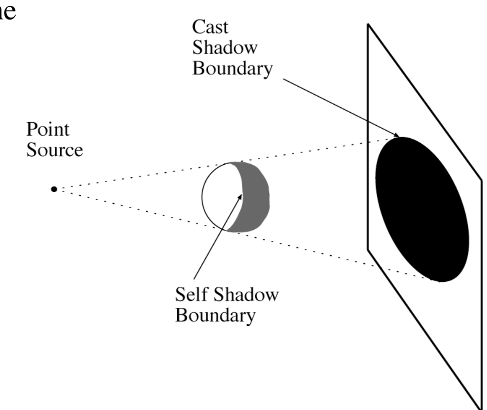
Can be handled by doing the integration (we won't)

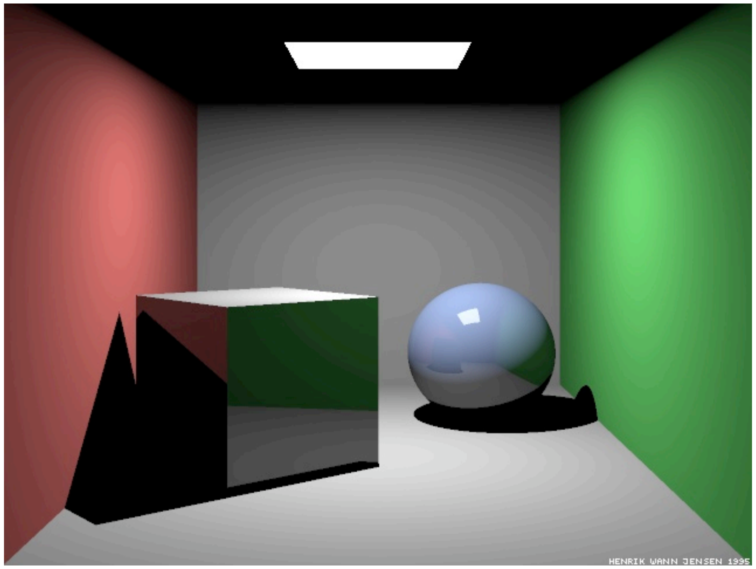
What if the source is large relative to the distance to it?

How about the hemisphere of the sky?

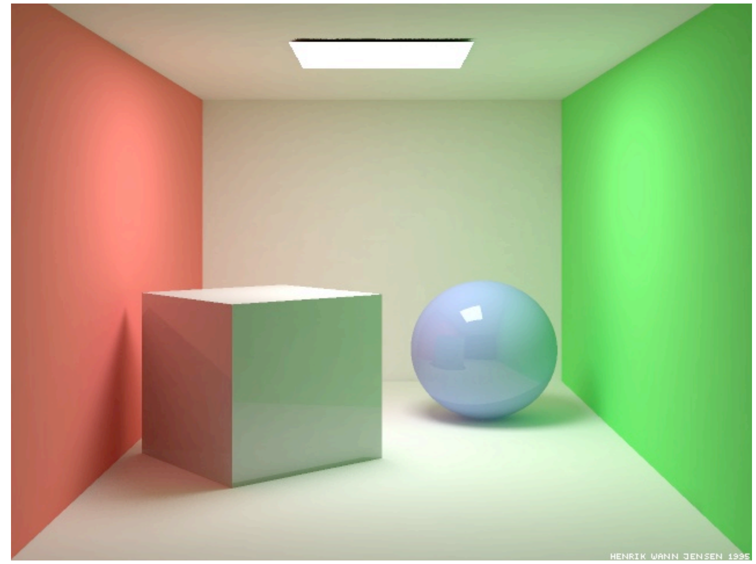
Shadows cast by a point source

- A point that can't see the source is in shadow
- For point sources, the geometry is simple





Ray-traced Cornell box, due to Henrik Jensen, http://www.gk.dtu.dk/~hwj



Radiosity Cornell box, due to Henrik Jensen, http://www.gk.dtu.dk/~hwj, rendered with ray tracer

Flat shading

- Compute shading value inside polygon using interpolate
- Flat shading
  - Use polygon normal for Lambertian shading
  - Advantages:
    - fast -- one shading value per polygon
  - Disadvantages:
    - inaccurate -- looks blocky

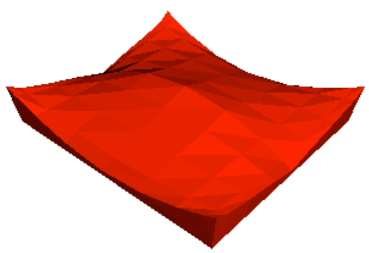


Figure from http://freespace.virgin.net/hugo.elias/graphics/x_polygo.htm

Gouraud (Interpolated) Shading

- Use normal at each vertex of polygon
  - known either from the "mesh" construction, OR, average normals where polygons meet.
- Shade these, and linearly interpolate
- Advantages
  - fast (interpolation can even be put into scan line algorithm)
  - much smoother
- Disadvantages:
  - specularities get lost