Lighting

Light types
- Ambient
- Point light
- Spot light
- Area light

Ambient Light
- Uniformly distributed throughout a scene in all directions.
- Fills areas that are not directly exposed to light and lightens shadows.
- A scene purely illuminated by ambient light, all surfaces receive the same amount of light.
Ambient Light

global_settings {
    ambient_light color
}

This statement will set the default color for the ambient light.

Result
Point Light

- Radiates light outward from a single position and shines evenly in all directions.

Light Fading

- It is not realistic for the plane to be evenly illuminated off into the distance.
- In real life, light gets scattered as it travels so it diminishes its ability to illuminate objects the farther it gets from its source.
- Objects closer to the light source get more light than the ones farther.
Light Fading

light_source {
<10,10,-10>
color White
fade_distance 10
fade_power 1
}

Spot Light

- A spotlight is a point that radiates light only in a specified direction.

light_source {
<x,y,z> color <colorspec>
spotlight
point_at <x,y,z>
radius <spotlight_angle>
falloff <falloff_angle>
tightness <tightness>
}
Spot Light

- This has spotlight with the same radius and falloff angles

```plaintext
light_source {
  <100, 100, -200>
  color rgb <1, 1, 1>
  spotlight
  point_at <0, 5, 0>
  radius 1.5
  falloff 1.5
}
```

Spot Light

- This has spotlight with different radius and falloff angles

```plaintext
light_source {
  <100, 100, -200>
  color rgb <1, 1, 1>
  spotlight
  point_at <0, 5, 0>
  radius 1.5
  falloff 2.5
}
```
Cylindrical Light

- Constant radius and falloff regardless of distance.
- A cylindrical light source is just like a spotlight, except that the radius and falloff regions are the same no matter how far from the light source our object is. The shape is therefore a cylinder rather than a cone.

Cylindrical Light

```
light_source {
<100, 100, -200>
  color rgb <1, 1, 1>
cylinder
  point_at <0, 5, 0>
  radius 1.5
  falloff 8
}
```

Spot Light

```
light_source {
<100, 100, -200>
  color rgb <1, 1, 1>
  spotlight
  point_at <0, 5, 0>
  radius 1.5
  falloff 8
}
```
Area Light

- More realism
- Spreads light intensity over a rectangle.

area_light <side-1>, <side-2>,
     len-1, len-2

- <side-1> and <side-2> describe orientation, length of rectangle. Should be perpendicular.
- <len-1> and <len-2> are the number of lights along the corresponding dimensions of the light.
Area Light

This has a 24x24 plane (YZ) with 4 lights

```
light_source {
  <100, 100, -200> color White
  area_light
  <0, 24, 0>,<0, 0, 24>,
  2, 2
}
```
Area Light

This has a 24x24 plane (YZ) with 64 lights.

light_source {
  <100, 100, -200> color White
  area_light
    <0, 24, 0>,
    <0, 0, 24>,
  8, 8
}

Natural?

- Banding
- NFIN

Area Light

- Jitter
  - Moves individual point sources in the light by a small random amount.
  - Breaks up bands of intensity.
Area Light vs Point Light

Other things to look at
- Parallel lights
- looks_like
- projected_through
Color in lights
- Adds drama, atmosphere
- Avoid white on white
- Use for testing lights
- Examples from TERA / Toy Story

Radiosity
- More accurate model of reflected light
- Replaces ambient component
- From engineering: thermal transfer

Visual Cues
- Color bleeding
- Variation in depth of shadow
Depth of Shadow

Area lights vs. radiosity
Radiosity algorithm
- Gather all of the light coming to a point on a surface
- Calculate color
- Send out this color as reflection
Finish statement

- diffuse .75 ambient 0

Radiosity in POV-Ray

```plaintext
global_settings { radiosity { [RADIOSITY_ITEMS...] } } 

RADIOSITY_ITEMS:
brightness Float | count Integer | distance_maximum
Float | error_bound Float | gray_threshold Float |
low_error_factor Float | minimum_reuse Float | nearest_count Integer |
recursion_limit Integer
```
global_settings {
  radiosity {
    pretrace_start 0.08
    pretrace_end 0.04
    count 35
    nearest_count 5
    error_bound 1.8
    recursion_limit 3
    low_error_factor 0.5
    gray_threshold 0.0
    minimum_reuse 0.015
    brightness 1
    add_bailout 0.01/2
  }
}

#declare RAD = off;
global_settings {
  #if(RAD)
    radiosity {
      ... }
  #end
  }

In POV-Ray

- See section 6.11.11 in the help file for an explanation on each one of these terms
- Enclose your scene and camera within an object or objects so you can get color bleeding