Topic Notes: Lighting

We have seen how to add light bulbs to our scenes, now more detail.

Lights

All of the lights have have used so far as of the `Light` class. They act like a light bulb hanging in space, shining equally in all directions from a center point.

As we have seen in examples previously, a `Light` is defined by its `position`, `color`, and `intensity`:

- By default, the `Light`'s position is the origin. We can set it with the `pos` message:

  ```
  (pos '(100 100 -100))
  ```

  This puts the light at (100, 100, -100) when added to the scene.

- A `Light` can have a color specified:

  ```
  (color red)
  ```

  This will make our `Light` produce red light instead of the default white.

- The light's intensity ranges from 0 (no light produced) to 1 (a very bright bulb), and is set with the `intensity` message:

  ```
  (intensity 0.4)
  ```

  By default, the `intensity` is 0.5.

We have used Mead's built-in `bulb`, which is defined internally by Mead as follows:

```
(object bulb Light
        (color white))
```

Since the default color is white, Mead could just as well define `bulb` as:

```
(object bulb Light)
```

The bulb takes on the default position at the origin and `intensity` of 0.5.

We have also seen that we can use this default bulb and send it the `translate` message to move it to the desired point in our scene:

```
(tell scene
      (add bulb (translate 100 100 -100)))
```

This creates a Mead `bulb` at the origin then translates it to (100,100,-100).

We could scale or rotate our `Light`s, but this would have no effect.

We can now take a look at Mead's default `scene` definition:

```
(object scene Group
      (description "The main scene.")
      (add bulb (translate 0 300 -300))
)
```

When we redefine the `scene` as an (initially) empty group:

```
(object scene Group)
```

we no longer have the default bulb at (0,300,-300).

Style tip:

Keep the lighting of your model separate from the obejcts you place in the scene. One way to do this is to create a `Group` (perhaps named `Lighting`) that defines all of your light sources. You can then easily add this to your scene.

Spotlights

We can also define and add directed point sources of light, called `Spotlights`, to our models.

In addition to the position, intensity, and color attributes, we can define other characteristics of a `Spotlight`:

- Center of interest: much like the center of interest we have seen on the `Camera` object, this is where the point source of light is aimed:

  ```
  (coi '(100 100 0))
  ```

  This will aim our `Spotlight` at (100,100,0). By default, a `Spotlight` is aimed at the origin.

- Radius: the half-angle of the main (fully illuminated) part of the cone of light. This will define the size of the brightest part of the "spot" produced by the light when it strikes an object.

      (radius 15)

  The radius can be a value between 0 and 90. The default radius is 10 degrees.

- Falloff: an angle that describes how wide of a fading area is produced between the main part of the cone of light and the unilluminated area.

      (falloff 10)

  The default falloff is 5 degrees.

See Example:
/home/jteresco/shared/cs110/examples/Spotlights