Assignment 1b Report

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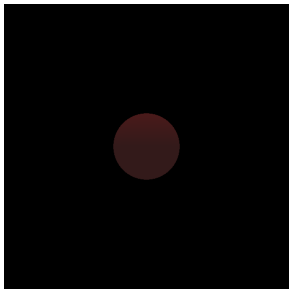
I've covered the effects of material properties and different lighting, including spotlights, to create shadows, including soft shadows.

1 Material Properties

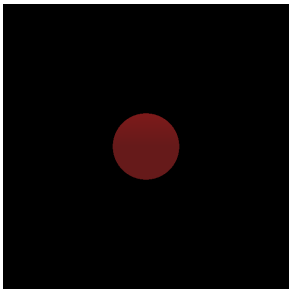
We analyze a sphere at $(0.0, 0.0, 0.0)$ with a radius 3.0. A directional white light source is used. $O_s = (1, 0, 0)$ and $O_d = (1, 1, .6)$. k_a, k_d, and k_s are varied.

1.1 Ambient Term

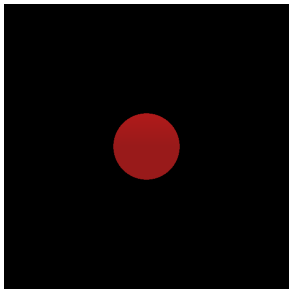
By increasing k_a with $k_d = .1$, $k_s = .1$, and $n = 0$, we see that the sphere looks more like a circle.



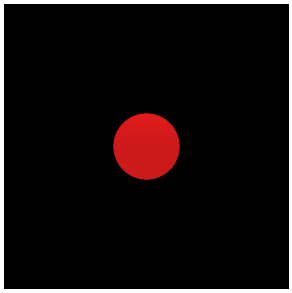
(a) $k_a = .2$



(b) $k_a = .4$



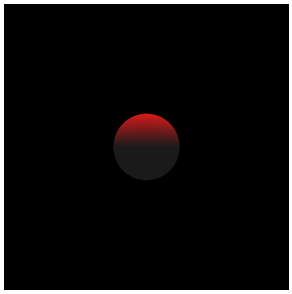
(c) $k_a = .6$



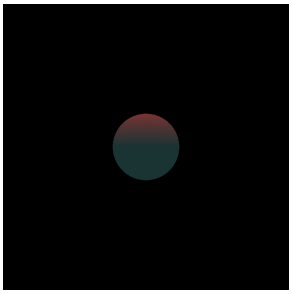
(d) $k_a = .8$

1.2 Diffuse Term

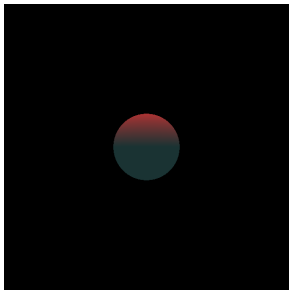
By increasing k_d with $k_a = .1$, $k_s = .1$, and $n = 0$, we see that the diffuse color becomes more apparent.



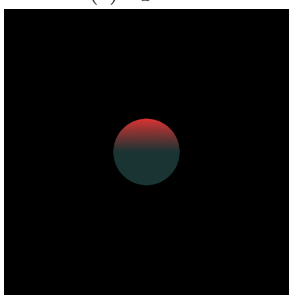
(a) $k_d = .2$



(b) $k_d = .4$



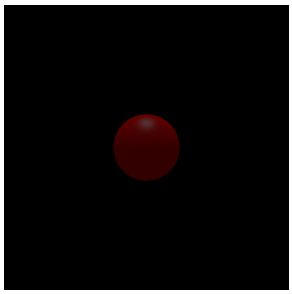
(c) $k_d = .6$



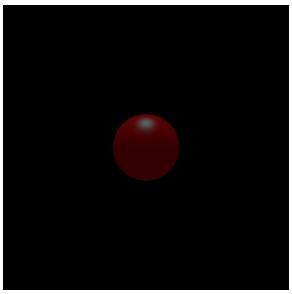
(d) $k_d = .8$

1.3 Specular Term

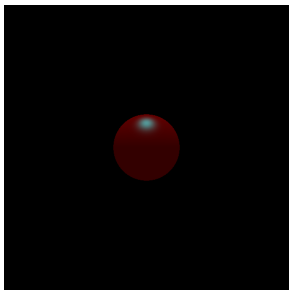
By increasing k_s with $k_d = .1$, $k_a = .1$, and $n = 30$, we see that the specular pattern becomes more apparent.



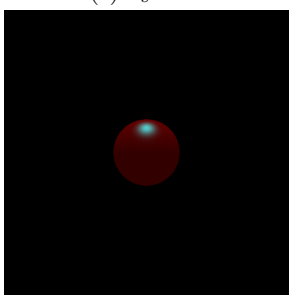
(a) $k_s = .2$



(b) $k_s = .4$



(c) $k_s = .6$

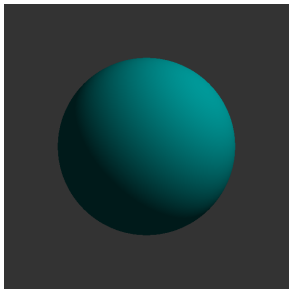


(d) $k_s = .8$

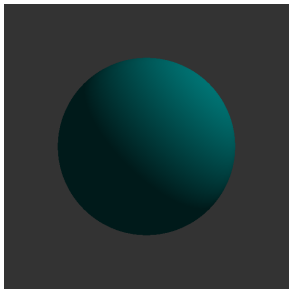
2 Lighting

2.1 Point Light

As the point light source moves towards the object, the narrower the illumination.



(a) Far from object



(b) Closer to object

2.2 Directional Light

Unlike point light sources which have a location, directional light sources only have direction.

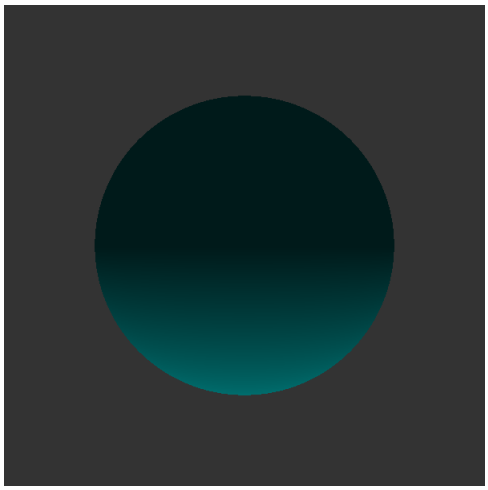


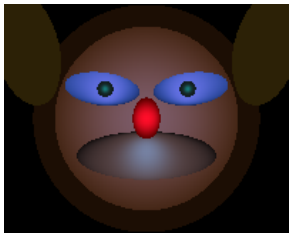
Figure 5: Directional light pointing from bottom to top

2.3 Spot Light

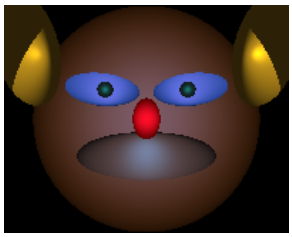
Spot light has a particular location in space, a direction which corresponds to where the light is points, and an angle corresponding to how wide is the spotlight beam. When increasing angle with $\theta = 10, 20, 25, 40$ the spotlight illumination area increases. When changing the direction to point to the left and right with $\theta = 10$ the spotlight illuminates surfaces at the left and right.

(a) $\theta = 10$

(b) $\theta = 20$



(c) $\theta = 25$



(d) $\theta = 40$

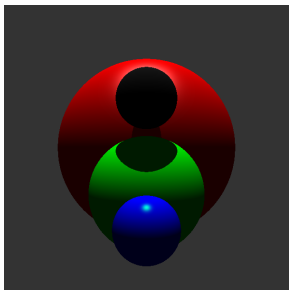
(e) $\theta = 10$ and light points to the left

(f) $\theta = 10$ and light points to the right

3 Shadows

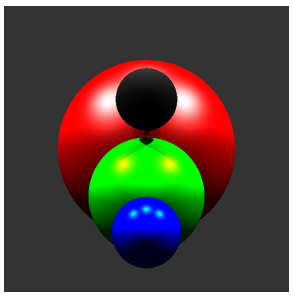
3.1 Hard Shadows

We see the black sphere cast a shadow on the red and green spheres. If there's only directional light then the shadow is vertically casted down on the green sphere. When we also introduce a point light-source on the right, the shadow gets casted to the left on the red sphere. When we also introduce a point light-source on the left, the shadow area gets diminished because of a wider area of illumination but there is also an apparent shadow that gets casted to the right with the darkest shadow at the intersection of left and right shadows.



(a) Only directional light

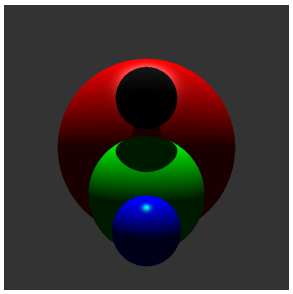
(b) Directional light with one point source light at the right



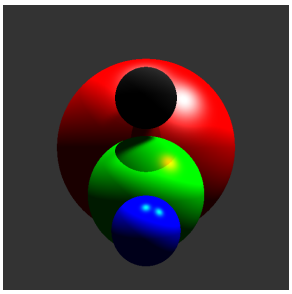
(c) Directional light with one point source light at the right and one at the left

3.2 Soft Shadows

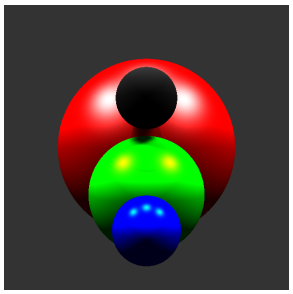
For soft shadows the same scenes as that of hard shadows were used but with an approximated area light-source instead of a point light-source. Soft shadows and hard shadows are the same for directional light. When we also introduce a point light-source on the right, a soft shadow gets casted to the left and feels more "natural". Similarly when we also introduce a point light-source on the left, a soft shadow gets casted to the right and feels more "natural", but because of the wider area of illumination, the shadow area is reduced. The soft shadows we created by approximating point light-source with diameter 2.0 with a bundle size of 480.



(a) Only directional light



(b) Directional light with one point source light at the right



(c) Directional light with one point source light at the right and one at the left