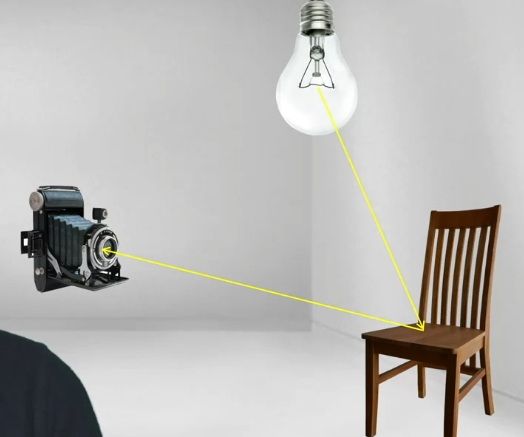
A picture containing text, pool ball, ball

Description automatically generated

Lighting can make it look more round



A picture containing icon

Description automatically generated

So a directional light doesn't have a position, it doesn't matter how near or far you are to the directional light. It just matters what direction it's facing relative to you.

Diagram

Description automatically generated with medium confidence

Point light, it has a position, but it doesn't have a direction, like just flows in every direction from the light source. So here the lighting is really going to be influenced by how near or far you are from the light source. Good for lamp

Diagram

Description automatically generated with medium confidence

Spotlight has a position and a direction and light only flows out in a certain cone. So, it's like a spotlight in the theater, it's it's quite a narrow focus light that only shows shines on a certain spot. Except that the further the light is away, the wider the area covers because it's a cone.

A picture containing shape

Description automatically generated

Ambient light is just a little bit of a hack to get around that, which is that you're just applying, like everywhere. You apply a certain amount of light to everything wherever it is, irrespective any in light source, it doesn't even have a position. So, it's a nice way of modeling those lights, it's not very realistic.

Graphical user interface, text, application

Description automatically generated

Shape, circle

Description automatically generated

First -> Doesn’t reflect light

Second -> Diffuse material, light is bouncing off the object and then bounces in every direction.

Third -> spectacular illumination, much more direct illumination. So lighting coming off a mirror bounces off in exactly the same direction or sort of exactly the same angle at which it bounces back but in the opposite direction. And that means that you can actually see things in a mirror because it's so exact.

Last -> Color, color is an object only reflects certain wavelengths of light. So a blue object will actually absorb all the green and the red wavelengths and only reflect the blue objects as you can see in this example.

A picture containing icon

Description automatically generated

A picture containing logo

Description automatically generated

Graphical user interface

Description automatically generated

Graphical user interface, application

Description automatically generated

Chart

Description automatically generated

A picture containing shape

Description automatically generated

Diagram

Description automatically generated

Diagram

Description automatically generated

A picture containing text, clock

Description automatically generated

Point B has the light source almost right on top of it, which means the surface normal at point B almost overlap with light ray from that point. So point B receives a lot of light, but for point A, the light casting on a surface where A is is from a bigger angle. Or in other words, the surface normal A really points away from the light source, so A does not receive a lot of light.

Diagram

Description automatically generated

where the intensity of the light at a certain point is proportional to the cosine value of the angle between the surface normal and a light ray.

Diagram

Description automatically generated

Diagram

Description automatically generated

Graphical user interface

Description automatically generated with medium confidence

Chart

Description automatically generated with medium confidence

Diagram

Description automatically generated

Graphical user interface, text, application, chat or text message

Description automatically generated

Diagram

Description automatically generated

Diagram

Description automatically generated

Diagram

Description automatically generated

Chart, bubble chart

Description automatically generated

For diffuse coefficient k\_d, we know that as k\_d increases, more lights are reflected. The same applies to k\_s, the bigger the k\_s is, the more lights an object reflects.

Chart, bubble chart

Description automatically generated

Because the maximum value of h dot n is one, this guarantee that the middle point is always highlighted, but as the point of interest shifts away from the center, where the pure specular effects applies, h dot n will be getting closer to zero, where the highlight vanishes. The higher m is, the more quickly this highlight effect vanishes, the smoother the highlight point is. The bigger m will give a more specular looking surface.

Chart, bubble chart

Description automatically generated

Graphical user interface, text, application, Teams

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Diagram

Description automatically generated

Diffused lighting doesn't depend on the viewer angle, though specular lighting will depend on the viewer angle.

Text

Description automatically generated

return OUT

Graphical user interface, text, application

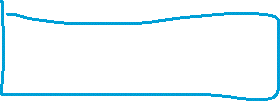
Description automatically generated

A picture containing graphical user interface

Description automatically generated

Diagram, text

Description automatically generated



## Ambient light

Graphical user interface, text, application

Description automatically generated

Text

Description automatically generated

Can get all the light then loop through the light

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application, letter

Description automatically generated