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CSCI-711-01 Global Illumination
Weekly report for Week #9

The Rendering Equation:
While methods to completely model physical world do exist, Kaija's equation attempted to simplify these without reducing their realism. Even though the equation is simpler, it still requires an incredible amount of power to run effectively, and it needs to be tuned in order to not run infinitely. The equation is so computationally expensive because for each given point that is under investigation, every object can contribute to the point -- the integral over S.

To measure how much an object contributes to another object, we used the emittance term to measure the amount of energy emitted by one surface to another. To completely measure an object's energy contribution to another object is very difficult to accomplish, so instead of using a complete BRDF, we use the relationship between the unoccluded three point transport reflectance, and the ordinary total directional reflectance (eq. 13).

In order to sample the integrand, a monte carlo technique is implemented in order to take solve the solve the equation. The most effective way to sample is to use nonuniform sampling -- importance sampling. A hyperplane is now chosen to split the scene up based on importance rather than simply splitting it into equal sized chunks.

An Improved Illumination Model for Shaded Display:
Most of the illumination models only take into consideration the light source and surface orientation, while ignoring the other objects in the scene. Ignoring the other objects in the scene only give us local illumination. Having the ability to use information of every object in the scene for a given point is the basis behind global illumination.

The Phong equation that we know and love is still used to calculate the local illumination, but two new components are added: transmissive and reflective. The transmissive component calculates how much light is transferred through the object, while the reflective is how much light is reflected off the object. To control these two components, coefficients are added the the equation that calculates them in order to increase or decrease these properties.

Rendering a scene can take advantage of a tree structure. One pass of the renderer can create this tree with what various rays will be spawned. If the tree is then saved, modifications to any of the illumination variables can be made, and the renderer only needs to use the tree to traverse the scene rather than recreate the entire scene from scratch.