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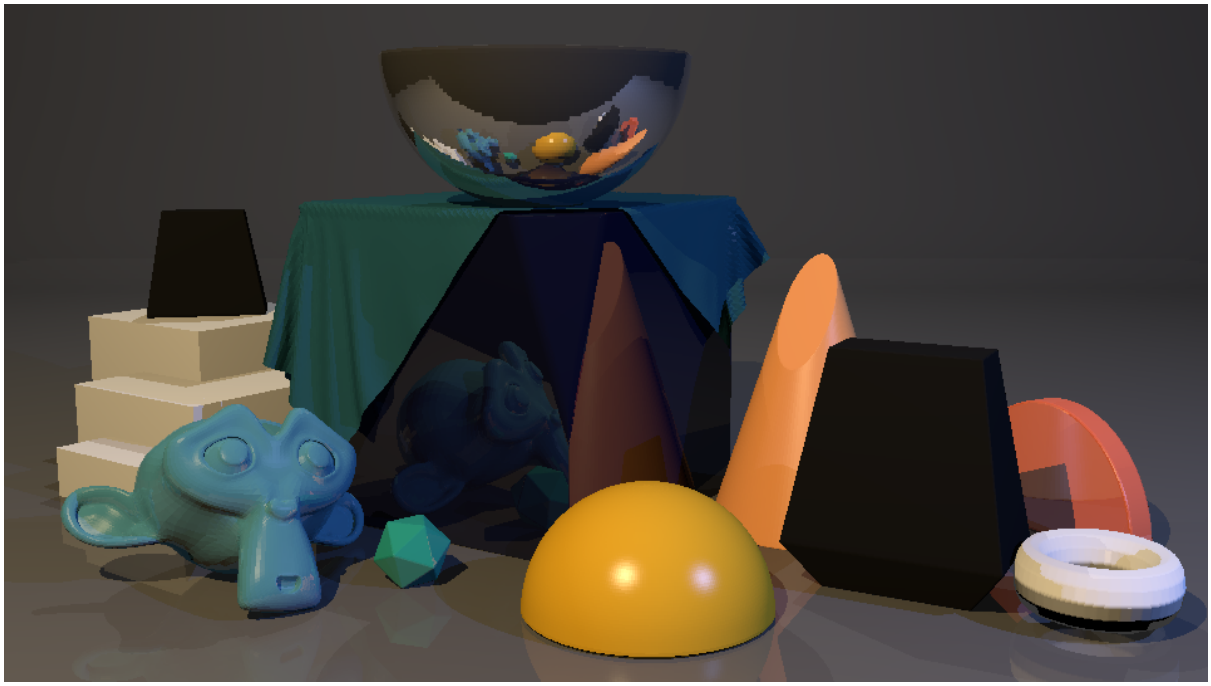
CMPE 360: PROJECT 5 REPORT

PART 1

A. Save the image with reflection and add the screenshot of it on your pdf file.
B. Explain your process and effect of reflection.



1. **Process:** First, we calculated the direction of the reflected ray using the reflection formula.

   D_reflect = ray_dir - 2 * ray_dir.dot(hit_norm) * hit_norm

   where ray_dir is the incident ray direction, hit_norm is the surface normal, and D_reflect is the reflected ray direction. Then, we normalized D_reflect to maintain the correct lighting calculations. To calculate the color contribution (reflect_color) from the reflected ray, we iteratively monitored the reflected ray using the RT_trace_ray function.

2. **Effect:** Objects with reflective properties began to reflect its surrounding objects and environment.

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PART 2

A. Save the image with fresnel and add the screenshot of it on your pdf file.
B. Explain your process and effect of fresnel.

1. **Process:** If the Fresnel is enabled (mat.use_fresnel), we should calculate the Fresnel reflectivity using Schlick's approximation. To do this, we calculated R0.

   R0 = ((n1 - n2) / (n1 + n2))2**

   where n1 is the index of refraction of air (1.0) and n2 is the material's index of refraction (mat.ior). Next, we calculated the final reflectivity using Schlick's approximation formula.

   reflectivity = R0 + (1 - R0) * (1 - cos_theta)5**

   where θ is the incident angle.

2. **Effect:** Materials with different angles according to the camera's point of view will exhibit varying reflectivity, with surfaces becoming more or less reflective than before depending on their orientation.

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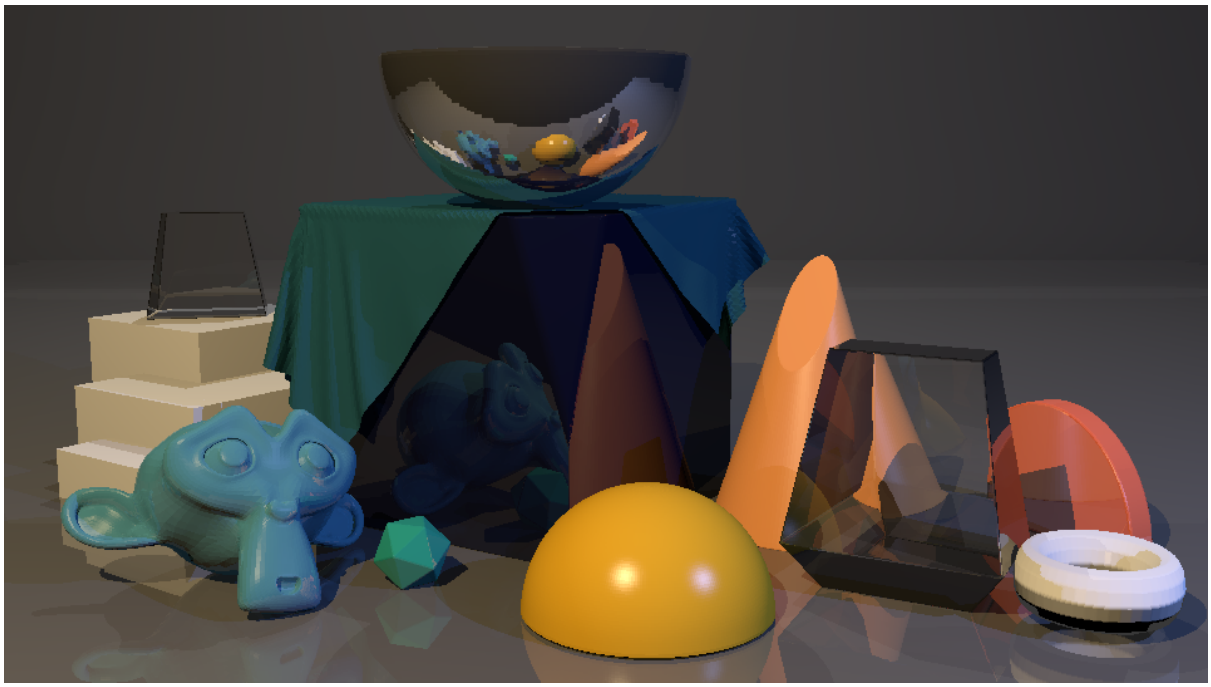
PART 3

A. Save the image with transmission and add the screenshot of it on your pdf file.
B. Explain your process and effect of transmission.

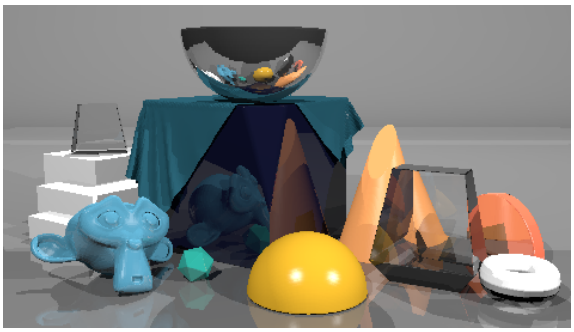


1. **Process:** We determined the direction of the transmitted (refracted) ray according to the transparency of the material. The calculation includes the refractive index of the material and the incident angle of the ray hitting the surface. Then, we calculated the color contribution of the transmitted rays. This contribution depends on the transparency of the material and the color / intensity of the transmitted light.

2. **Effect:** Transparent objects, such as glass, will begin to refract light allowing the viewer to see objects through these materials, affecting their appearance based on refraction. As a result, they will have a transparent appearance.

TESTING

When we finished coding, we realized that our outputs were not the same with the expected outputs. The problem was in TODO 1. We wrote light_dir.normalize() instead of light_dir.normalized(). So, we changed and fix it.



(before changing the code)

(after changing the code)