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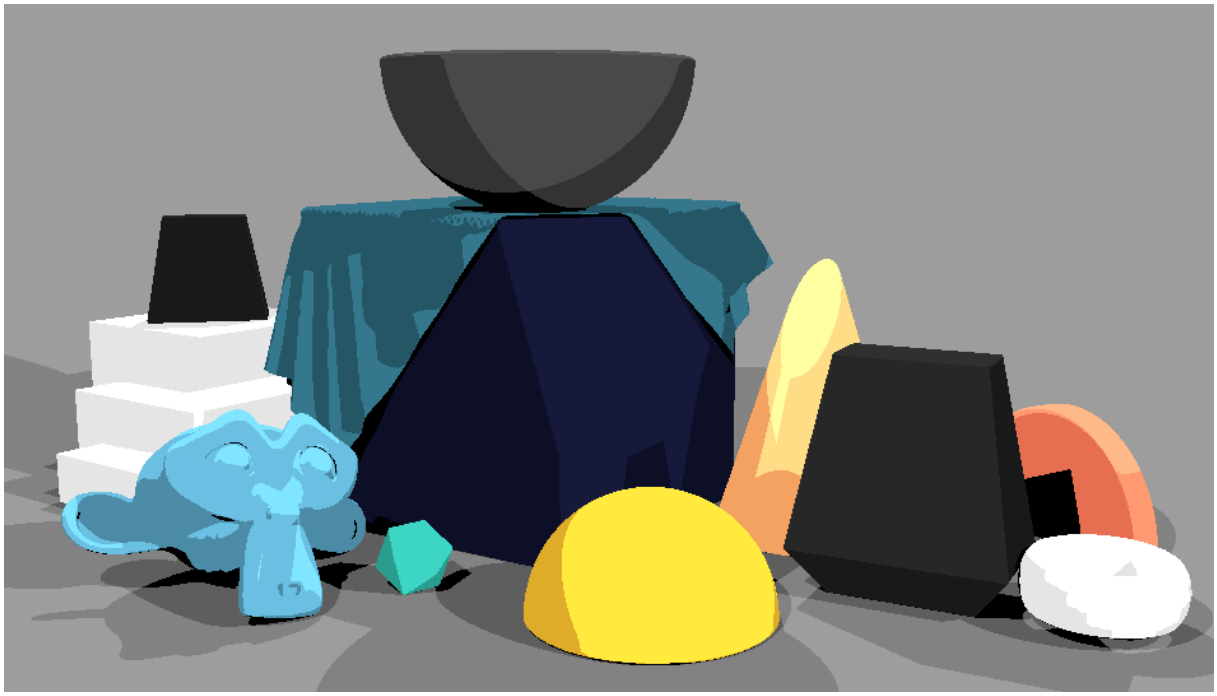
PROJECT 4 REPORT

PART 1

• Save the image with shadow-ray and add the screenshot on your pdf file
• Explain your process in detailed and effect of shadow-ray.

Shadow Ray:

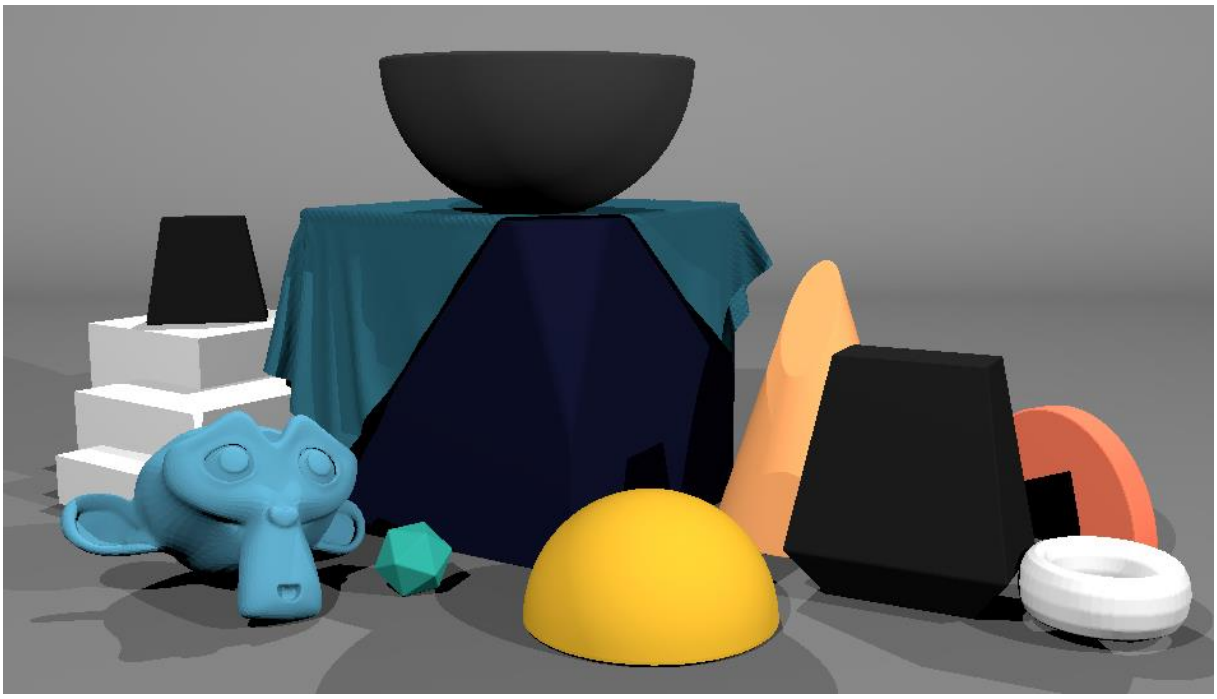


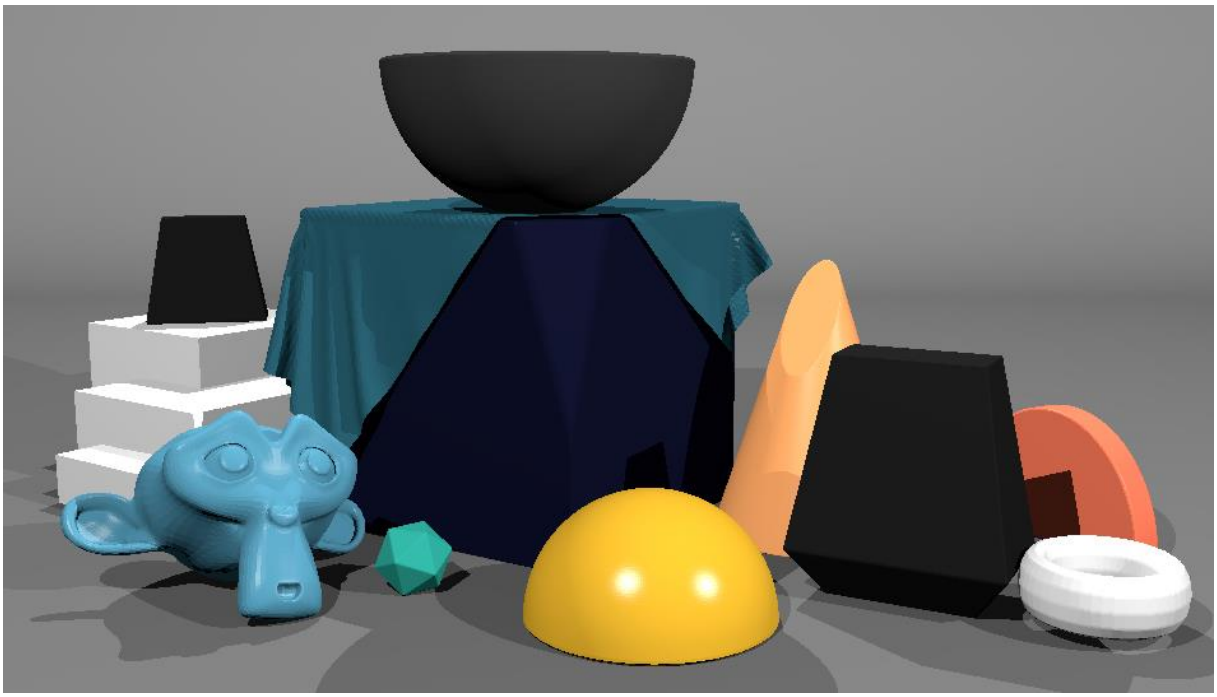
By using shadow rays to render a scene, we can create a more realistic image by accurately depicting which points on surfaces are in shadow, which creates a more realistic image. To execute this approach, we start a shadow-ray with the intersection point of our initial ray from the camera and the object as its starting point. The shadow-ray then attempts to reach the light we are inspecting (there may be several cameras, but we inspect each one individually). Here is a step-by-step explanation of what have we done:

1. First, we calculate the **direction vector** (light_vec). This vector corresponds to the direction of the light source from the surface point where the camera's first ray intersected an item.
2. Then, we create a copy of the light_vec (the direction vector) and convert it to a unit vector. In other words, we keep the normalized value as a vector named **light_dir**.
3. Calculate the origin of the shadow ray: (**new_orig**). To prevent self-occlusion, the shadow ray's new origin is calculated and shifted slightly from the surface's intersection point.

PART 2

- Save the images with Blinn-Phong diffuse-shading add the screenshot on your pdf file.
- Save the images with Blinn-Phong specular-shading add the screenshot on your pdf file.
- Explain the Bling-Phong effect on your image and explain your process in detailed.





Bling-Phong model is used to obtain a more accurate image in terms of lighting, shadows and reflections. We acquire these results by implementing diffuse & specular shadings, leading to a more realistic rendering. It affects our image by making shiny surfaces more accurate and

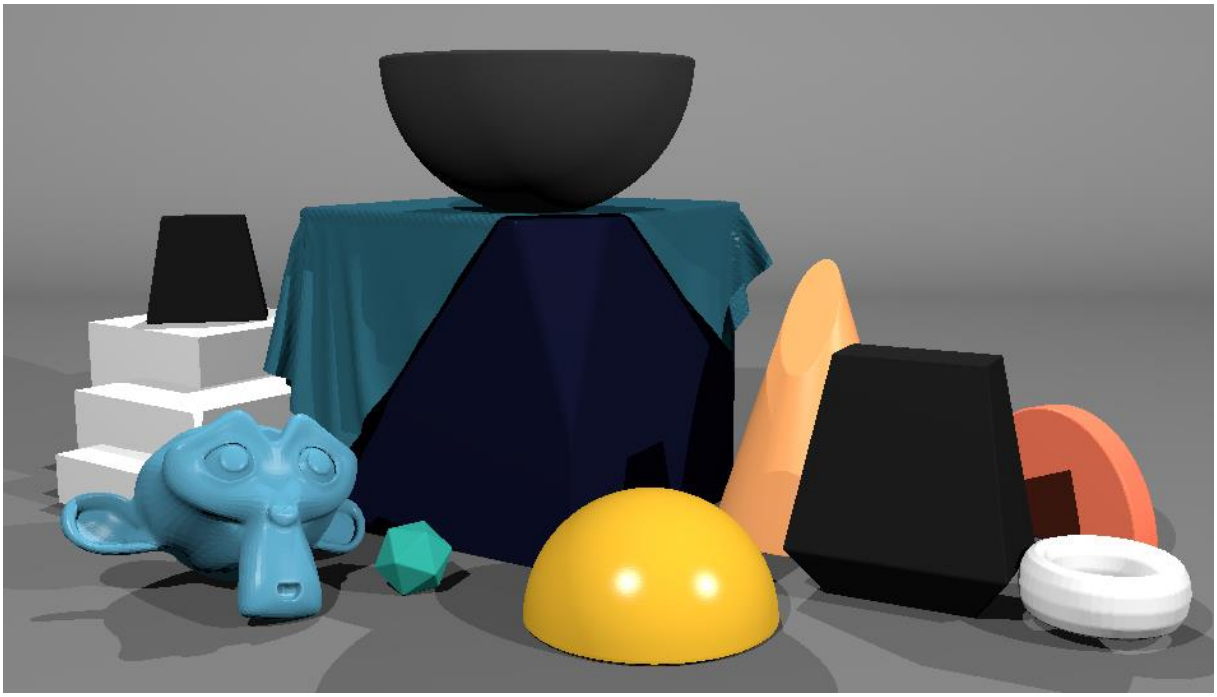
realistic. It also enhances the diffuse effects, leading to more realistic light scattering for objects. Here is a step-by-step explanation of what have we done:

1. We calculate the diffuse component (I_diffuse). This is a representation of the light hitting the surface and dispersing in various directions, which gives the surface its overall color. It can be determined as the product of the material's diffuse color (diffuse_color), light intensity (I_light), and the dot product of the surface normal (hit_norm), light direction (light_dir).
2. We calculate the diffuse component (I_specular). This is a representation of light hitting the surface and reflecting in a certain direction to create shiny highlights. It can be calculated as the product of the material's specular color (specular_color), light intensity (I_light), and the dot product of surface normal (hit_norm) and half vector (half_vector) raised to the power of the specular hardness.

After calculating these two components (I_ diffuse and I_specular), they are added together to get the final color of the pixel (color).

PART 3

• Save your image with ambient light and add the screenshot on your pdf file
• Explain your process and effect of ambient light.



Thanks to ambient light, a small amount of light is scattered around our entire scene, even in the complete shadows. Because of that, we ensure that we don’t have completely dark shadows, very similar to what we observe in real life also. By adding ambient light to our scene, we achieve more realistic images with lifelike shadows. These shadows have a touch of

illumination, not from a direct light source, but from light indirectly reflected off nearby objects or surfaces. Here is a step-by-step explanation of what have we done:

1. First, we check whether any light is hitting the surface or not. If none, than we add the ambient light to the object's color, indicating that the surface is not directly lit by any light source, but an ambient light reaches to that surface. We calculate the ambient light (I_ambient) as the product of the diffuse color of material (diffuse_color) and the ambient color (ambient_color).