COMP 313 - Computer Graphics
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Research on Lighting

In this project, I decided to do my independent research on lighting using Blender. One of the reasons is that this topic is not covered in our lectures, and I am pretty curious about how to set the sun or the light in the scene. Furthermore, from my experience, directors will use light with a cool tone when the scene is sorrowful, and light with a warm tone in a cozy situation. Therefore, I believe that lighting is fundamental in recording video, especially in the film industry, because it creates a visual mood and atmosphere for the audience.

During the research, I learned that there are several attributes for me to adjust and look for when dealing with lighting. First, we have to get accurate brightness by changing the intensity of the light. By adjusting the intensity of the light, we can balance the harshness of light and how much indirect light is bounced from a light source, and then we can simulate real-life lighting using the proper intensity and exposure scale. Secondly, we can take control of the size of the light source, which will directly affect the highlights and shadows of the object it shines at. For example, light with a smaller size will create sharper shadows, while light with a larger size will generate a softer shadow. Thirdly, the color temperature will directly affect the realism and the mood of the scene. Changing the exposure values of the environment light will change the dullness and sharpness of the shadows and highlights. A low exposure value will give a blurrier result that lacks highlights or shadows compared to a scene with a high exposure value.

Relevant properties and objects of Blender

The relevant objects of Blender for my research are the light objects, and there are four categories: point, sun, spot and area lights. In this section, I will define each type of lights and the properties related to them.

A point light is like a light bulb, which is a point that radiates the same amount of light in all directions. The surface that is further away from the point light will be rendered darker, since the light intensity decays based on the distance from the point light to the object. Under the properties of point light, we can adjust the power and radius, which one controls the intensity of the light and the other controls the size of the light. The sun light will emit a single direction light from infinitely far away, and we can increase or decrease the strength and angle of the sun light. The strength is in watts per square meter, and the angle is the measurement according to the angular diameter as seen from earth. The spot light emits the light in a cone shape in a specified direction. Lastly, the area light simulates the light that emits from a surface, like a computer screen or a window. Therefore, for the properties under the area light, we will have an additional option to choose what kind of shape we want for the light.

My experimental activity and products.

In my project, I mounted five lights along the runway to create a bright and warm atmosphere for the plane to depart and arrive, and one spot light that shed at the area where my plane starts and ends. I placed a realistic sun using the sun light object at the border of one side of the world, a realistic moon on the other side of the world, and shining stars in the sky. I also made the runway using glass material, which can do some amazing light reflections. I will discuss the implementations in the following section.

Blender-specific implementation

I created the five light objects along the runway to be five area lights that shed light in squares since the runway is a quadrilateral shape. I then changed the color of the area lights into five warm tone colors by clicking the color button under the object data properties tab, so that I created a welcoming and relaxing atmosphere for the plane to depart and land. I also designed the color in green, yellow, orange, red, and purple because this is the same order as in the RGB model. In this order, the light colors can blend well at the borderlines. I then added another light object that is pointed at where the plane starts and ends, and increased its intensity by clicking on the power button under the object data properties section. Therefore, it illuminates my plane at the starting position and focuses the audience's attention on the plane.

I also constructed a realistic sun using the sun-light, which will make a sun visible to the audience. I first add a sun-light object, and then cursor select the light. Then, I add a UV sphere mesh at the cursor position, and smooth it out by adding a subdivision surface under the modifier properties section. After the subdivision surface is added, I increase the level properties so that the surface of the UV sphere is smooth. Then, I add a material to the sphere and set the surface property to emission, so that the sphere will have the ability to shine. Next, I added two empty spheres (by clicking add → empty → sphere) and one at the world origin and one around the sun. Then, I set the sun as the parent of the sphere, and then set the empty object that's around the sun as the parent of the sun. After that, I clicked on the sun, and go to its object constraint properties, and added a constraint that tracks to the empty object at the origin. This step allows us to move the sun around while still keeping it's light shining to the origin. Therefore, I have created a realistic sun that shines. The moon and stars are using the same implementation by adding a texture with emissions.

For the runway, I created it with a cube mesh, and then reformed it into the size I wanted. Under the material tab, I set the transmission to 1 and roughness to 0 to ensure the shader refracts light. Then, go to the render properties tab and turn on the screen space reflections and refraction to make the object glossy and able to transmit light. Lastly, go back to the material tab and check the screenspace refraction box under setting, and we will get a glass-like runway.

Throughout this project, I feel like I am very comfortable with creating models using Blender. Moreover, I enjoyed how Professor Schiffer teaches us to use the text editor to control the objects and their motion in the Blender, which is fascinating and is also something I want to keep working on in the future.