Design Decisions

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For my scene, I created a room with an arcade machine, a stool, a soda can, and a floor lamp. This allowed me to utilize several primitives and get creative with each object. I also tried to balance the lighting and material properties to create a realistic scene. Starting with the room itself, the floor, ceiling, and walls are each a plane. When creating textures, it allowed me to add more detail to the walls, such as trim for the floor and ceiling (both copied over and rotated in paint), along with wood panels. I could also copy over a wallpaper design to give it some definition.

The first object I created in the room was the soda can. I utilized a tapered cylinder mesh, flipped upside down and without a bottom drawn as the base of the can, with an aluminum texture and material effect applied to it. The body of the can was created as a cylinder mesh, which was then rotated so that the texture with writing on it would face the camera. On top of this, I placed a half sphere to simulate the neck of the soda can, which is curved, having the same red texture applied but without the text written on it.

From there, I needed to add a flat cylinder for the top of the lid, where I applied a texture containing the pop tab aluminum parts. This didn't look realistic as is, and required a lid rim going around the top that could also help merge the half sphere with the lid. The default torus settings when loading the mesh needed to be modified so that the tube radius was smaller for my purposes. This allowed me to create what I would consider a mostly realistic looking soda can.

For the stool/chair, I remember the leg positions and angles being a bit annoying since they all required being tilted. I used a metal texture for all four legs, each made of a cylinder, with a torus foot ring, and a cylinder seat cushion using a leather texture.

The lamp object has been modified at each stage. I utilized a flat cylinder as the base, with a tapered cylinder on top of that connecting it to the elongated cylinder pole. All of which I reused the leather texture. On top of the pole, I placed a metal cylinder texture socket for the bulb, with a small cylinder mesh rotated on the side to mimic a light switch. For the bulb, I switched back to simply using the shader color to simulate a bright bulb. This is the main location of two of my point lights, on both sides of the bulb, which required a lot of adjustment to get it looking accurate.

I also added two different torus metal texture hoops, which would be typically used to support the shade, along with a sphere mesh emblem on top of that. The lamp shade itself is made out of a tapered cylinder mesh with only the sides drawn and a linen texture applied to it. I feel that the resulting output has a realistic look.

For my final object, the arcade machine, I went with several different combined primitives to build all of it. The base is just a big box with a themed Tekken texture and material applied. I used a coin slot texture plane mesh overlay on the front of it. On top of the base box, I created a thin box, which comes out further in the front, acting as the base for the control pad and screen box. For the control pad, I created a prism to put on top of the thin box, so that I have a slanted control pad. I also experimented with this part by using mirrored repeat for the texture wrap. Then I added another prism on top of the prior prism, to create a flat surface for the screen box.

From there, I added a screen box, also using the same Tekken themed texture, with a plane for the screen on the front of it. The plane uses a Tekken themed screen-shot and has a point light source emitting a blue/purple colored light at the top of it. Then on top of the screen box, I had the final thin box simulating the top of the arcade machine.

I added trim to the left and right sides of the front and control pad area, all thin box meshes, utilizing a metal texture. And I created the control panel by adding a flat cylinder base for the joystick, a thin cylinder for the joystick rod, and a sphere for the joystick sphere; all reusing prior textures such as aluminum and the soda can's red texture. The buttons and their base are all flat cylinders with a yellow texture applied.

Each of these full objects I made modular by separating into their own methods and then calling each Render’Object’ inside PrepareScene, which allowed me to minimize methods I'm not working on and easily find what I need without scrolling through a wall of code. With the benefit of each object being separated and reusable, although with minor adjustments to the positioning to move them around.

There are various features to help users control and navigate the scene. The ESC key exits the app, W, A, S, and D control space movement (forward, left, backward, right) while the view angle is controlled by mouse movement. Q and E were added as additional camera movement options for up and down space movement. The Right Mouse Button is a toggle for zooming in and out. The Left Mouse Button is a toggle for a flashlight, which is a spotlight. And the Middle Mouse Button (scroll wheel up/down) changes the movement speed for space movement through W,A,S,D to be slower or faster.

In addition, I added different projection views, such as Orthographic and Perspective. O is orthographic front view, I is orthographic side view, U is orthographic top view, and P is perspective view.

This required various custom functions, such as callback functions for resizing the screen, mouse button (LMB/RMB) effects, and scroll wheel detection for movement speed adjustment. We also had to add methods for creating and deleting textures, setting up lighting, and defining material properties, all of which can be reused in other projects. The base project with or without the scene created could be used for learning OpenGL further by modifying it and adding more features.

Overall, I felt that the 16 texture limit did force me to rethink design decisions. Which is one of the first adjustments that would be required to extend the project. I’ve researched options such as atlas textures, texture arrays, and bindless textures. This would then allow me to add texture maps for diffuse, specular, and emission. With emission maps, I could create glowing objects. And as we go further, creating a simple 2D or 3D game would provide the opportunity to put everything we’ve learned and more into practice with a fun and interactive project.