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**CS 330 Final Project**

**Reflection Document**

**Development Choices and Object Representation**

For my CS 330 final project, I selected a 2D image of my nightstand featuring several personal items: a lamp, an Echo Spot, an Owala water bottle, an iPad, and a desk organizer. My goal was to create accurate, low-polygon 3D representations of these objects using primitive shapes like boxes, cylinders, planes, and spheres.

The lamp is composed of multiple primitive shapes: two spheres for the base, a cylinder for the neck, and a larger cylinder for the lampshade. The Echo Spot is represented with a simple sphere, colored matte black to resemble its plastic body. The Owala bottle includes a tall cylinder for the body and a sphere for the cap, using dark textures to mimic the real item. For the iPad, I used a flat box to form the device, then overlaid it with a textured box using a royalty-free image to depict the home screen. I also created a subtle light source near the iPad to simulate screen glow, which adds realism and ambiance to the scene. Finally, the desk organizer was built using a box base, four box walls, and a series of inner dividers (both vertical and horizontal) in varying lengths, placed to resemble compartments inside a real organizer.

All 3D models used minimal polygon counts and were kept under 1,000 triangles each. I relied heavily on the box, cylinder, sphere, and plane shapes, meeting the four-shape requirement. Only one object—the lamp—used multiple primitive shapes to complete the structure.

**Textures and Lighting**

I applied multiple high-resolution textures to enhance realism. The lamp base uses a “lampbase.jpg” texture, while the Echo Spot is a solid matte color. The Owala bottle uses a “black.jpeg” texture for the body and a custom color for the cap. The iPad includes a screen texture (“ipad.jpg”) and was given a white border to replicate the bezel. The desk surface is a textured plane using “crackedpaint.jpg.”

Lighting was implemented using three point lights. The main light is positioned near the lamp to simulate ambient room lighting with a warm tone. A second point light is placed near the Echo Spot to provide soft accent lighting. The third is a bluish-white light near the iPad, which mimics screen glow and helps illuminate nearby objects. I used all three components of the Phong shading model—ambient, diffuse, and specular—to enhance realism.

**Scene Organization and Camera Navigation**

Each object was carefully placed to match the perspective and layout of the original 2D photo. I used X, Y, and Z coordinates to align the lamp on the far left, the Echo Spot near the center back, the Owala bottle on the right, and the iPad on the front right. The desk organizer is placed between the lamp and the iPad, slightly behind both.

Camera navigation includes WASD keys for horizontal and depth movement, and QE for vertical motion. Mouse movement allows the user to adjust pitch and yaw, enabling full scene exploration. Mouse scroll adjusts camera speed, giving fine control during navigation. A keyboard toggle allows switching between perspective and orthographic projection, enabling the viewer to see the scene in both 3D and flattened 2D views.

**Code Organization and Custom Functions**

I wrote all shape rendering logic directly within the RenderScene() method. I did not create custom reusable functions for each object, which limited modularity but allowed for precise control over placement and transformation. Code formatting follows best practices with proper indentation, spacing, and consistent naming conventions. Each object was created using calls to SetTransformations(), SetShaderMaterial(), SetShaderTexture() or SetShaderColor(), followed by the appropriate DrawMesh() call.

**Reflection**

I chose these objects because they were personal and familiar, which helped guide accurate modeling. Matching the layout from the image required adjusting transformations repeatedly and refining positions. The iPad glow effect was especially effective for realism, and the custom-built desk organizer gave me a chance to creatively use simple shapes for a more complex structure. While I didn’t encapsulate objects into separate functions, I now understand the benefit of doing so and will apply that approach in future projects.

The final result meets all project requirements and reflects a functional, interactive, and visually accurate 3D scene developed using OpenGL and C++.