Design Decisions Document

In this project, I set out to create a 3D scene that captures the essence of a creative workspace, inspired by my daughter's arts and crafts desk. The scene includes various objects such as paper, a pencil, a marker, a paintbrush, a palette, scissors, a cup of water, and a camera. This document details the design decisions made throughout the project, the challenges encountered, and the solutions implemented to meet the project requirements.

Object Construction and Transformation

The construction of complex 3D objects was a key focus of this project. For the pencils and markers, I utilized a combination of cylinders, cones, and tapered cylinders. The pencil bodies were represented by cylinders, while the tips were crafted using cones. This approach allowed for a realistic representation of these objects. The markers followed a similar design, with the addition of a torus shape at the end to simulate the cap connection.

The scissors posed a unique challenge. Initially, I planned to use triangular prisms for the blades, but I later opted for cones to achieve a more streamlined appearance. The handles were created using torus shapes, which were rotated to lay flat on the table, ensuring a cohesive design.

Texturing and Materials

Texturing played a crucial role in enhancing the realism of the scene. I applied a wood texture to the pencil bodies to give them a natural appearance. For the pencil’s metal binding, I used a "metal" shader material and imported a "stainless-steel" JPEG from the textures folder for the torus rings. This choice was intended to mimic the metal holding the pencil body and eraser. On the pencil’s tapered end, I added a wood-grain texture to the tapered cone to make it look more like a sharpened pencil.

The paintbrush was another area where texture and shape manipulation added depth. The sphere at the tip was stretched and slimmed to resemble a paint bristle shape, and a texture image was applied to enhance its appearance.

The marker tip was another area where texture added depth. By applying a black leather texture, similar to the camera bag, and scaling the image down, I achieved a unique felt tip texture. This small adjustment in texture scale provided a distinct look that complemented the overall design.

For the camera, instead of creating a realistic model, I used the same box and cylinder shapes for the body and lens, texturing them with the black leather image. This decision transformed the camera into a fancy camera bag, adding an element of creativity to the scene.

Lighting and Scene Setup

Lighting was carefully considered to illuminate the scene effectively. I incorporated multiple light sources, including a colored light, to highlight the objects. The Phong shading model was employed to achieve realistic lighting effects, with ambient, diffuse, and specular components contributing to the scene's depth.

To create a cohesive environment, I added a background plane to serve as the "wallpaper" for the scene. Once the texture image was applied, it provided a backdrop that enhanced the overall aesthetic.

Camera Navigation and Viewports

Camera navigation was implemented to allow users to explore the scene interactively. The WASD and QE keys were used for basic movement, while the mouse controlled the camera's orientation. This setup provided a comprehensive view of the scene, allowing users to appreciate the details from different angles.

Additionally, I enabled users to switch between perspective and orthographic views using keyboard keys. This feature offered different viewing angles, enhancing the user's understanding of the 3D space.

Challenges and Solutions

Aligning the torus handles with the scissor blades was a significant challenge. I adjusted the rotation and position of the torus shapes to ensure they connected seamlessly with the blades. Texture mapping also required careful attention; initially, some textures appeared stretched. By adjusting the UV scale, I ensured the textures were applied correctly, maintaining the scene's visual integrity.

Conclusion

This project was a valuable learning experience, highlighting the importance of iterative design and testing. By continuously refining the objects, textures, and lighting, I was able to create a cohesive and realistic 3D scene. The project not only enhanced my skills in 3D modeling and OpenGL programming but also provided insights into the complexities of computer graphics development. The final scene captures the essence of a creative workspace, reflecting both the technical and artistic aspects of the project.