Design Decisions

This document outlines the design and implementation of my 3D scene using OpenGL. The project focused on creating a 3D environment, adhering to principles of organized geometry, efficient texturing, and effective lighting. The project involves modeling real-life objects such as a desk, a laptop, a lamp, a tissue box, a piece of paper with writing on it, and a coffee cup to create an office scene.

* Desk: The desk is the central element, constructed using a rectangular box for the tabletop and tapered cylinders for the legs.
* Laptop: The laptop is modeled as a simple box with a plane at the top. A metallic texture is applied to mimic the appearance of an aluminum-cased device.
* Lamp: The lamp consists of a cylinder for the base, a tapered cylinder for the stand, and a cube box for the lampshade.
* Coffee Cup: The coffee cup is modeled using a cylinder for the body and a brown sphere on top to mimic some coffee.
* Tissue Box: The tissue box is constructed as a simple rectangular box with a texture applied to simulate a patterned surface, adding to the scene's realism.
* Paper with Writing: A flat plane represents the paper, with a texture of handwriting text applied, adding a touch of detail to the scene.

Texturing plays a crucial role in adding realism. The desk is textured with a wood finish, the laptop has a metallic surface, and the lamp has a tile texture on the stand. These textures, applied at appropriate scales, enhance the visual fidelity of the scene.

Lighting is essential for creating depth and realism in my scene, so I used two main light sources and two additional ambient light sources to fill the room with natural light, for a total of four lighting sources. The primary light was the desk lamp which emitted a warm, colored light. The secondary light was a directional light that simulated sunlight, it was positioned to cast soft shadows and provide overall illumination. The lighting design employs the Phong shading model, incorporating ambient, diffuse, and specular components. Ambient lighting provides base illumination, diffuse lighting emphasizes the form and structure of objects, and specular lighting adds highlights to metallic surfaces, enhancing their realism.

Object placement was crucial to ensure a cohesive and visually appealing arrangement. The desk was positioned centrally in the foreground as the focal point. The laptop and lamp were placed on the desk, the laptop in the center, with the lamp to the left, creating balance. The coffee cup was positioned to the lower right of the desk, right below the tissue box. A plane shaped paper with handwriting was placed on the lower left of the desk. The planes that represented the wall and floor were placed a couple of inches away from the desk and below the desk.

Camera navigation is key to allowing users to explore the 3D scene. The camera moves along the X, Y, and Z axes with controls mapped to the WASD keys for horizontal movement, QE keys for vertical movement, and the mouse for orientation adjustments. The mouse scroll controls movement speed, offering users fine control over navigation. The camera can also switch between perspective and orthographic views, providing users with different ways to explore the scene. This functionality is implemented with a simple keyboard command, enhancing the versatility of the scene.

The choice of objects such as a desk, laptop, lamp, tissue box, paper, and coffee cup, ensures a realistic and relatable scene. Using models and efficient texturing techniques highlights the principles of 3D modeling. The navigation and camera controls are designed for an intuitive user experience, allowing smooth exploration of the scene. The modular code structure supports reusability and maintainability, aligning with best practices in software development.

This project demonstrates the application of key computer graphics concepts, including object modeling, texturing, lighting, and camera control, within the context of OpenGL. My scene effectively captures the essence of creation, providing a realistic and visually compelling representation of a desk setup. The adherence to coding best practices further ensures the quality and maintainability of the project.