CS-330: Computer Graphics & Visualization  
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7-1 Final Project: Design Decisions

**Design Decisions**

The design of my 3D scene was guided by both functional requirements and aesthetic considerations. My primary goal was to create a visually cohesive environment that demonstrated technical proficiency in OpenGL, including the use of textures, lighting, materials, and object transformations. At the same time, I aimed to make the scene feel realistic and immersive by applying principles of visual composition, scale, and lighting balance.

One of the earliest decisions was to structure the scene around a modern minimalist desk setup, as this concept provided a clear focal point and allowed for the integration of multiple objects with distinct materials and textures. The desk serves as the central element, with a textured wooden surface that contrasts with the smooth surfaces of other objects in the scene. This choice supported my learning objectives by enabling the use of multiple texture maps, normal maps, and specular highlights in a single view.

Lighting decisions were also critical. I implemented four-point light sources positioned strategically to enhance depth and realism. A warm glowing lamp was placed on the desk to provide localized illumination and soft shadows on nearby objects. To balance the warm tones, I included cooler ambient lighting across the wider scene, preventing color dominance from the lamp and creating visual harmony. The combination of directional, point, and ambient lighting also allowed me to showcase how different materials respond to light. For example, metallic components such as the lamp base were given higher specular reflection values, while matte surfaces such as the desk or cement wall maintained lower reflectivity.

Object placement within the scene followed the rule of thirds to avoid symmetry that might feel unnatural. The mug with two distinct textures became a key example of texture blending, illustrating my understanding of UV mapping and material property adjustments. Similarly, the wall was divided into two planes with different material responses to light, allowing for experiments with reflective and diffuse lighting effects.

From a technical perspective, I made deliberate decisions to maintain code readability and modularity. Each object was encapsulated in its own class, with transformations and texture loading handled through separate, reusable functions. This approach aligns with industry best practices for maintainability and scalability (Shreiner, Sellers, Kessenich, & Licea-Kane, 2013). I also separated shaders for different lighting models, ensuring that modifications to one lighting style would not introduce unintended changes to others.

Textures were chosen and optimized to ensure seamless tiling, minimal distortion, and compatibility with OpenGL’s requirements for dimensions. For example, the marble and cement textures were prepared as 1024×1024 JPG files to balance quality and performance. Applying these textures requires adjustments to UV coordinates to avoid stretching or visible seams.

Finally, performance considerations informed me of my decision to limit polygon counts on objects that did not require high detail. By applying level-of-detail principles, I maintained smooth real-time rendering without sacrificing visual quality. This balance of efficiency and realism reflects an understanding of the constraints developers face when targeting interactive applications such as simulations or games.

Overall, these design decisions resulted in a coherent and technically robust 3D scene that met the course requirements while also reflecting creative problem-solving. By combining intentional artistic choices with structured technical planning, I created a project that demonstrates both my aesthetic sensibilities and my capability to implement professional-quality OpenGL solutions.

**References**

Shreiner, D., Sellers, G., Kessenich, J., & Licea-Kane, B. (2013). *OpenGL programming guide: The official guide to learning OpenGL (8th ed.)*. Addison-Wesley.

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