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Reflection

Working as a C++ and OpenGL 3D graphics developer for Triangle and Cube Studios has been a challenging but rewarding experience. My task was to take a 2D image provided by a client and bring it to life as a fully realized 3D scene. This project pushed me to create 3D models, apply textures, set up lighting, and make the scene interactive, all while following best practices in graphics programming.

One of the main goals of this project was to create 3D objects that closely resemble the elements in the original 2D image. I designed four key objects: a saucepan, a coffee cup, a paper towel roll, and a balloon. Each of these was built using basic geometric shapes like cylinders, spheres, cones, and torus. I focused on keeping the polygon count low—under 1,000 triangles for each object—so that the scene would render quickly without sacrificing too much detail.

For example, the balloon was made using a scaled sphere for the main body and a torus for the knot. The coffee cup was more complex, with a cylinder for the body and torus forming the handle. By combining these simple shapes, I was able to create models that were not only efficient but also visually convincing.

Textures were essential in making the 3D objects look realistic, but the process had its challenges. I applied high-resolution textures to the paper towel roll and balloon, selecting ones that closely matched their real-world surfaces. For instance, the paper towel roll's texture mimicked its rough, fibrous surface, while the balloon's texture captured its smooth, glossy finish but I was unable to achieve the transparent look of the balloon or the table due to alpha not being accounted for within the texture shader. Finding and orange sauce pan texture was harder than I had imagined due to a lack of good seamless textures for this type of item.

Lighting was another critical aspect of the project. I changed the lighting model from a Phong lighting model to a Blinn-Phong model. The scene features two light sources: a bright white directional light that illuminates the entire scene and a warm-colored point light positioned to add depth and atmosphere. The first light ensures that all objects are well-lit, while the second light brings warmth and highlights the textures and materials. I carefully adjusted the ambient, diffuse, and specular components of the lighting to achieve the right balance. This setup allowed me to create a scene that looks polished and professional, with objects that appear well-integrated into their environment.

Positioning the objects correctly was crucial to making the 3D scene match the original 2D image. I placed each object in the scene using X, Y, and Z coordinates, ensuring they were aligned properly. For example, the sauce pan was placed prominently in the foreground, while the balloon was positioned in the back, just like in the reference image.

I also implemented camera navigation so that users could explore the 3D scene interactively. The camera can move along the X, Y, and Z axes, and the WASD and QE keys allow for precise movement. Additionally, the mouse controls the pitch, yaw, and roll of the camera, while the scroll wheel adjusts the speed of movement. This makes it easy for users to view the scene from different angles and get a complete picture of the 3D world. To add another layer of functionality, I included the option to switch between perspective and orthographic views. This allows users to see the scene in both 3D and 2D, depending on their preference.

Throughout the project, I made sure to follow best practices in coding. This meant writing clean, well-organized code that was easy to read and understand. I modularized the program by creating functions for specific tasks like setting transformations, applying textures, and configuring lighting. This not only made the code easier to manage but also made it reusable for future projects.

I also took care to comment my code thoroughly, explaining each function and block of code clearly. This ensures that anyone reviewing my work can easily follow my logic and understand how the program operates.

Overall, this project has reinforced the importance of following best practices in software development and has equipped me with skills that I will continue to build on in future projects at Triangle and Cube Studios. The demand for high-quality 3D graphics is only growing, and I feel more prepared than ever to meet that challenge.

References

Southern New Hampshire University. (n.d.). CS 330 applying lighting to a 3D scene [PDF]. Retrieved from module source

Southern New Hampshire University. (n.d.). CS 330 applying textures to 3D shapes [PDF]. Retrieved from module source