Final Project Submission Design Decisions

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CS – 330 Computer Graphics and Virutalization

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For my final project, I chose to replicate a breakfast scene inspired by a 2D image that featured a stack of pancakes that I had found on Google web search It contains pancakes being the star piece, a marble countertop, and various breakfast items like a glass of orange juice, a syrup bottle, and some berries with syrup flowing down the pancakes. The goal was to approximate the original scene using simple geometric shapes and make it visually engaging with texture, lighting, and camera controls in the provided OpenGL templates that were provided to me.

The most prominent object in the scene is the pancake stack, This was made up of cylinders and torus rings. I carefully crafted this into a function to create a stack using a stored value in ‘I”. I wanted each pancake to have some dimension, so I used a cylinder for the body and topped it with a torus to simulate the curved, fluffy edge. The stack uses a custom texture featuring a pancake pattern, which I sourced from Google advanced web search and scaled to tile correctly over each shape. While there were some headaches with bugs (discovering if the image is stretched it doesn’t render at all without error) I had overcame many times where I had to improvise and I’m especially proud of this because I wrote a loop to render each pancake individually, applying the same transformation logic with just minor Y-axis offsets.

To create a more immersive scene, I included a kitchen-style counter using a large, flat plane and applied a marble texture to give it that polished surface look. A back wall made from another plane was textured with bricks to add depth and context to the scene. Both textures were scaled appropriately using UV settings to avoid any stretching or pixelation, while ensuring lighting was simulating a kitchen.

One of the most challenging but rewarding aspects of this project was the lighting setup. Initially, my scene rendered very dark, and it took some troubleshooting to figure out how OpenGL’s lighting and shading model was interacting with the materials and textures. I ended up using a directional light to simulate daylight coming from a window, along with a warm point light directly above the scene to soften shadows and brighten up key elements like the pancakes and plate. Originally this did not work because I wasn’t setting the shade material to ‘default’ and this wouldn’t let apply the shading at all. This was forcing the entire scene to show up black if used improperly. There was no error handling for this, so it eventually took some considerable time troubleshooting. I used the full Phong lighting model with ambient, diffuse, and specular components to give the scene a more polished, realistic look. I also adjusted the shininess and color properties of each object to help them react more naturally to the lighting setup. Conclusively, lighting was the most difficult set up to proceed through.

Navigation was another area that was a requirement. I implemented full camera control using both keyboard and mouse. The WASD and QE keys control movement on the X, Y, and Z axes, while mouse movement allows for changes in pitch and yaw. The scroll wheel adjusts the camera’s movement speed for fine control. I also added the ability to toggle between orthographic and perspective views using a key press, which helped with debugging and viewing the scene from different artistic perspectives.

As I built out the scene, I continued adding objects little by little each week to make it feel more complete. The glass of orange juice was made using tapered cylinders, and I played around with alpha values to simulate transparency, though I ultimately toned it down for visual clarity. I also created a syrup bottle using a half-sphere for the bottom, a cylinder for the body, and another half-sphere and torus for the top. I colored the syrup a dark brownish hue to emulate molasses.

To keep my code clean and maintainable, I broke tasks into reusable functions and kept the transformations organized using variables for scale, rotation, and position. I also made sure to apply coding best practices like clear indentation, commenting, and modular design to ensure everything was readable and easy to follow.

Overall, there were some obstacles I found creating this graphic scene and other portions that were simple to implement. At times, I duplicate objects from one line object to another and received different results (such as pancakes or the cup of orange juice, and syrup bottle) and this ultimately was the reason why graphics programming I consider it to be more tedious, it requires a careful and very attentive approach to each detail. But this project allowed me to bring together everything I learned during the course in end. From modeling and texturing to lighting and interactivity. I’m happy with how the scene turned out. It captures the spirit of the original image and demonstrates my ability to think critically about 3D graphics and apply them using C++ and OpenGL.  
  
 I look forward to sharing my work!  
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