When I began designing my 3D scene, my primary focus was on incorporating geometrically-based shapes that, regardless of their complexity, could be effectively deconstructed into simpler components. This approach allowed me to steer clear of overly organic forms, like intricate foliage, that might appear unnatural within a 3D environment. The notepad proved to be an engaging initial object due to its spiral binding. While composed of many similar shapes, each pair of rings required precise intersection and orientation with the notepad, subtly shifting down the page. The coffee mug presented another enjoyable challenge, as I was able to use a large torus to form the main body and rounded lip. A cylinder was then used to create the interior coffee, and half of a torus formed the handle.

The scene truly began to come alive with the addition of colors and textures, bringing a new level of realism. Suddenly, the mug transformed into ceramic, and the spiral bindings took on the metallic sheen of real objects. Lighting was the third crucial element that elevated the scene's realism. It's far more complex than simply shining a flashlight from one direction; effective lighting combines ambient, diffuse, and specular components, which together form the Phong lighting model. To achieve balanced illumination and avoid harsh shadows, we incorporated a key light, a rim light, and a fill light. We also experimented with adding color to our lighting to evoke different moods, such as the warm glow of morning, the softer light of afternoon, or the cooler tones of a winter scene.

To ensure users could fully explore the scene, we prioritized approachable input devices. Given the prevalence of keyboard and mouse controls on most computers, we opted to utilize these familiar tools. From the keyboard, users can toggle between orthogonal and perspective views, offering a quick switch between 3D and 2D perspectives. Mouse movement controls the camera's direction, mimicking the turning of a human head. The familiar WASD keys facilitate forward, backward, left, and right movement, while Q and E allow for upward and downward adjustments. These combined navigational elements empower users to traverse the scene and view it from any angle. Furthermore, the mouse scroll wheel can be used to adjust the camera's movement speed.

Our program was designed with modularity in mind, abstracting unique functionalities into individual functions. This approach ensures that specific actions are self-contained and easily reusable in future OpenGL projects. For instance, the SetupSceneLights() function was dedicated to defining the various types of lighting within our scene, each with distinct characteristics for the key, fill, and rim lights. DefineObjectMaterials() was responsible for establishing rules and characteristics for how different materials reflect light, covering materials such as metal, bamboo, ceramic, paper, and marble in this project. LoadSceneTextures() handled the initial definition of textures and their locations, assigning each a unique key for later application to objects. The PrepareScene() function then orchestrates the calling of the Material, Texture, and Lighting functions, along with loading the basic shape meshes. These prepared elements are subsequently utilized by the various objects called under the RenderScene() function. Each box, torus, cylinder, or other shape is assigned a scale, rotation, orientation, material, and texture, all drawing characteristics from the modularized functions discussed above. This modular design makes these functions highly recyclable, not only for additional objects within this project but also for other OpenGL 3D rendering projects.