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**CS 330 Computer Graphics and Visualization**  
**Design Decisions for 3D Environment**

In this project, I created a 3D environment based on a 2D image featuring two croissants, a tablecloth, and a ceramic coffee mug. Below is a detailed explanation of the design decisions and how they address the rubric criteria.

**1. 3D Objects: Representation**

* **Wooden Table:**  
  I used a box mesh to represent the table, applying a wood texture to simulate a realistic wooden surface. The texture coordinates were adjusted to ensure proper alignment, and the scale was configured to accommodate all other objects. This approach makes it easy to reuse or modify the table in different scenes, demonstrating effective use of basic shapes.
* **Croissants:**  
  The croissants were modeled using a combination of a sphere and tapered cylinders to capture their distinct shape. A “croissant” texture and “bread” shader were applied to emphasize the flaky and buttery characteristics. This combination of primitive shapes fulfills the requirement for creating objects with more than one primitive.
* **Coffee Mug:**  
  The coffee mug was constructed from a torus (for the rim), a tapered cylinder (for the body), a smaller tapered cylinder (for the coffee inside), and a half torus (for the handle). This combination of geometric primitives creates a functional and visually appealing design. Textures for both the ceramic surface and coffee were applied to enhance the detail.
* **Tablecloth:**  
  Box meshes were used to simulate the tablecloth under the croissants. A “paper” texture and a “cloth” material were applied to represent the fabric's appearance and reflect light appropriately, contributing to the scene's realism.

**2. 3D Objects: Textures**

* **Textures Applied:**  
  Textures were applied accurately to enhance realism. The “wood” texture on the table, “croissant” texture on the pastries, and multiple textures for the coffee mug are all high-resolution (1024x1024 pixels) and well-coordinated to avoid stretching or misalignment.

**3. 3D Objects: Lighting**

* **Lighting Setup:**  
  Three light sources were used to illuminate the scene: a point light simulating natural daylight from an angle, a fill light to soften shadows on the opposite side, and a specular light to enhance the reflections on the coffee cup. The lighting setup incorporates ambient, diffuse, and specular components of the Phong shading model to achieve a polished visualization.

**4. 3D Objects: Organized World**

* **Object Placement:**  
  Objects were placed using X, Y, and Z coordinates to avoid clipping and ensure a balanced arrangement. Scaling and translation were used to position the croissants and coffee mug correctly on the table, maintaining an accurate representation of the original image.

**5. Navigation: X, Y, and Z Axes Camera Movement**

* **Camera Navigation:**  
  The camera supports horizontal, vertical, and depth movement using WASD keys (forward, backward, left, right) and QE keys (upward, downward).

**6. Navigation: Nuanced Camera Controls**

* **Camera Control:**  
  Mouse cursor allows for changes in camera orientation (pitch and yaw) and scrolling adjusts movement speed. This nuanced control enhances user experience by providing precise adjustments.

**7. Navigation: Perspective and Orthographic Displays**

* **Display Modes:**  
  The scene supports both perspective and orthographic views. Users can switch between these projections using the P key for perspective and O key for orthographic, keeping the camera’s orientation unchanged.

**8. Reflection: Custom Functions**

* **Custom Functions:**  
  Future improvements include creating modular functions like *RenderCroissant()* to enhance code organization and reusability. This approach will simplify the addition of new elements and improve overall code efficiency.