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PA3 Report: Scene Graph and Illumination

Task 1: Scene Graph Drawing

First, I worked on the scene graph drawing. I focused on **each node's transformations** were correctly passed down to its children. To do this, I implemented **matrix multiplication** so that every child node inherited the transformations of its parent. After that, I ensured that if a node contained a MeshDrawer object, it got drawn with all the proper transformations in place.

Task 2: Lighting Setup

Next, I moved on to the lighting in the fragment shader. I started with the given ambient lighting (set at 0.35) and then added the calculations for diffuse and specular lighting. For diffuse lighting, I used the dot product between the surface normal and the light direction. For specular highlights, **I used the Phong reflection model**, making sure to correctly calculate view and reflection vectors. I spent some time tweaking these lighting parameters to get a realistic and visually appealing result.

Task 3: Adding Mars

Finally, I integrated Mars into the solar system simulation. The task was very clear in the documentation and I made the necessary changes by simply looking at the other planets codes. I created a **new node for Mars as a child of the Sun**. I then set up its transformations given. I also applied the provided Mars texture to give it the right appearance.

Technical Details

I used WebGL for rendering and implemented a hierarchy like: Sun → (Earth → Moon, Mars). The transformations (position, rotation, scaling) were all handled by the scene graph structure. I also made sure textures were mapped correctly onto each planet, and the lighting model was based on Phong shading for a realistic look.

Results

In the end, the lighting and shading felt natural, the rotations looked correct, the scaling looked right, and the textures were applied correctly. Overall, I'm pleased with my outcome **it looks very similar to the images given** for the complete versions of the tasks.