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CS 248 Final Write-Up

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## Cube Person 2.0

### **Intro**

The inspiration for our project was the cube person from Lecture 3. While the original Cube Person helped us learn about transformations and perspective projection, our new cube person would help us learn about geometric processing, texturing, and materials/lighting. We extended Assignment 2 and Assignment 3 to help us create this new Cube Person through the following functions:

### **Functionality**

Assignment 2:

`bevelVertex( )` that takes a `vertexIter` and replaces it with a beveled face, updating the connectivity of the mesh.

`bevelVertexComputeNewPositions( )` that calculates the new vertex positions according to the `tangentialInset` specified by the user.

`bevelEdge( )` that takes a `edgeIter` and replaces it with a beveled face, updating the connectivity of the mesh.

`bevelEdgeComputeNewPositions( )` that calculates the new vertex positions according to the `tangentialInset` specified by the user.

triangulate() that takes a non-triangular mesh and divides it into triangles

bevelFace() that takes a faceIter and creates new edges and halfedges around it to create a beveled face. This function was not completely implemented and still has a bug.

Assignment 3:

metal\_BRDF() that calculates the color of an anisotropic metal material given the location, lighting, color of the material, etc.

### **Process**

The functions implemented from Assignment 2, in combination with loopSubdivision() (and a little creativity) are theoretically enough to create the complex robot Cube Person mesh that we imported into Assignment 3.

From assignment 3, we implemented anisotropic BRDF lighting to give our cube person a brushed metal look. We also textured our robot cube person. Assignment 2 doesn't support texture mapping, so we had to create the cube robot person in blender and texture accordingly.

Also, it would not be feasible to apply transformations to individual cubes in the assignment two framework and assemble them together in a JSON file. Many of the same concepts that came up during our coursework appeared while creating this assignment. We had to deal with, transformations in different coordinate systems, normal maps, and UV maps.

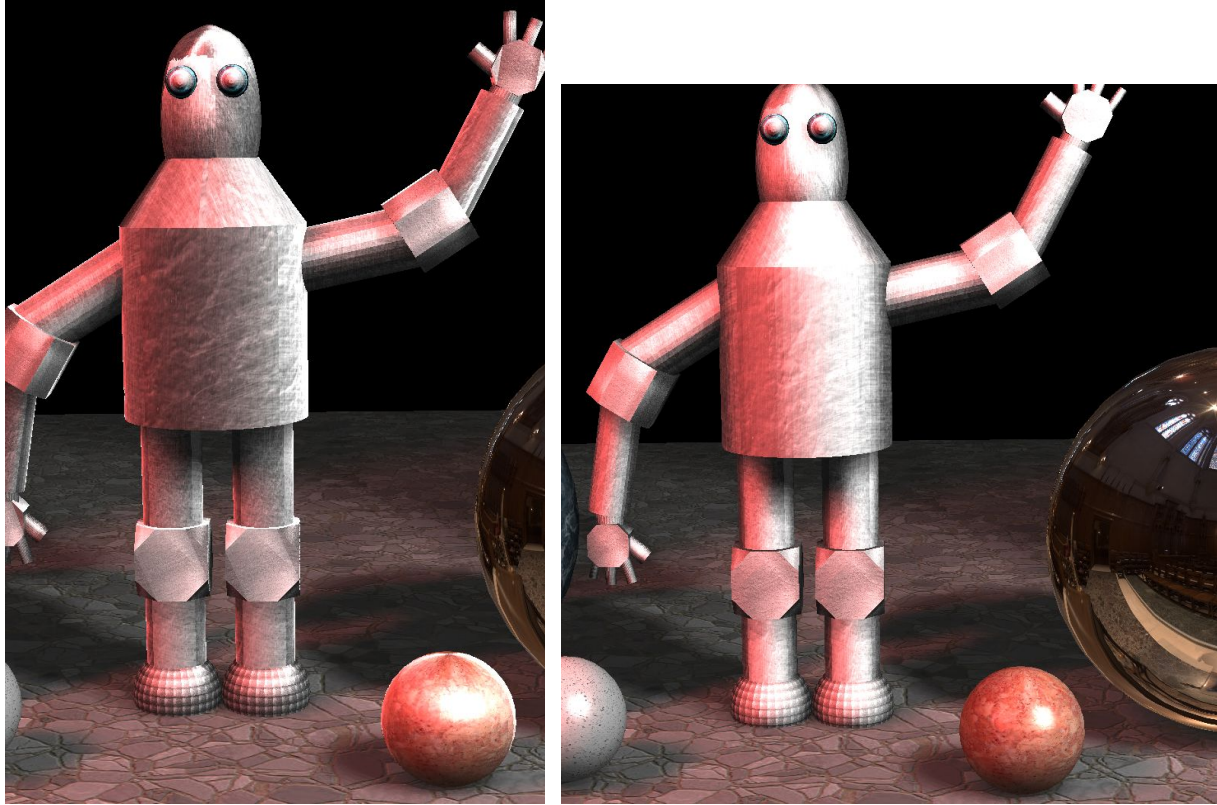
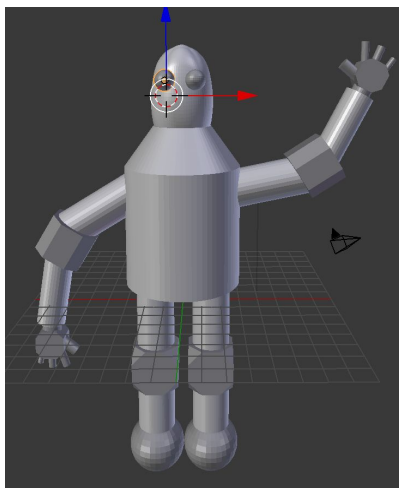


Figure: Left images uses anisotropic BRDF for both the robot and bottom right sphere, right image uses regular Phong BRDF for both the robot and the bottom right sphere.

You can see the effect of the anisotropic BRDF in these pictures. The light reflected by the lower right sphere is more spread out over the object. This is also seen on the Cube Person.

### Example assets



We created the following new Cube Person in blender. It was important to make sure that the Cube Person had normals facing in the right direction. Also, we had to map the UV's of the various shapes, or else there would be a repeating pattern of the texture we used.



Figure: Entire scene rendered above

### **Installation instructions**

The installation instructions are the same as Assignments 2 and 3. The assets should already be in their corresponding folders. We have modified the JSON files from assignment 3 to import our object files. If you want to import objects into the Assignment 3 framework, make sure the normals are consistent/facing the right direction, and make sure that the mesh is triangulated.

### **Considerations**

The behavior for `bevelVertex()` and `bevelEdge()` on triangle meshes is a bit odd. Some non-planar faces are created. Also, `bevelEdge()` seems to crashes on certain edges for some reason. Most of our testing was done on `cube.dae`. `bevelFace()` also crashes.