

3D Model Creation using Blender

Creating the Syntax Logo

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Abstract—A Wavefront object that stores information about a 3D model and can be rendered in OpenGL is created with a 3D modelling software such as Blender. Blender uses geometry terms such as vertex, edge, face and normal to help the user create a 3D model of his/her choice. This paper discusses about the creation of a model of a logo using Blender's variable tools such as Scale, Modifiers, Loop Subdivide, Material and Recalculate Normals.

Keywords—3D; model; vertex; edge; face; normal; material; tool; logo

I. INTRODUCTION

In Computer Graphics, one of the most basic ways to display a 3D object on a screen is defining vertices, faces and textures for each face using OpenGL. Another way of doing it is to load a 3D model and display it, without the need to define each vertex. One of the popular 3D model formats are Wavefront files that ends with .obj . These files contain information about vertex positions, UV position of each texture vertex, vertex normal and faces. Using them, OpenGL can render the object described by that information, removing the need to manually type each vertex coordinate and which texture correspond to which face.

But how does one create Wavefront files? One of the software capable of doing that is Blender, a open-source 3D creation suite used to perform 3D related activity – such as modeling, rigging, animation, simulation, rendering, compositing and motion tracking. In 3D model creation, Blender also uses 3D object terms such as vertex and faces. To create a 3D model, the first thing to do is to create a mesh which is a combination of vertices, edges and faces that defines the shape of an object. Then, textures are used on those mesh to give context such as colors, patterns or textures in the form of images or videos.

II. LITERATURE STUDY

A. Vertex

A *vertex* is a point in a polytype created by an intersection of edges or faces of an object. A vertex's properties are coordinates X, Y, and Z in the Cartesian coordinate system. These coordinates define the position of the vertex in 3D space. It is

used to determine where itself, edge or face corresponding to that vertex is rendered to the screen in Computer Graphics.

B. Edge

An *edge* is a line segment between two vertices in a polytype. Since it is made from two vertices, it can be a line in any direction and length in the 3D space.

C. Face

A *face* is a flat surface bordered by two or more edges. Because of this, each vertex can have more than two faces. It is a plane that can have complex shapes depending on the vertex and edges it is made of.

D. Normal

A *normal* is a vector perpendicular to an object such as a face. This vector is used to determine the front and/or back side of a face which is used for lighting.

III. METHOD

To showcase 3D model creation using Blender, I have made a simple model of my university year's, Syntax's, logo.



A. Blender Overview

When a new project in Blender is created, the state of the editor will look like this:

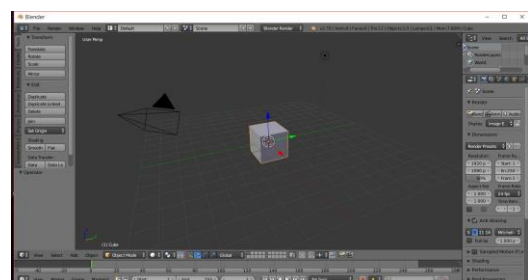


Image 3.2 Blender Overview

There is a cube in the middle as a template for creating models. The pyramid shaped object next to the cube is the camera in which the object is viewed in default. On the cube itself there are 3 arrows; red, green and blue. Each of these arrows correspond to the X, Y, and Z axis in order. The cube can be moved on certain axis by moving the arrows to a certain direction. The object can also be moved in increments by moving while holding the Ctrl key or in very small increments by moving while holding the Shift key.

B. Movement

The middle mouse button is used to change the view of the object to a different angle. Note that this is not the camera that is mentioned previously but the screen in Blender that the user is looking the object through. To shift the view in a certain direction the user has to hold the Shift key and middle mouse button. The scroll wheel on the mouse is used to zoom in or out towards the object.

C. Logo Frame

First of all I created the frame for the logo by scaling the cube. The first step is to select the cube using right click. The left click is used as the 3D pointer to put a marker on a coordinate in the editor. This is very unusual for me and I needed some time to adjust to the feature. To scale an object, press the S key and move the mouse further from the object to enlarge the object or towards the object to reduce the size of the object. I made the cube a square and reduced it's height to the appropriate size. After that I copied the edited cube and made the copy a smaller square with the same height of the previous cube.

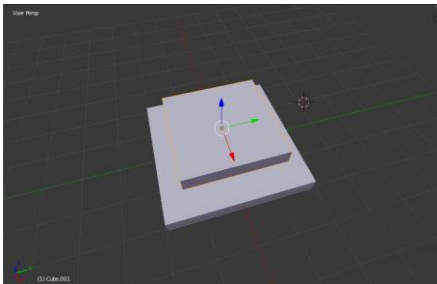


Image 3.3 Larger cube below the smaller cube

To make the frame, I need to create a hole in the larger cube. The way to do that is to add a modifier to the larger cube. Modifiers are tools to modify an object. It is comprised of 4 categories: Modify, Generate, Deform and Simulate. The modifier that I used is the Boolean modifier in the Generate category. To add the modifier, move to the Modifier tab on the right side (the one that look like a wrench), click Add Modifier, select the Boolean modifier, choose the target object (in this case the smaller cube), choose the Difference operation and click Apply. The result of the modification is the larger cube with a square-shaped hole in it.

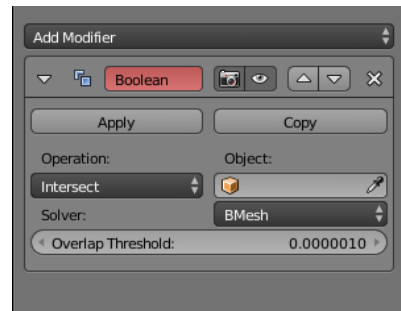


Image 3.4 Boolean Modifier Menu. Intersect is chosen as the operator.

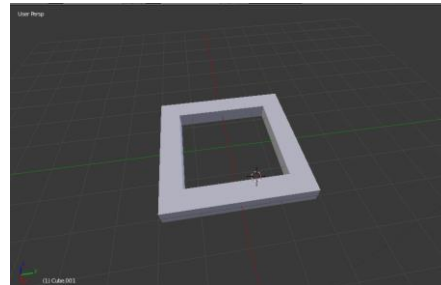


Image 3.5 Larger cube with a square-shaped hole

D. Logo Interior

The interior is roughly divided into 6x6 squares and shaped like the number 1, 4, and the letter S. To create the 6x6 grid, I used the Loop Subdivide tool to cut the cube into 6 equal parts. The first thing to do is to press the Tab key to go into Edit mode. In edit mode, you can see the vertices, edges and faces of the object. After pressing the Ctrl + R key combination as the shortcut for Loop Subdivide, when scrolling the mouse wheel a couple of pink squares will show up inside the object. If scrolled further, the squares will increase in numbers. This is to notify how many parts will be generated after the division. I adjusted the division into 6 parts and press the Enter key. The cube is now split into 6 equal parts.

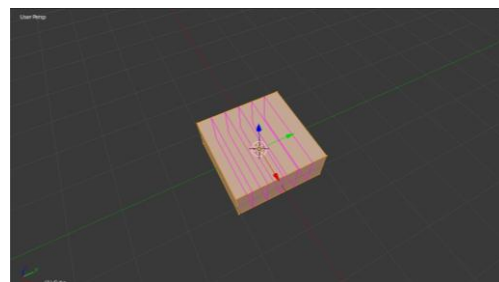


Image 3.6 Loop Subdivide Tool. The pink squares indicate how many parts the object will be divided into.

Now each part has to be divided into another 6 equal parts. To do that, first select each vertex of one part to select the part, press the P key and select Selection. This will separate the selected part from the larger cube. When going back to View mode (by pressing the Tab key while in Edit mode) and moving the separated part, it can be seen that it is indeed separated. After that is the matter of using the Loop Subdivide tool again to

divide it. While the separated part is missing a face (thus having a hole in it's side), it is fine because I am only using the top part of the part to create the logo.

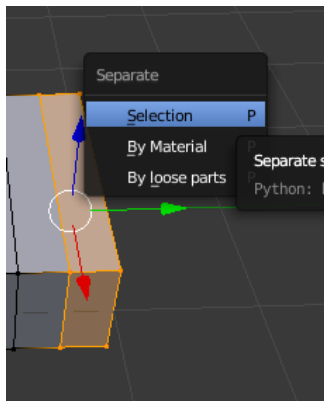


Image 3.7 Separate by Selection Tool

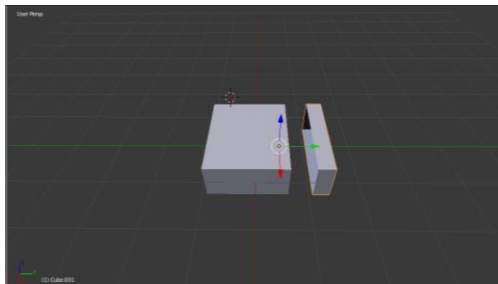


Image 3.8 The result of the separation. Note that it is missing a face on the side.

After separating all the needed parts, I configure them to look similar to the logo's interior. In this step I added color to the parts so that it is easier to recognize and edit. To add a material, the Material tab on the right side (the one that looks like a sphere), click the plus button on the right and choose a color for the material. I used 3 materials in this model; Blue, Dark Blue and Wpresse. To add the material to a face, select a face in Edit mode, click the desired material in the Material tab and click Assign. This will assign that material the face and give it color.

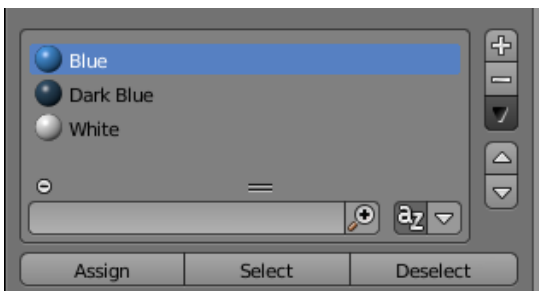


Image 3.9 Materials used in the model. To add a material, click the plus sign on the top right.

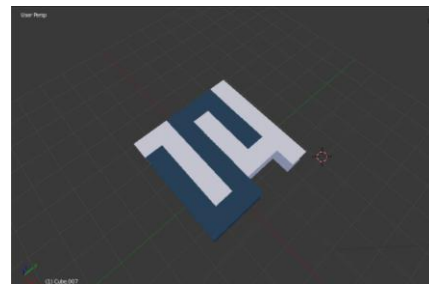


Image 3.10 The finished interior using Dark Blue and Wpresse material. The frame uses the Blue material.

E. Finalization

To finish the model, I combined the frame and the interior together and raised the interior a bit to give a 3D look. After raising them, I need to add faces so the model doesn't have any holes. To add a face, select 3 (or more) vertices that you want as the border of the face and press the F key. This will create a face based on the vertices that you selected.

Sometimes when I am in the process of making faces, it has a different color even though it uses the same material. This is caused by the normal of the faces being different and not facing the same way. To show the normal of each face, press the N key and a tab will pop up. On the normals section, click the face button (a cube with it's face selected) to show the normal of each face. To fix the color problem, simply press A to select all the faces in Edit mode and press the Ctrl + N key combination to use the Recalculate Normals Outside tool. This will cause all the normals in the selected faces to face outwards thus showing the correct color.

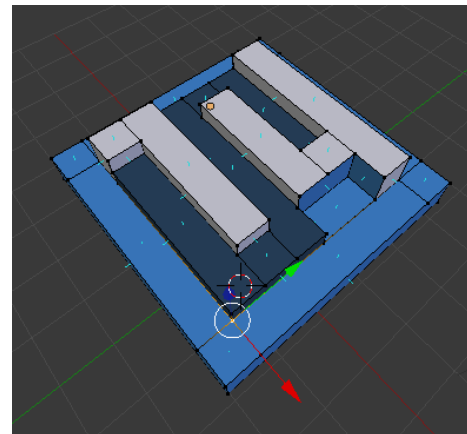


Image 3.11 The normal of each face in the model

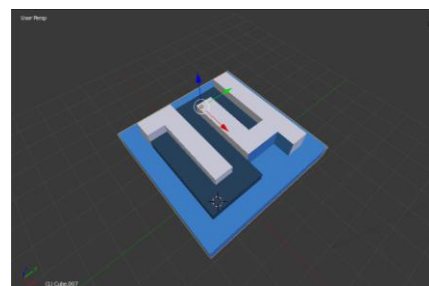


Image 3.12 The finished model

IV. CONCLUSION

After my experience in using Blender, I concluded that it is a very useful and versatile software. It is considerably easy to use even though former knowledge of 3D geometry terms is very helpful in utilizing the software. Overall, it is an excellent software for 3D modelling purposes.

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STATEMENT

With this I declare that this paper that I write is my own writing, not an adaptation or translation of others' papers and is not based on an act of plagiarism.

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