

# Intro to Blender

in digestsible bits *urp!*

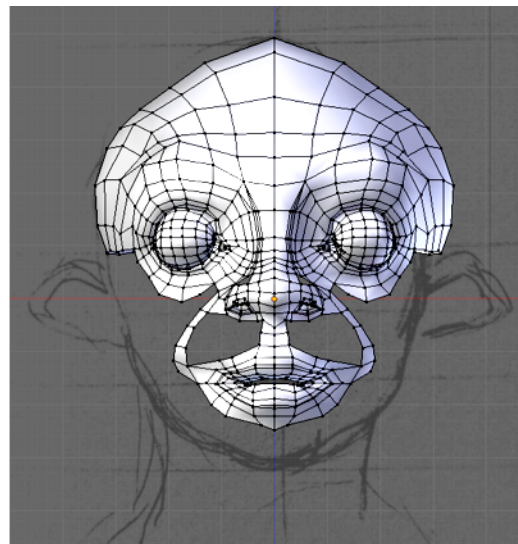
## Lesson 3: Custom Mesh Development

### Custom Meshes

Often meshes that you develop for an animation will have a geometry that is far more organic than a sphere, cube, or other stock mesh that comes with Blender. These custom meshes require that you add vertices, edges and faces to your own specifications. This lesson will cover the methods that I use for developing a custom mesh. You'll use the shortcuts in that you used in Lessons 1 and 2, and learn some more. You can use the more exhaustive shortcut tables available at this link:

<http://www.blakeketchum.com/docs/uploads/ShortCuts.pdf>.

You can build objects in Blender freeform or from sketches. In this lesson, we'll start with 3 or 4 sketches of an object and move into Blender. If you prefer to work freeform, you can skip the following Background Images section, but keep it on hand in case you decide to try it on another mesh.



*A sketch of a fictional character and a mesh with background image in early stages of development in Blender by Blake Ketchum.*

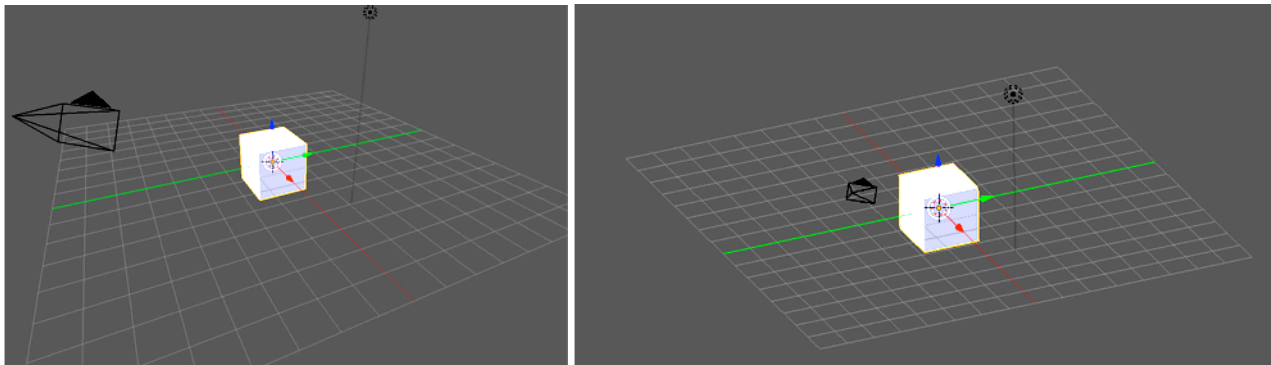
## Background Images

In many cases, working with background images is very useful. If you are building a mesh that must look like a real object or an object that you have drawn, a set of background images can be very useful. Depending on the complexity of your object, anywhere from 2-6 images may be worth preparing.

## Orthographic Views

You've seen blueprints of houses that show a front view, side view and plan (top) view of a house. These are *orthographic* views. They do not have perspective, and therefore do not have converging lines.

In Blender, you can view the 3D viewport in perspective or orthographic modes by toggling **5**. Open a new blender file and see the default cube. Blender opens up in perspective mode. See that the lines on the base grid that are parallel in virtual 3-space actually converge as they approach the horizon? That is close to how we actually see objects in 3-space. Press **5**. Now you have entered orthographic mode. Lines do not converge. You will need orthographic drawings or photos of your object for your background images.

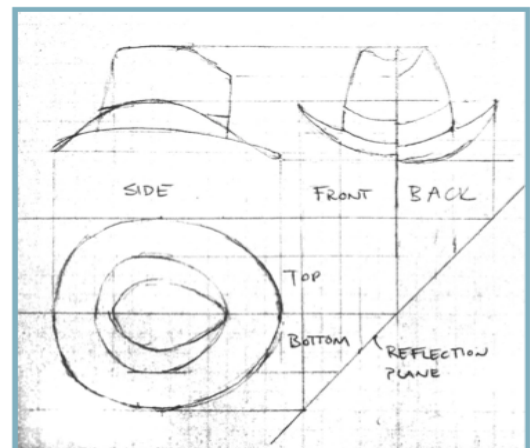


Left, The default cube in Perspective mode. Right, Orthographic mode accessed by toggling **5**.

## Creating Orthographic Images

### Sketches

One option is to sketch your object for use in Blender. Draw your object carefully from different orthographic views. Graph paper is great for this. Here's an example of three orthographic views of an object that I prepared for this lesson. If you are feeling lazy, you can access these images <http://www.blakeketchum.com/docs/uploads/HatOrthos.zip> and use them as you work along. I suggest that you make your own drawings and develop a mesh that relates to your interests. Scan or photograph your drawings. If you are photographing your drawings, take a look at <http://www.blakeketchum.com/docs/uploads/2DPhotos.pdf> for pointers.



Orthographic sketches of a hat. Note the use of a reflection plane to project the lateral dimensions of the front and back to the top and bottom views.

## Photography

If you are interested in using photographs of real objects, there is an important consideration: photographs, like the human eye, capture images in perspective. You've noticed how distorted your face is when you take your own cell phone photo, that's perspective in extreme. You can minimize the effects of perspective by standing far away and zooming in to your object. Make certain you are standing facing your object squarely from the different sides that you want to capture.

## Preparing for Blender

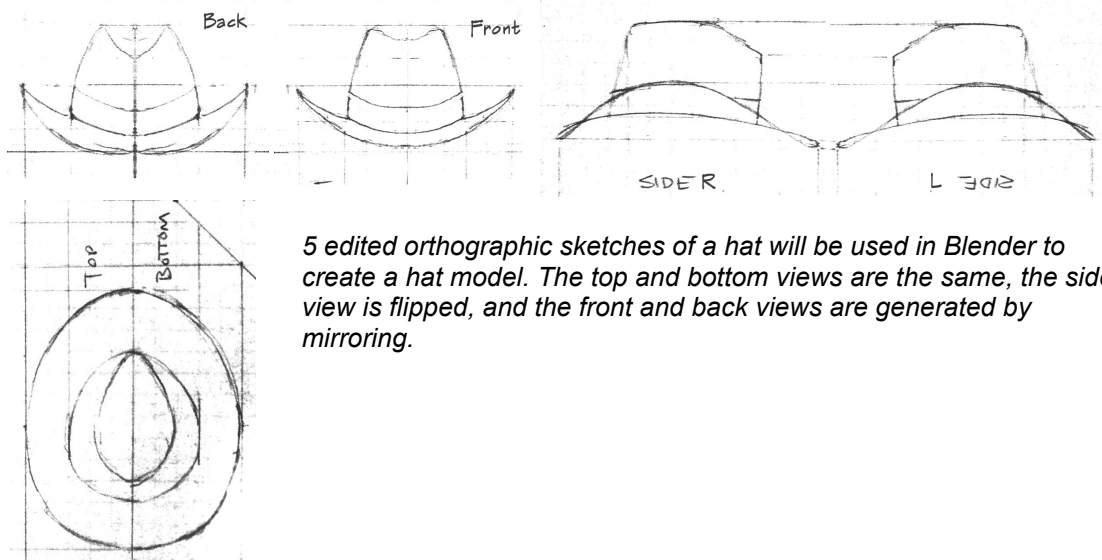
### Editing

Take your images into a photo-editing program like the free *Gimp* program or Photoshop. In my sketch, I only drew half a front view and half of the back. For symmetrical objects, this can be the fastest approach. The top and bottom contours look the same, so I will just use one drawing for those views. I'll have to create a mirror of the front and back views for Blender.

Crop the image down removing distracting background parts, adjust the contrast so that you can see the details clearly save the images in the same file where you will keep your .blend file. This is important because Blender accesses the background images files, it does not import them. If you move a background image from the folder where Blender originally found it, Blender will no longer be able to find that image.

- Right side view will have the front pointing to the left.
- Left side view will have the front pointing to the right.
- The top and bottom views should have the front pointing down.

Here are the readied hat images.

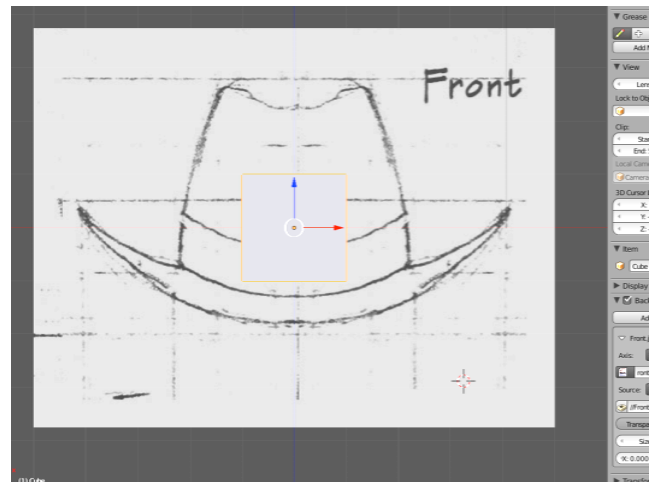
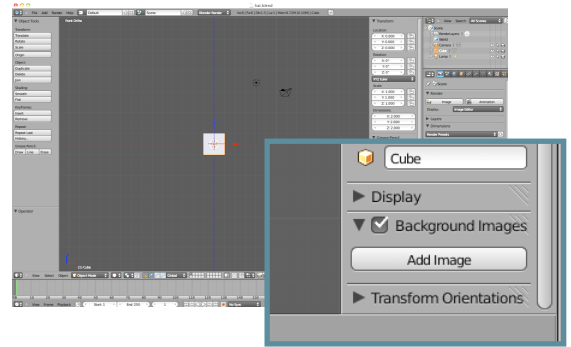


5 edited orthographic sketches of a hat will be used in Blender to create a hat model. The top and bottom views are the same, the side view is flipped, and the front and back views are generated by mirroring.

## Adding Background Images to Blender

This can be a little tricky first time through, so follow these steps closely:

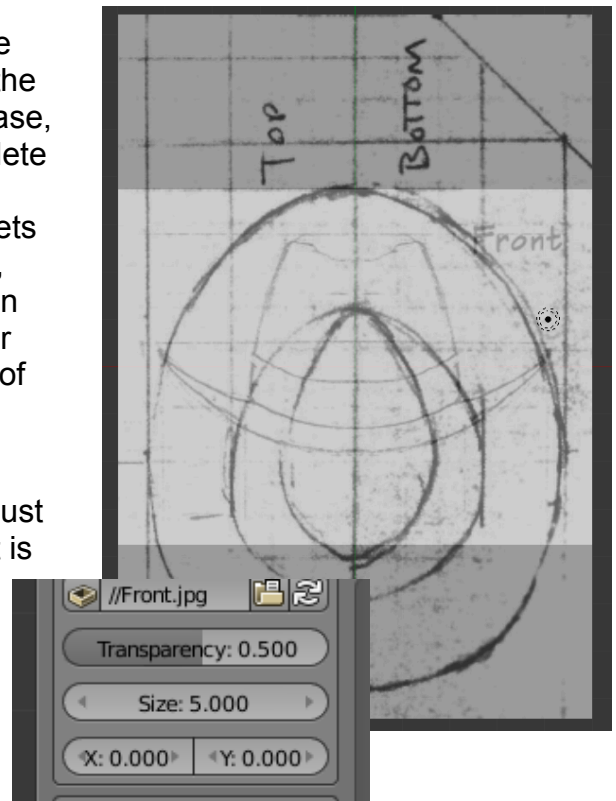
1. Open a fresh Blender file and immediately save it to the same file as your Orthographic images.
2. Press **5** to get into Ortho mode.
3. Press **1** to get the front view.
4. Now, press **N**, a new menu cleverly called the “n-menu” will appear to the right of the 3D Viewport.
5. Hold your mouse pointer over that menu and scroll to the bottom. Click on the arrow and box next to the words “**Background Images.**”
6. Click on “**Add Image**” and scroll down a little more. The Background Image menus are at the bottom of the n-Menu, so you need to keep scrolling.
7. Click on the white arrow that appears next to the words “**Not Set.**”
8. Click on the word “**Open.**” Select the front view image, and click “**Open**” again. The image will appear in the 3D viewport.
9. Now, where the n-Menu says “**All Views**,” click on the little white arrows and select “**Front**” or whichever view you are adding. Now the front view of your object will only appear in orthographic mode when you are precisely in front view – as when you press **1**.
10. Go through the same process to add the rest of your orthographic views by repeating steps 6-9. Each time you press “Add Image,” a new subpanel will open for you to select and format your new background image below the last one you added. Scroll down with your cursor in the n-Menu if you don't see the submenu. When you add images to different views, you will need to go to the appropriate view by pressing the number keys to see the image. You also need to be in Orthographic mode. (**1**= front, **7**=top, **3**=right, **control + #**= reverse).



11. Your background images are added, but they may not be sized and aligned precisely. Decide upon a single point of view that will be your reference for the others. I will choose the front view. Change the view to "**All Views**," like you did in Step 9. I am using the front view in this way.

12. When you migrate to one of the views, you should see both the reference image and the other image overlaid. In this way, I can see the top/bottom view, and the front view. In my case, the image of the front and the top views. Delete the default cube so you can see the images clearly (**x > delete**). Blender automatically sets the background image transparency to 50%, that's why you can see both images. You can adjust that in the N menu if you like later. For now make certain that the position and size of your images is correct.

13. On the n-menu of your **reference image**, adjust the size of your image and location so that it is centered in the screen and about 5-10 widths of a cube. You can see the size and x and Y bars in the n-Menu. If you click on those bars, you can use them as sliders, or click the arrows, or even enter a decimal number.



14. Next find the other image on the n-menu, and adjust its position and size to fit the reference image. In my case, because I used graph paper and photographed all the images at once, they were all the same size. I did need to adjust the position of all of them. The centerline created by the graph paper helps center the images very well. To adjust reflected side images, you can just use the same the size and positioning values from the first side view to the second. Use negative values when needed.

15. Once all background images are sized and positioned, set the reference image to only the appropriate single view again, **front** in this case.

16. Lastly, save your work again. The Save shortcut for a previously save file is **cmd+S**.

## Starting the Mesh

### First Face

In Ortho mode, go to the front view, and center your cursor (**shift + C**). Make the n-Menu disappear (**type N**). Add a cube (**Add > mesh > cube**), and enter edit mode (**tab**). Go to the side view (**3**), press **Z** to for wireframe mode. Press **A** to deselect everything, then select the back of the cube (see box for tips on selecting multiple points). Delete vertices (**x > delete**) on the back of the cube, leaving only the front face.

Select multiple vertices in one of these ways:

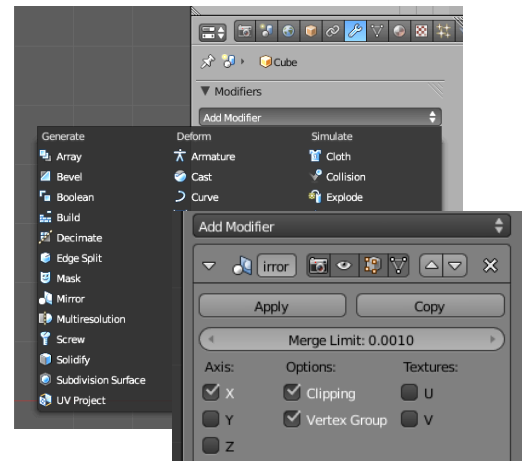
- **B** (release), **left mouse button** click to box select.
- **Control (hold) + left mouse button** drag a lasso around points
- **Shift (hold) + RC** points.

This will be the first face of your mesh!

### Symmetrical Objects

If your object is symmetrical, adding a mirror modifier will be a huge time saver. This is how it's done:

1. Deselect your face. Make a loop cut right in the middle of it along the axis of symmetry (**control + R, LC, LC**).
2. Deselect the vertices (**A**) and delete the two vertices on the left- your face will In the Properties Panel (Right Margin, find the **little wrench** and click on it). It will reveal the Modifier tools.
3. Click **Add Modifier > Mirror**. Also click on "clipping." Clipping makes the center plane of the mesh "sticky," which can be very helpful when you edit points near it. It trims the centerline flat so the two halves meet cleanly. Also click the little mesh triangle that *isn't* next to the wrench. This will enable you to edit both sides of your mesh.



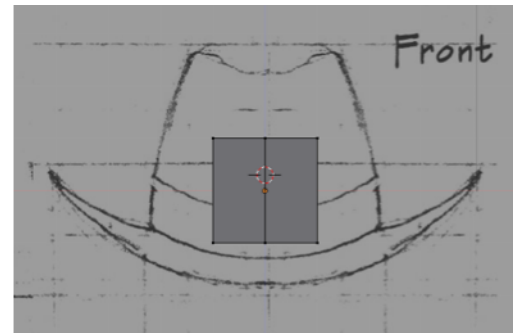
4. Important for later: When ever you add points to the mesh, be sure to add them on the same side of the center plane as that first half of the starter rectangle- in this case, that's the right side of the screen when looking at the front view.
5. Now you can toggle z to enter and edit wireframe or solid mode.. Don't change the modifier until you are completely finished, with this mesh, though!
6. When you edit one side of your mesh, the changes will automatically appear on the other side.

## Working the Mesh

### Grabbing, Scaling, Rotating (G, S, R)

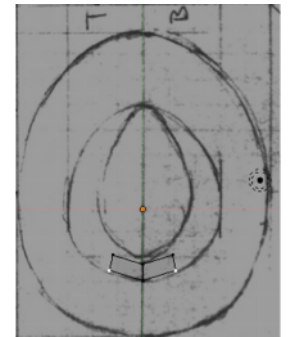
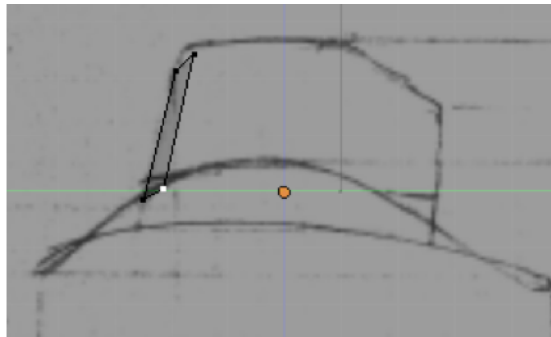
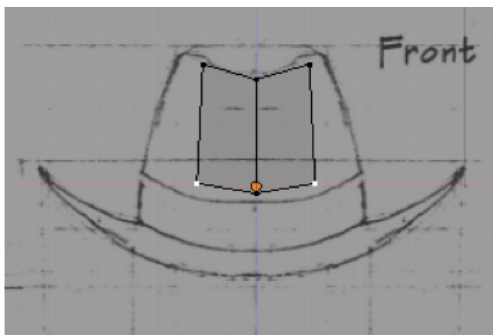
Now that you have your first face, you need to scale and position it. Select the entire mesh in Edit Mode (**A**), and use **G**, **S**, and **R** to scale, position and orient the plane somewhere that makes sense as a starting point on your object. Remember that pressing **X**, **Y**, or **Z** after **G**, **S**, and **R** enables you to constrain that transform to a specific axis. Make certain to look along each axis by using the number keys **1**, **3**, and **7**. You can also rotate the view, but you will notice that your background images are only visible from those views and their opposites. You can select any set of vertices, edges, or faces and apply **G**, **S**, and **R** transforms. If you select 1 vertex, **R** and **S** have no effect.

You may notice that there are some flaws in your drawings, maybe they don't line up exactly. That's fine. Get them close by positioning and sizing them in the n-Menu. These images are just guides. I can tell my hat band is off, for example, but I'll keep moving forward.



#### Selecting Points in 3-Space

In wireframe mode, you will select all the vertices behind the one that you select, in solid mode, you select only the vertex that you see. There is a semi transparent mode that you can access by clicking this icon beneath the 3D viewport. This has intermediate selection properties. Go ahead and experiment.



The front, side and top views of that first plane and the associated background images.

### Growing Your Mesh

In order to complete your mesh, you need to add vertices, edges, and faces. In this section we'll go over different techniques to do this. The methods that you use will depend upon the structure of your object. You probably won't use them in the same order that I use them for the hat, but they may all prove useful at some point.

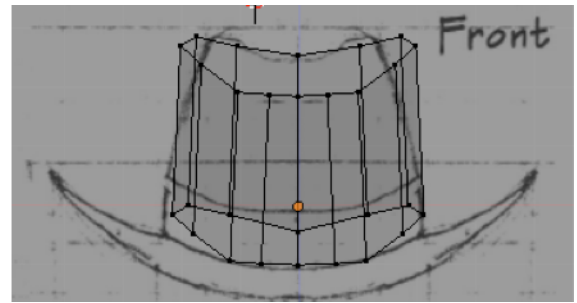
When you add components to this mesh, make certain that you are in Edit mode. If you add things in Object mode, you will be adding new objects that will not be a part of this mesh.

### Adding Vertices

This is the easiest method, but it isn't particularly efficient. **RC** on a vertex on your mesh to select it, Press **ctl + LC** to extrude a single point. You can build lots of things this way, but it's best to save this for tight spots with unusual geometry. Check the final position from front, side, and top views to make certain the point is where you suspect it landed.

### Extruding from Edges

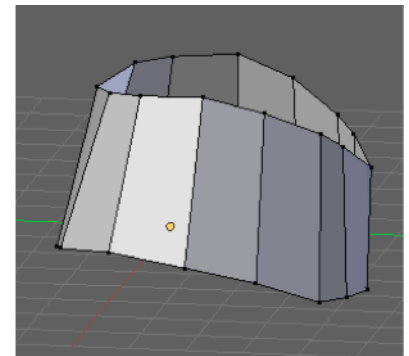
Early on in a mesh development, this is a great option. Consider how your mesh will be developed, and select to points from which you can extrude a series of planes. I'll do this here. Select two vertices, or more that are in a line if that makes sense in your case, and press **ctl+ LC** where you would like the extrusion to land. Check the final position from front, side, and top views to make certain the extrusion is where you suspect it landed. Since your extrusion is automatically selected, use the GSR/XYZ transforms to place and size it the way you want. Right, I have extruded a band for the body of my hat. When I dragged the final extrusion to the back seam, the vertices automatically bond at the mirror plane because *clipping* was selected in the modifier.



First extrusion, creating a rough body of the hat.

### Selecting Loops

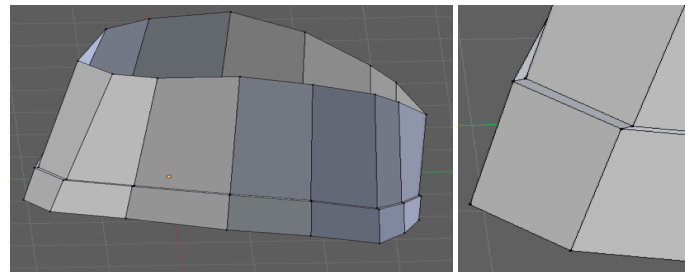
A very handy way to select a loop of vertices is **alt + RC** on an edge of the loop you want to select. You did this to divide the first plane, if you went through the section for symmetrical objects. For my hat, I need to scale and rotate the top loop. I'll loop select that top loop and then use the transforms on that whole loop to get close to the correct configuration. I can edit individual vertices after I to the rough cut using loop select.



The first face-loop of the hat.

### Adding loops

For the ribbon of the hat, I will add a loop. This is a nice way to add complexity to the mesh where needed. Never add unnecessary complexity. You've done this before, add a loop by deselecting the entire mesh, then **ctl + R. LC** once to get the mesh in Grab transform mode, edit the way you wish, then **LC** again to cement it. It will still be selected so you can easily make adjustments. In the case of the hat, I'll make a loop, and move it to the proper position and lock it, then make another loop right below it and scale it up just a hair to represent the thickness of the ribbon.



The hat body with a ribbon created by adding two edge loops and scaling one slightly.

### Adding Faces

Sometimes you need to add a face between vertices. It's usually best to have faces defined by 4 vertices. Select the 4 vertices that you would like to define a face and press **F**. If the geometry is acceptable, Blender will add a face.

### Rip and Merge

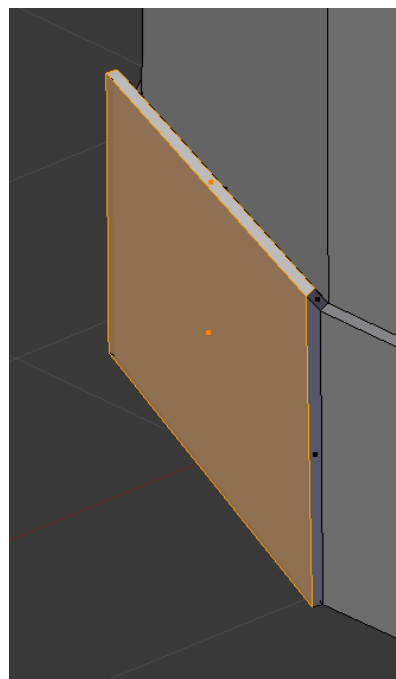
The toolbar on the right has many mesh tools for you to explore. Merge and Rip are just a couple of the useful mesh developing tools. Try some of the Transform, Deform, Add, and Remove functions.

## Face Extrusion

Face extrusion is useful when a plane or set of planes need to be extended. It is done by selecting a face and using the same extrusion keystrokes as with extruding vertices or edges. There are two ways to select a face: you can select all the face's vertices, or you can switch to face select mode.



Beneath the 3D Viewport there is a set of icons where you can choose vertex, edge, or face selection modes. When you Click on face select the vertex points disappear and dots appear in the center of each face. I will use face select mode to make the band ornament around the ribbon. First I will select two faces that are a section of the ribbon. Then I will extrude and scale a thin thickness to make it appear as if the ribbon has an ornamental winding, as common in hats. Because I have the mirror modifier on, this will appear on both sides of the hat. I can leave it on and delete it later, or I can add it later. In this case, I think it would be best to add this detail later on with others, so I will delete these added vertices. I can either delete the individual vertices, or I can go back in a stepwise fashion. This is done by pressing **cmd + z**.



## Duplication

Duplication can be useful depending upon what kind of object you are making. It's not so useful for this hat, but the way it's done is as follows: select the vertices, edges or faces (in Edit mode) object in (object mode) and press **shift + D**, the new object shares the same space as the original, so drag it away from the initial object into it's new position. In Edit mode, the new copy will be a part of the same object, it won't be attached until you unite it, but Blender deals them in the same object space. If you duplicate an object in Object mode, it will become a separate object.

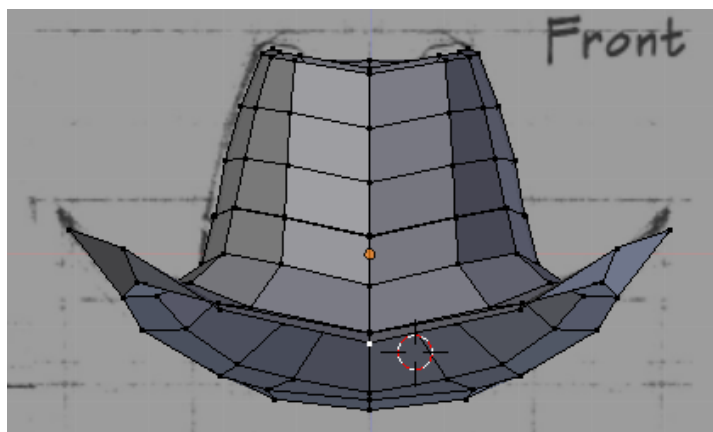
## Shade Smooth

It's not a way to add vertices, but you can get a rough Idea of what your mesh will look like when rendered by select All, **A > W > Shade Smooth** when in Edit mode. To switch back, **All > W > Shade Flat**. It's rough, but can help visualize. Details won't show up with this tool.

## Summary

By adding vertices, edges, and faces through extrusion or duplication then positioning them using the transforms, you can build just about any kind of mesh. Learn the various shortcuts to develop your meshes efficiently.

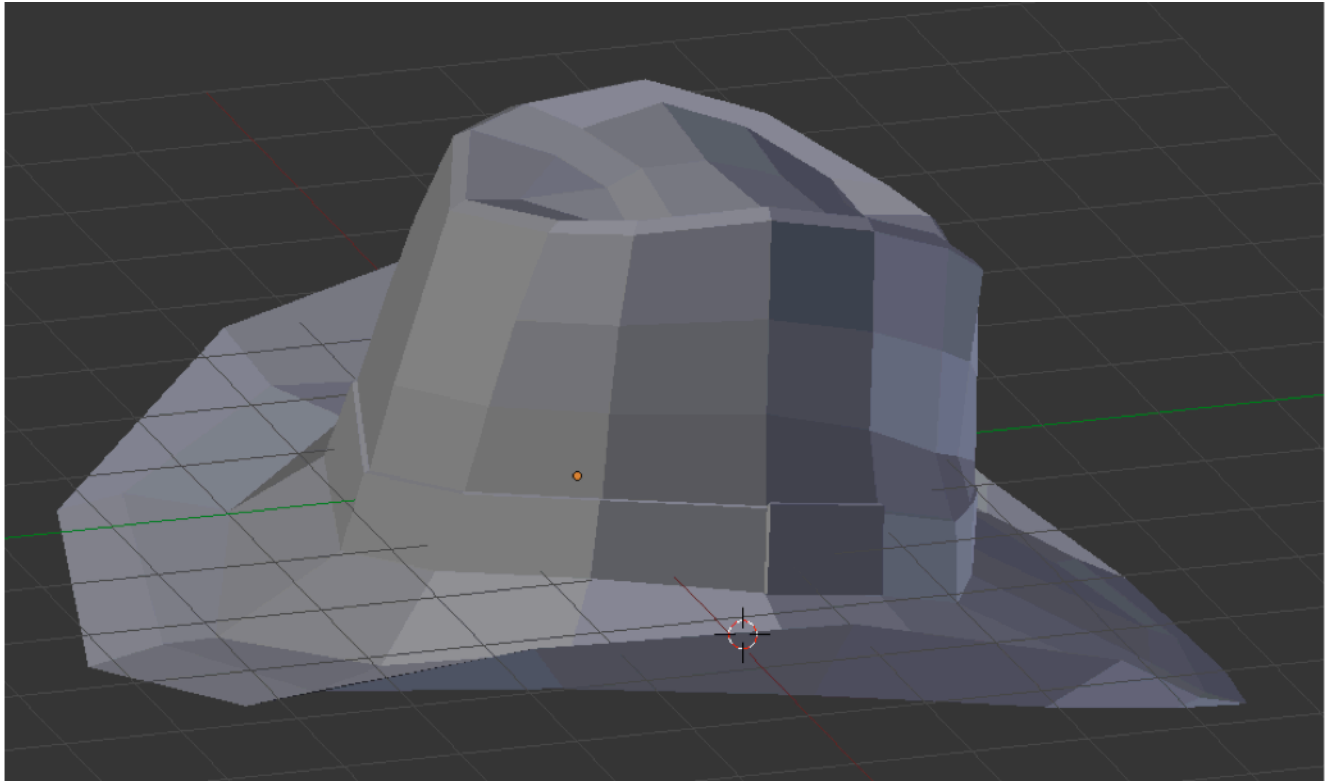
For the hat, the most effective methods were loop select > Grab > Scale. Then moving individual vertices as needed.



## Applying the Modifier

If you had a mirror modifier and you are done with the symmetrical work, you can apply the modifier. Go into Object mode (**tab**). Select **Apply** in the Modifier Panel on the right. Now you can edit the sides of the mesh independently. There's no effective way to go back once you've made the mesh sides asymmetrical.

I will add that extra thickness to the ribbon band now.



Mesh hat completed using techniques presented in Lesson 3.

## Don't forget to save your work!

### *Wrap Up*

Congratulations! That concludes Lesson 2, and you've completed your first original mesh. There are numerous online resources for working in Blender and it's a good idea to look at a variety of tutorials. There are a lot of techniques that I don't cover here, this lesson is just the tip of the iceberg.