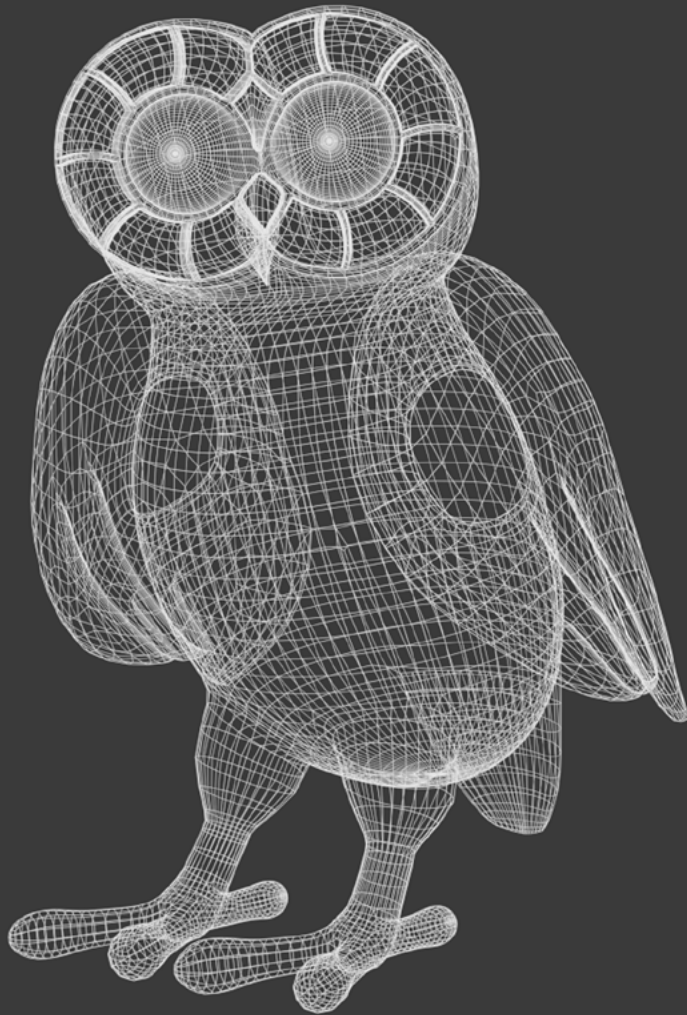


RICE DMC

SHORT COURSE



Creating a 3D model in Blender

Edit Shortcuts

Shift + S snap

X or delete button delete

TAB toggle edit/object mode

↓ In edit mode ↓

E extrude

Ctrl + TAB choose component

K knife

F add face

Navigate Shortcuts

Shift + hold MM wheel pan

Hold MM wheel tumble

Scroll MM wheel zoom

Window Shortcuts (in 3D view)

N Properties Panel

T Tool Shelf

Manipulate Shortcuts

R rotate

S scale

G move

↓ After selecting R,S or G ↓

X constrain to X

Y constrain to Y

Z constrain to Z

Select Shortcuts

A deselect

B box marquee tool

Shift + RMB add to selection

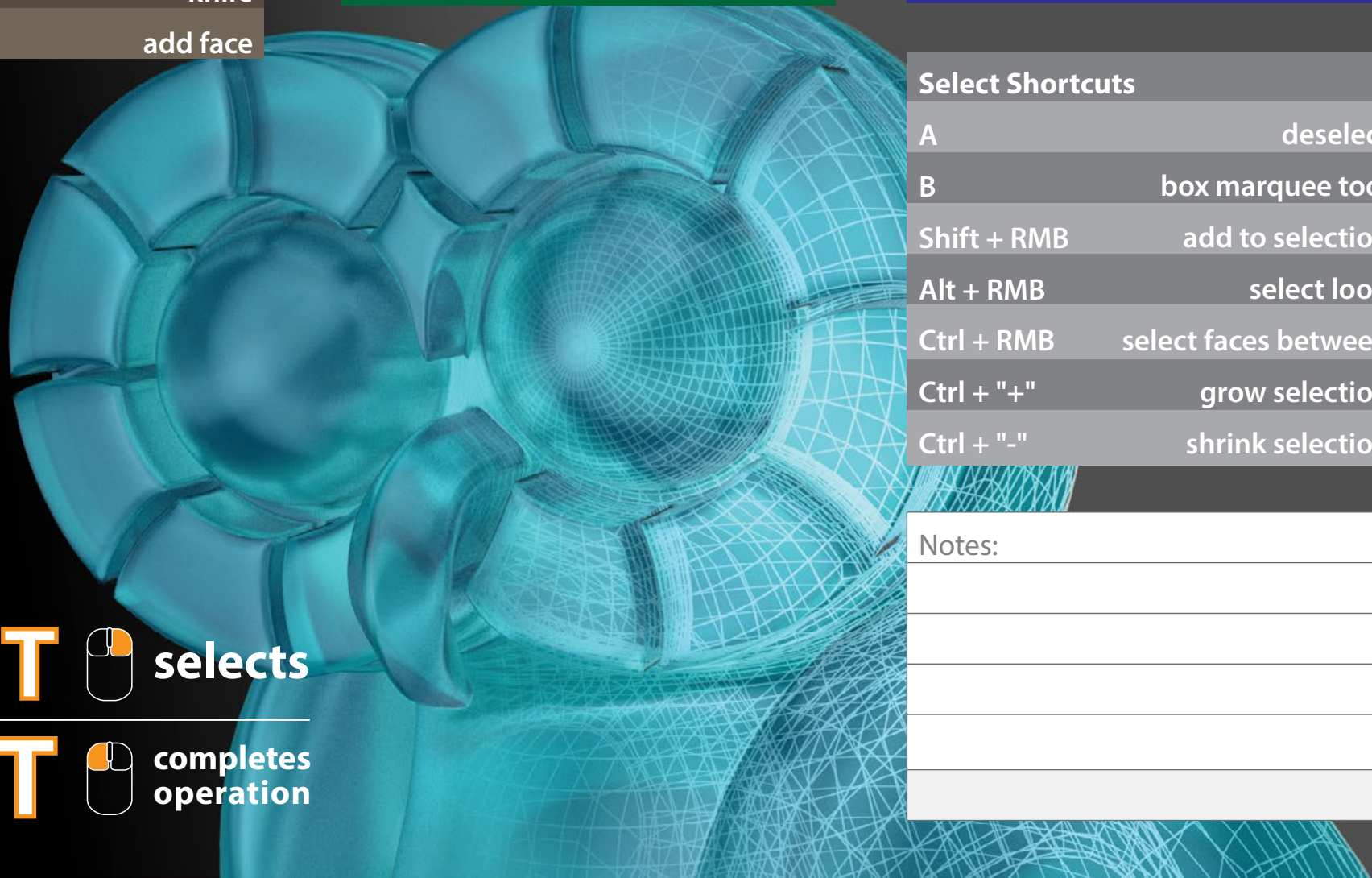
Alt + RMB select loop

Ctrl + RMB select faces between

Ctrl + "+" grow selection

Ctrl + "-" shrink selection

Notes:

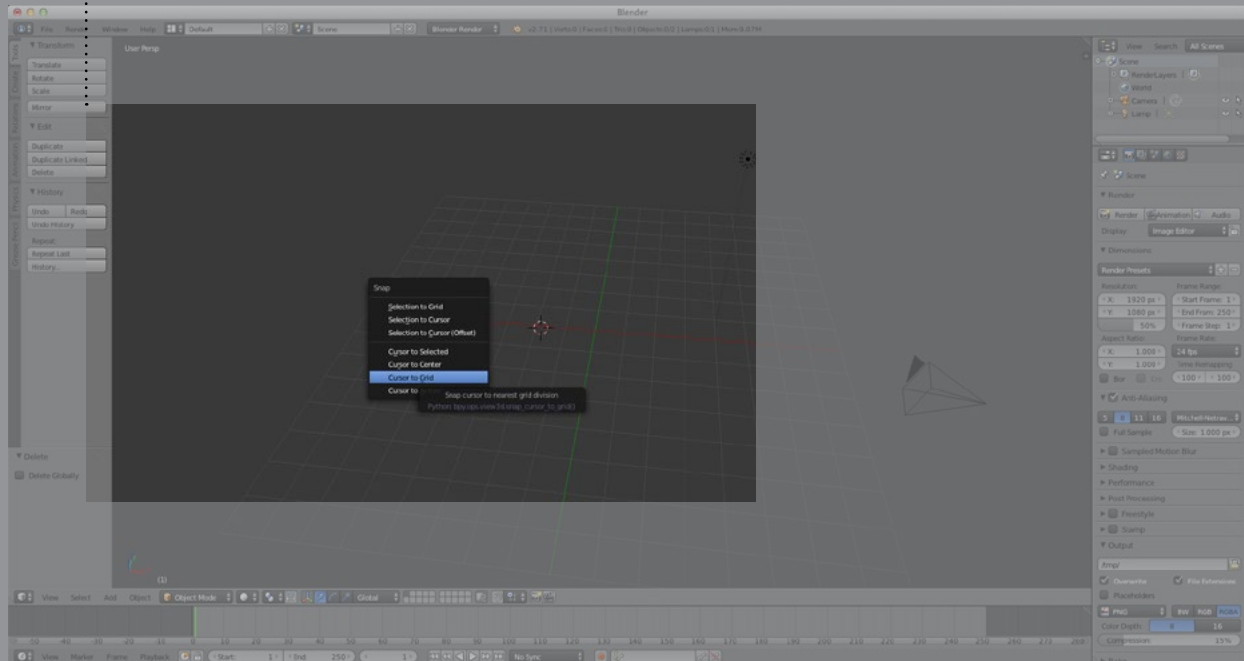


RIGHT  selects

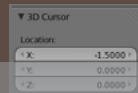
LEFT  completes operation

How to use this guide

Blender Screenshot



1. After getting familiar with the UI, left click near (-1.5,0,0)
2. If your 3D cursor is not quite at (-1.5,0,0) use Shift + S, "Cursor to Grid"
3. If left clicking and snapping are unreliable, press "N" to toggle the properties window within 3D view. Find the 3D cursor options and manually input coordinates.



Steps. The orange text is an alternative step.

Shortcuts Used:

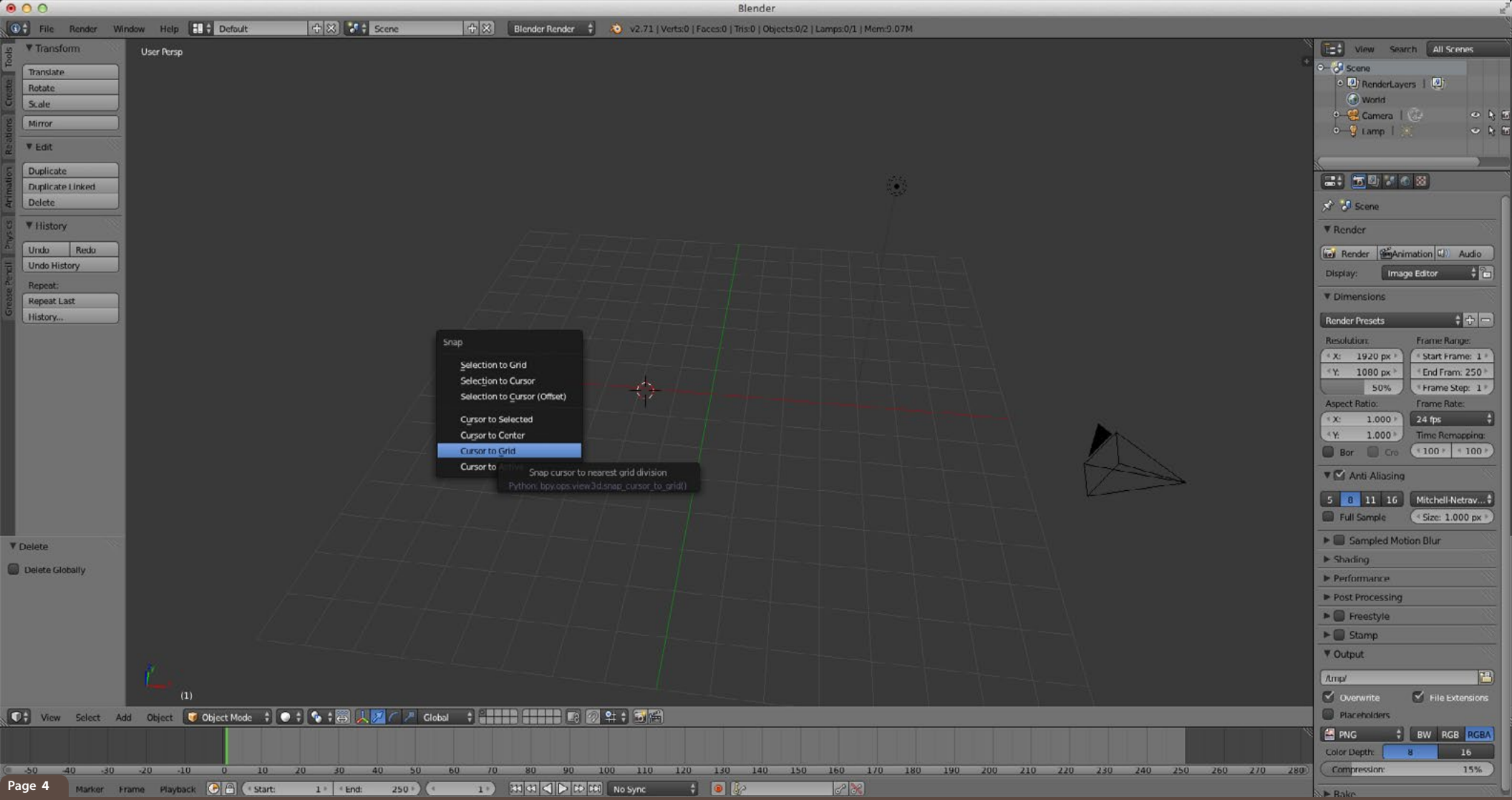
Shift + S snap
N properties panel

Keyboard Shortcuts

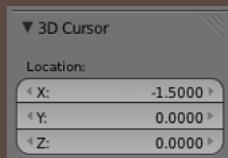
Why:

Primitives are created at the 3D cursor. Other operations also depend upon the 3D cursor's location. You may left click anywhere to move the 3D cursor or give explicit coordinates in the properties panel "N" (not to be confused with the properties editor)

explanation to contextualize the steps taken



1. After getting familiar with the UI, left click near (-1.5,0,0)
2. If your 3D cursor is not quite at (-1.5,0,0) use Shift + S, "Cursor to Grid"
3. If left clicking and snapping are unreliable, press "N" to toggle the properties window within 3D view. Find the 3D cursor options and manually input coordinates.

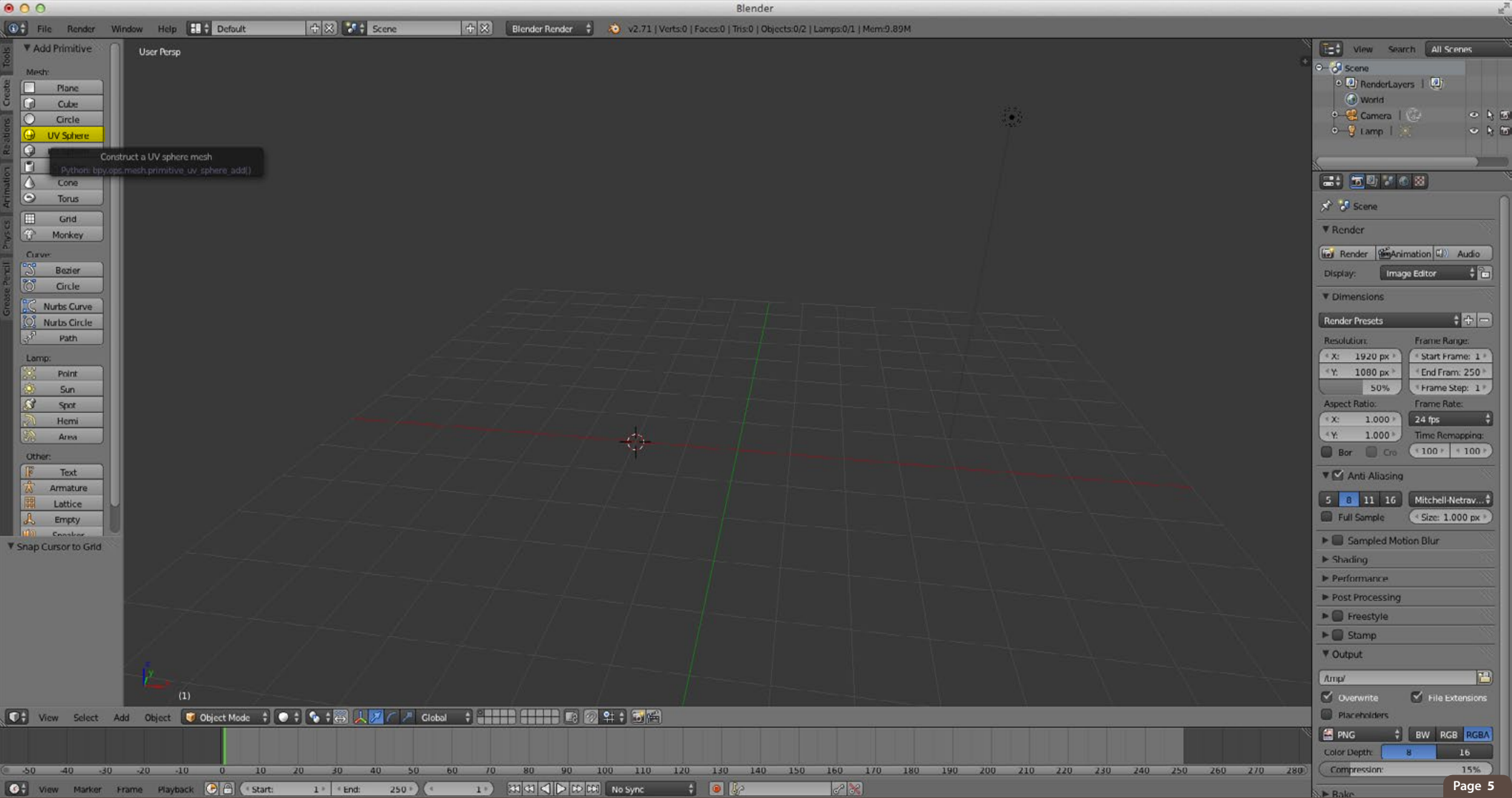


Shortcuts Used:

Shift + S snap
 Nproperties panel

Why:

Primitives are created at the 3D cursor. Other operations also depend upon the 3D cursor's location. You may left click anywhere to move the 3D cursor or give explicit coordinates in the **properties panel** "N" (not to be confused with the properties editor)



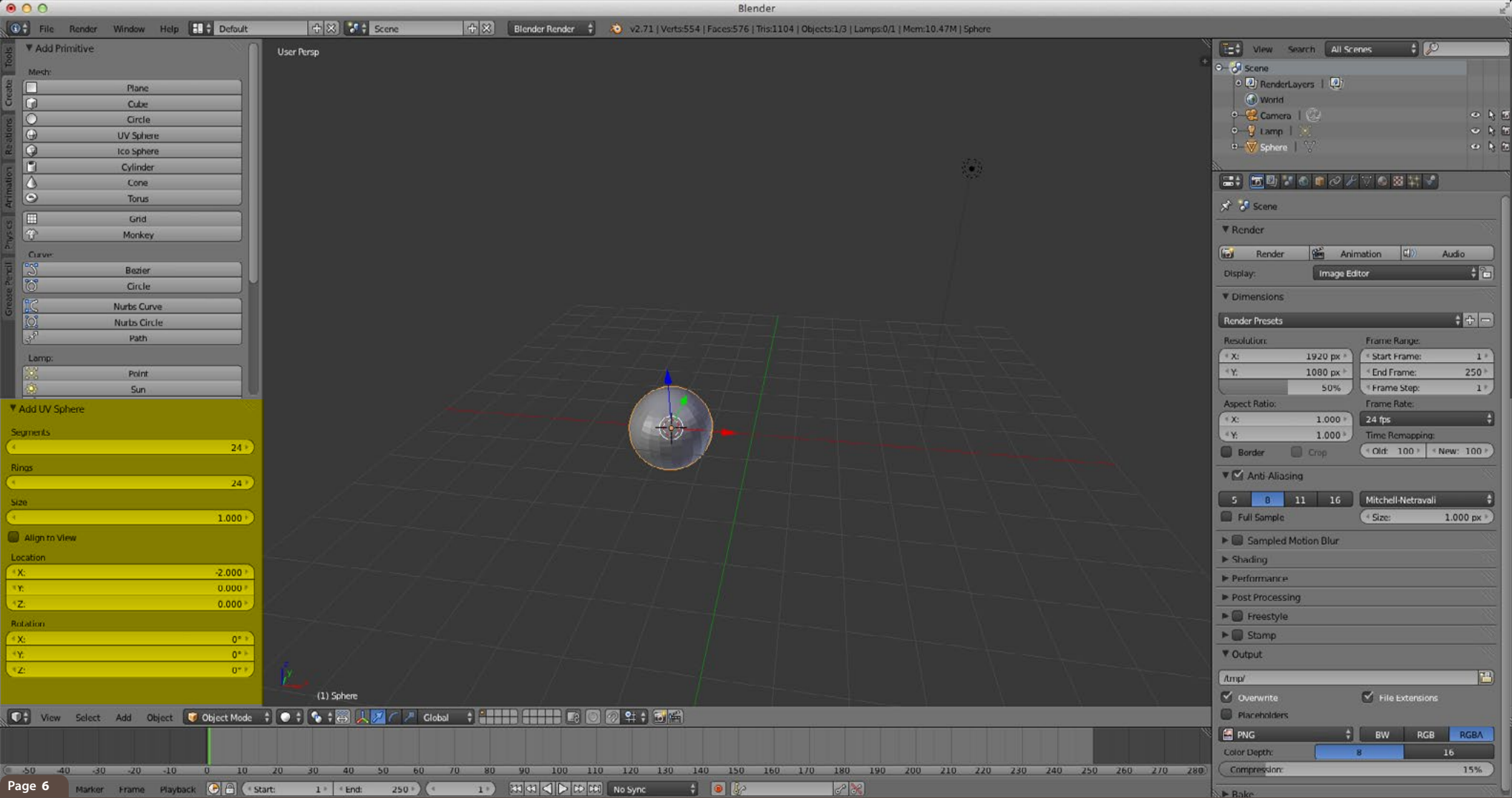
1. In the Tools panel under "Create", select UV Sphere.
2. Alternatively, use the keyboard shortcut **Shift + A** to add to the scene. Under "mesh" select UV Sphere.

Shortcuts Used:

Shift + A add

Why:

Remember: new objects are created at the 3D cursor's location.

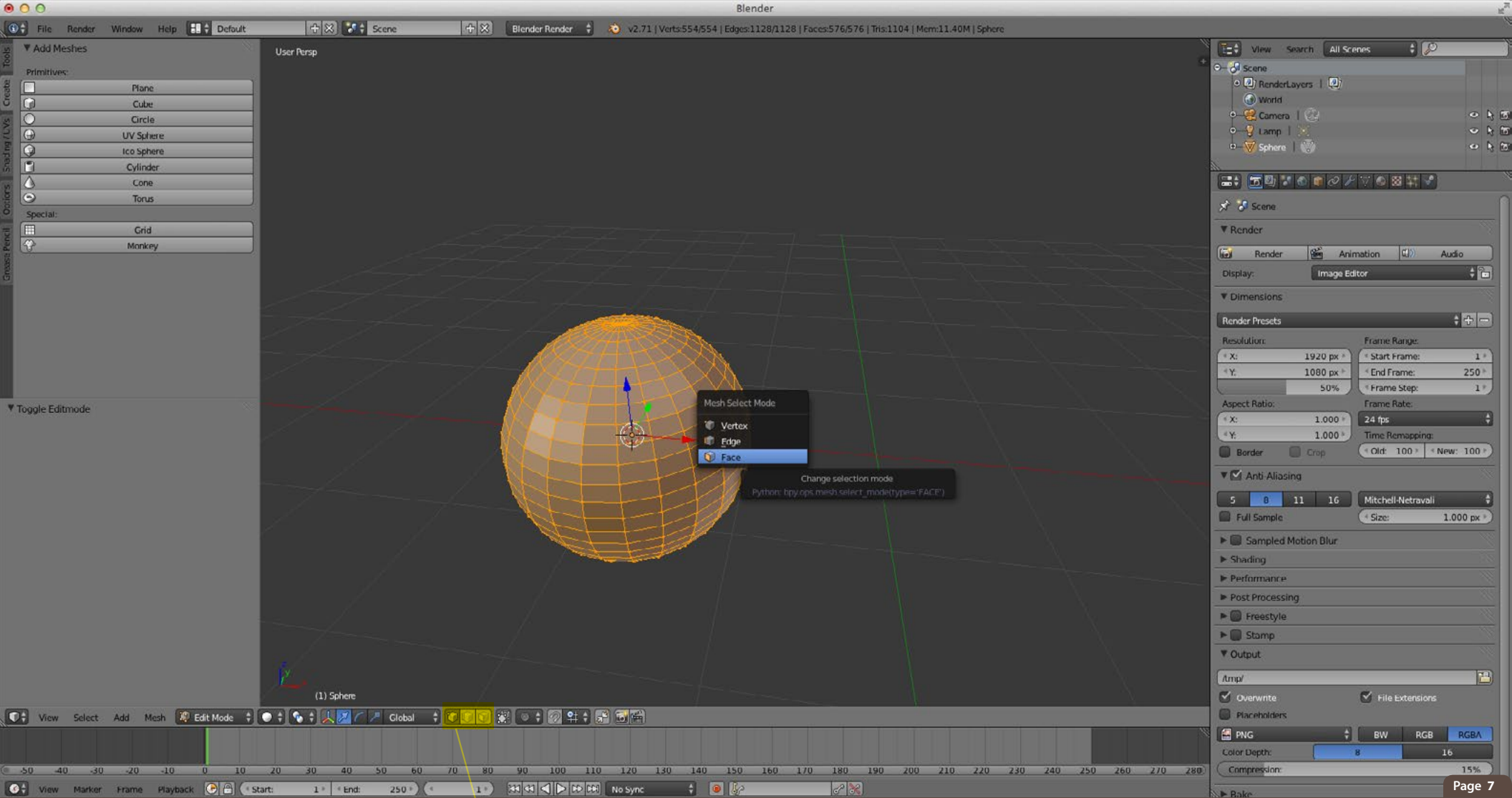



1. Notice the **temporary** panel that pops up at the bottom left immediately after adding the UV Sphere. Now is your chance to change the geometry.
2. Set to 24 segments and 24 rings.

Shortcuts Used:

Why:

When moving on after this operation, this temporary panel will either disappear or contextualize to the current operation.



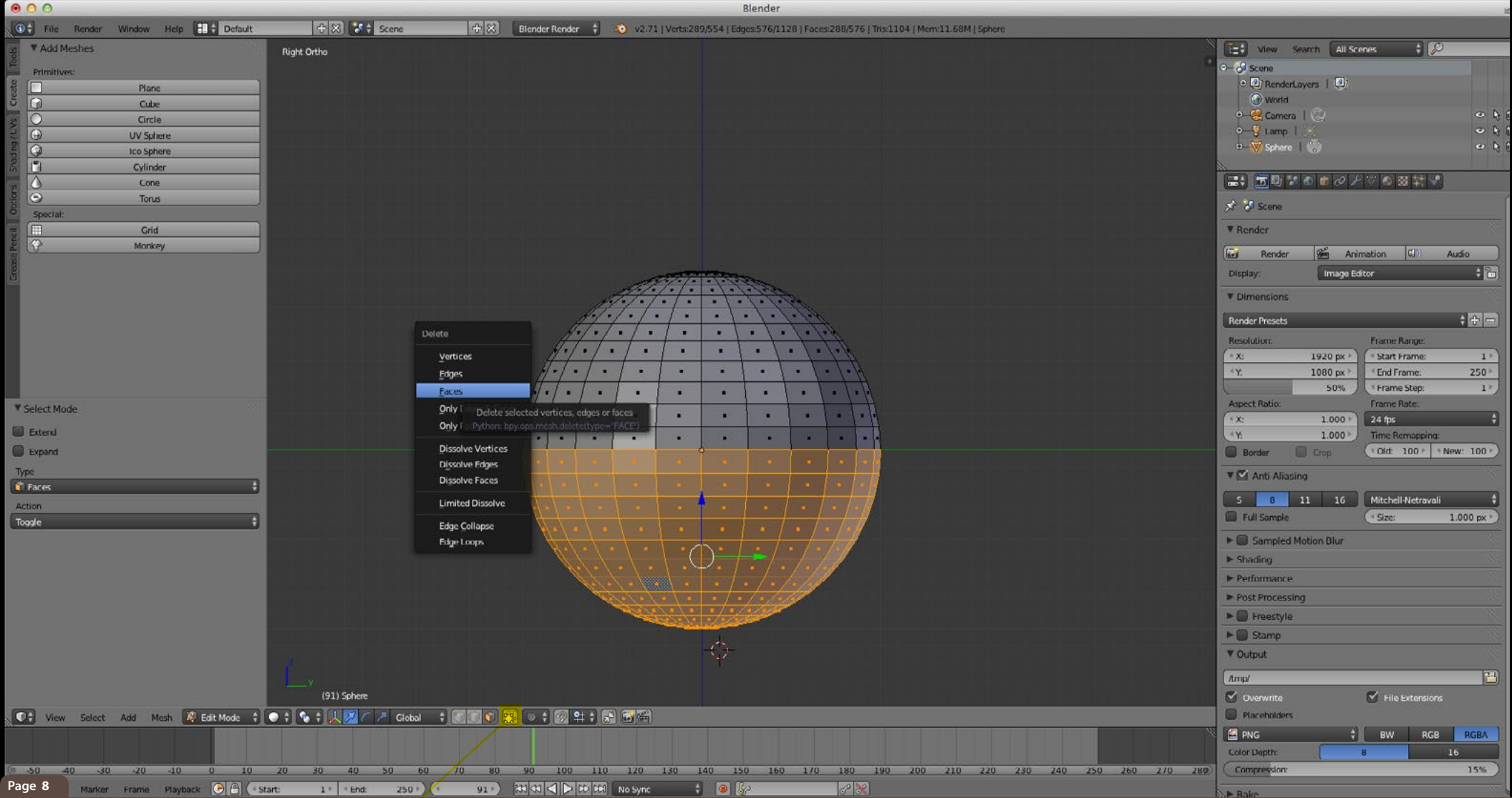
1. Hit Tab to move into edit mode. Notice that all of the vertices turn orange to indicate that they are selected.
2. Once in edit mode you may alternate between vertex/edge/face by either selecting the icons in the UI  or hitting Ctrl + Tab (while in edit mode) and then select the component


Shortcuts Used:

Tab edit mode
Ctrl + Tab change component

Why:

Use edit mode to make changes to your polygon mesh or curve.



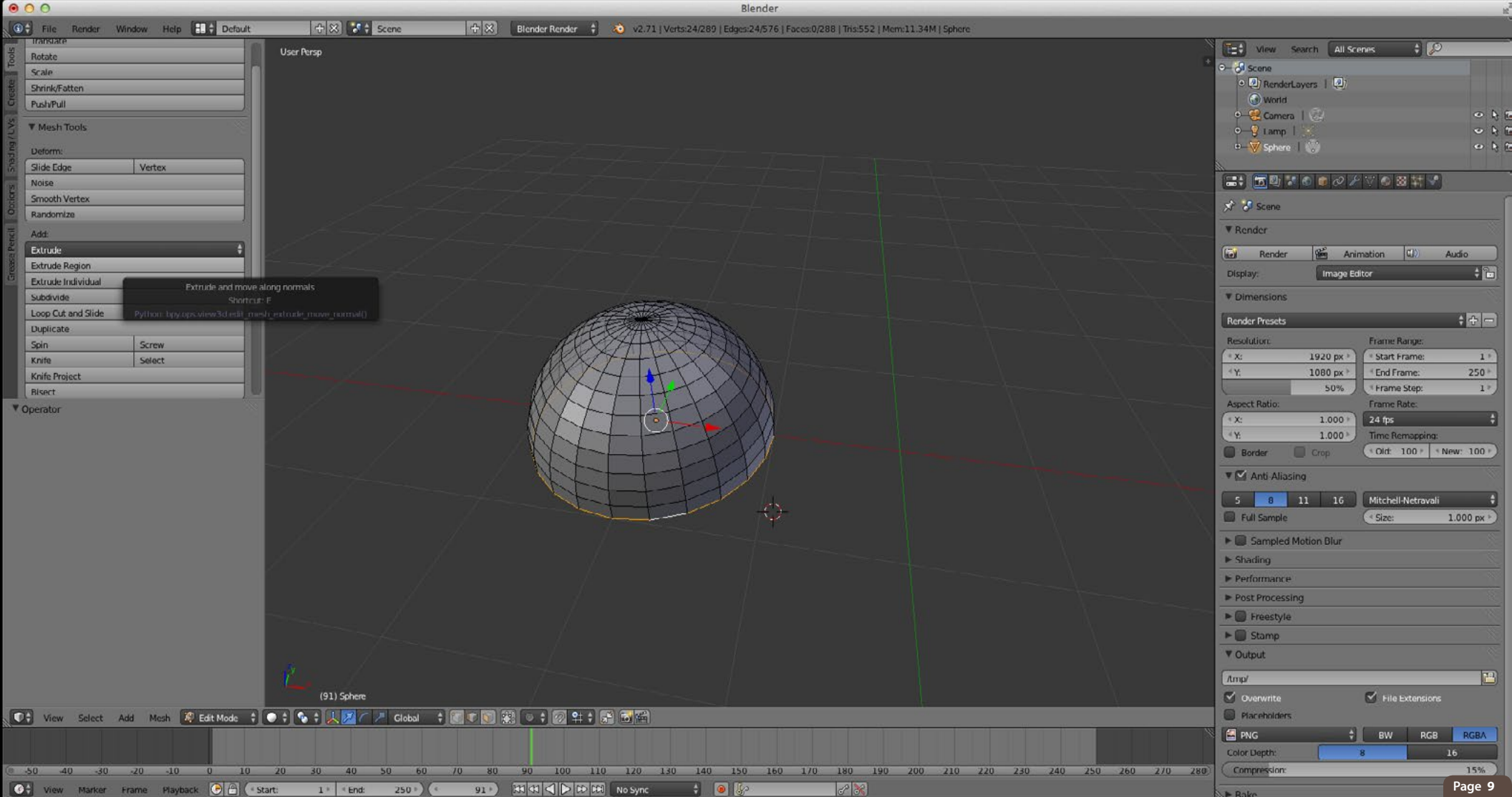
1. Hit 5 on the numeric keypad to go into orthographic view. Now hit 3 on the numeric keypad to move into Left view.
2. Be sure to toggle  "limit selection to visible" to allow for selection of back faces.
3. Hit the shortcut for box marquee "B" then left click and drag to select the bottom half of the sphere.
4. Hit "X" or delete and select faces to delete the bottom half of the sphere.


Shortcuts Used:

5..... orthographic/perspective view
 3..... left view
 B.....box marquee select
 X.....delete

Why:

The numeric keypad shortcuts make it easy to switch between views. Use 1,3 and 7 to switch views, 5 to toggle ortho/perspective view and 2,4,6,8 to rotate the view in increments. The box marquee tool (b) makes selecting multiple faces easy.



1. Switch to edge mode with Ctrl + Tab or the UI symbol 
2. To select the bottom edge loop hold Alt and right mouse click one of the edges. This will automatically select the entire bottom loop of edges
3. Hit "E" to extrude the bottom edges.
4. **Note:** You will not see any difference after extruding. **DO NOT** hit "E" again in doubt, this will only create excess faces with zero area. Jump immediately to the next step to observe our extruded geometry. Refer to the "pitfalls" section of this guide to see the consequences of doing step 3 incorrectly.

Shortcuts Used:

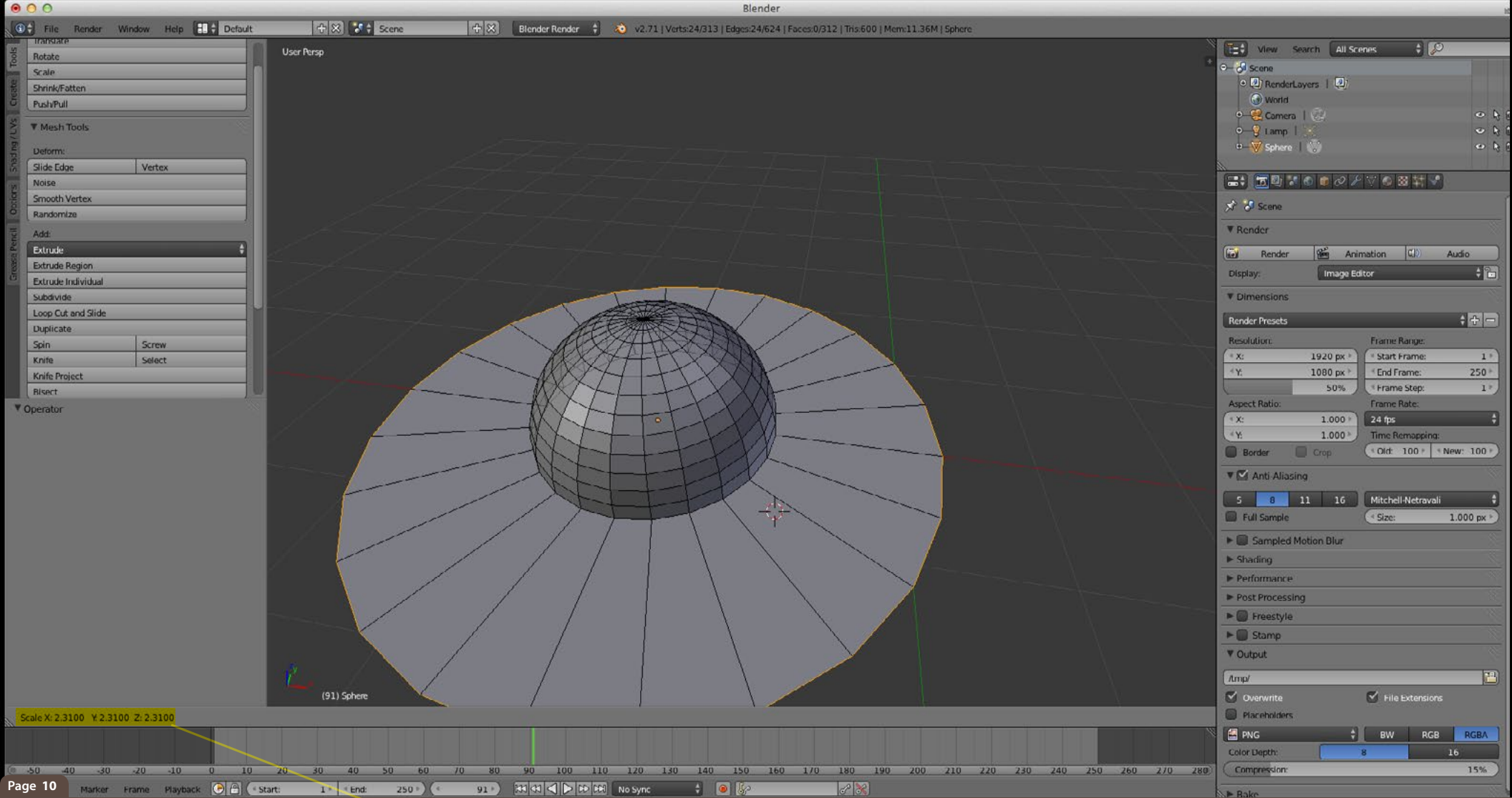
Ctrl + Tab..... change component
 Alt + RMB.....select edge loop
 E..... extrude

Why:

Often times you will need to select an entire edge loop. Alt + RMB makes that easier.

The extrude command can be used for faces and edges. Be wary when using extrude on edges.

Read step 4!



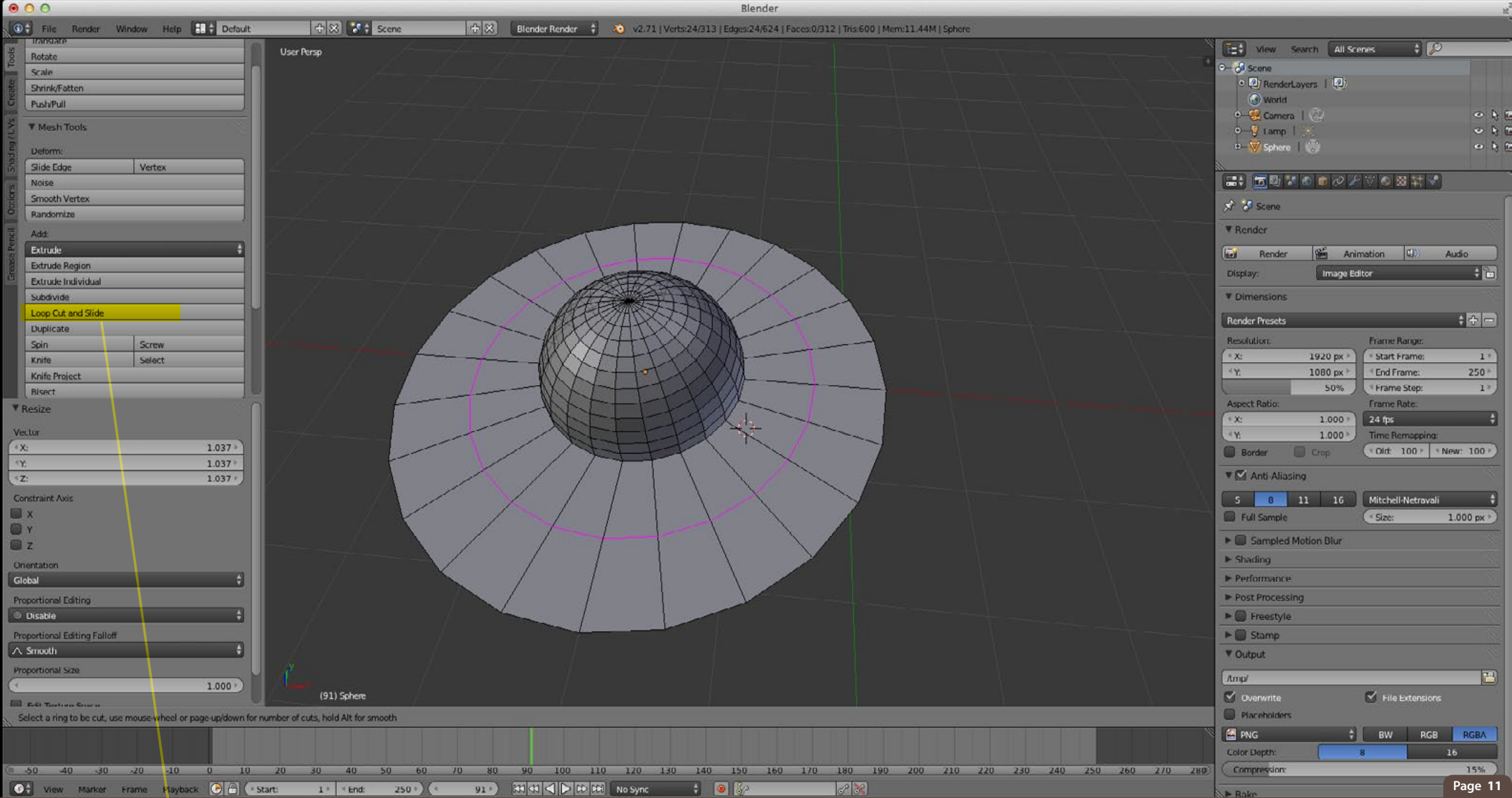
1. With the newly extruded geometry still active, hit "S" to scale it around X:2.3 Y:2.3 Z:2.3. Note that the values will be shown near the bottom. At this time, you are able to manually type in the scale factor.

Shortcuts Used:

S..... scale

Why:

Hitting S,R or G will scale, rotate or move in all 3 dimensions. To constrain to a dimension simply press X, Y or Z directly after scaling, moving or rotating

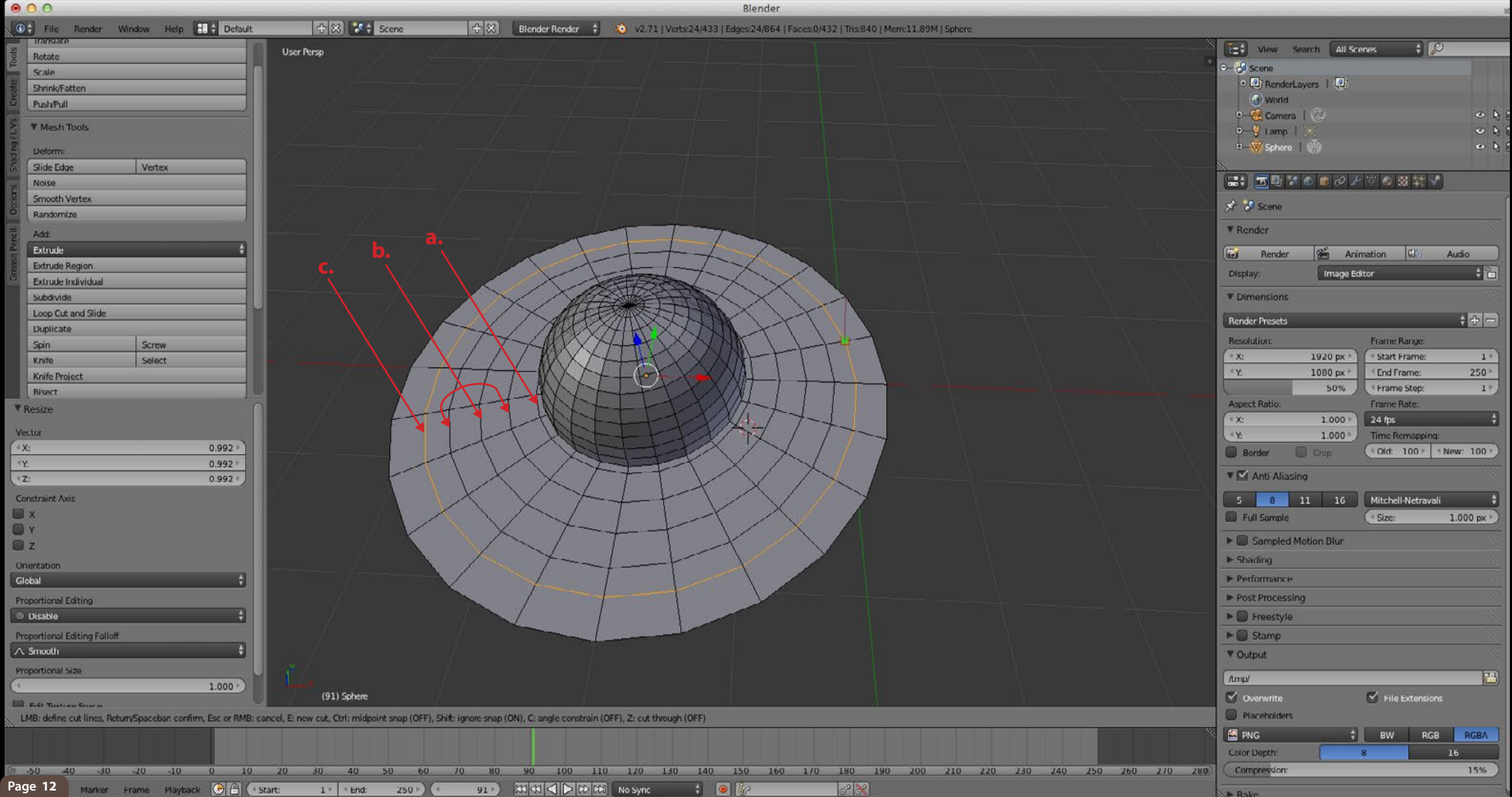


1. Hit "Loop Cut and Slide" under Tools>Mesh Tools>Add>Loop Cut and Slide.
2. Position your mouse near the middle of the cylindrical base. Left click once to activate and left click again when you are happy with the location. Note: use the next page as a guide for your new loops

Shortcuts Used:

Why:

After hitting "Loop Cut and Slide" the purple loop indicates the midpoint of 2 loops. After clicking once, you may select a new location for your loop.



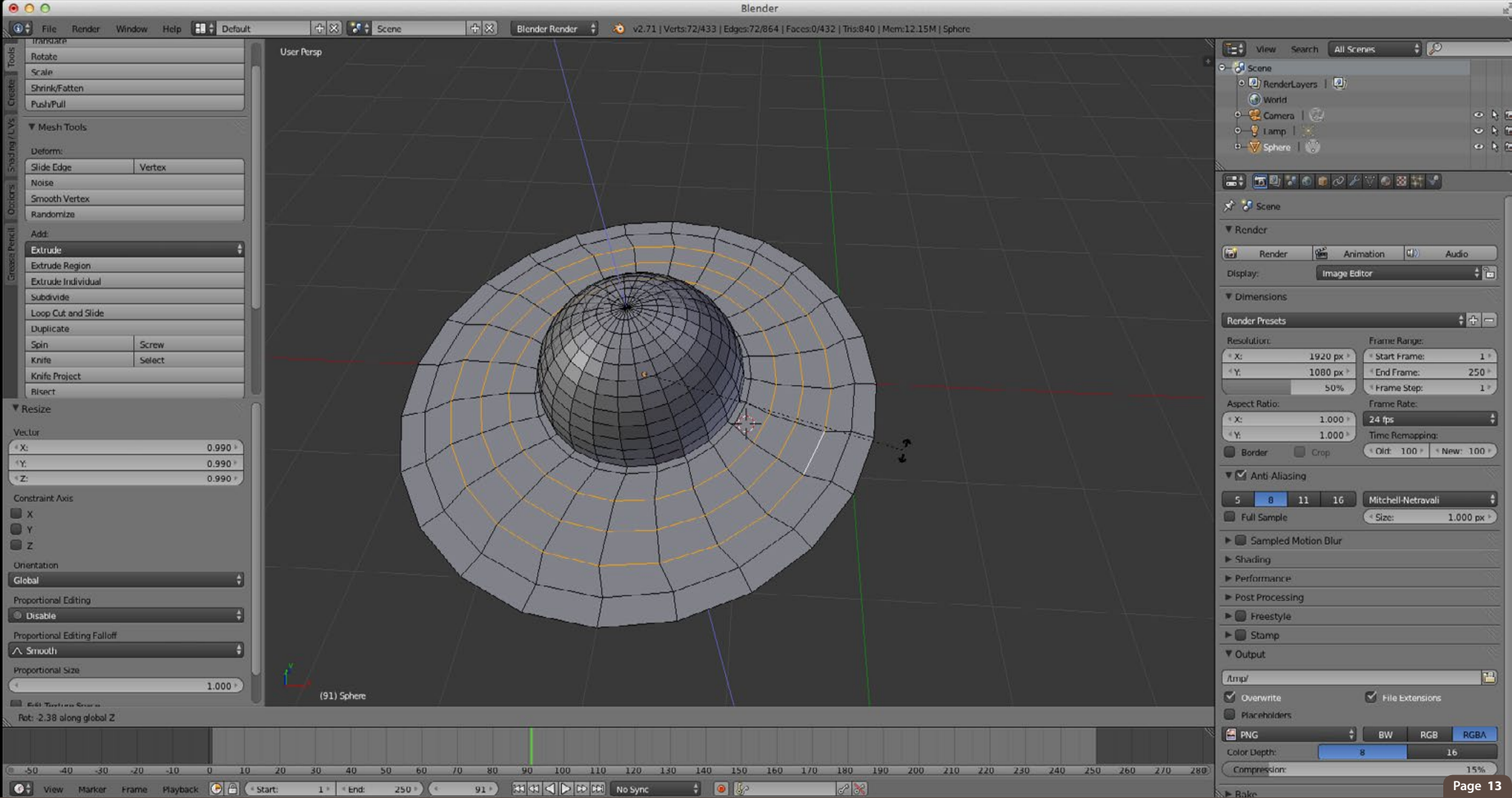
1. Loop Cut and Slide once near the sphere (a.), three equidistant loops in the middle (b.) and one last loop at the outer edge (c.)
2. Notice the area being modeled to the right. Creating edge loops will offer more geometry to rotate on the next page of steps



Shortcuts Used:

Why:

"Adding Geometry" means that we are dividing, extruding or subdividing our model to create more polygon faces. This creates detail. It is best to work with the least number of polygons as possible then add a subdivision modifier at the end.



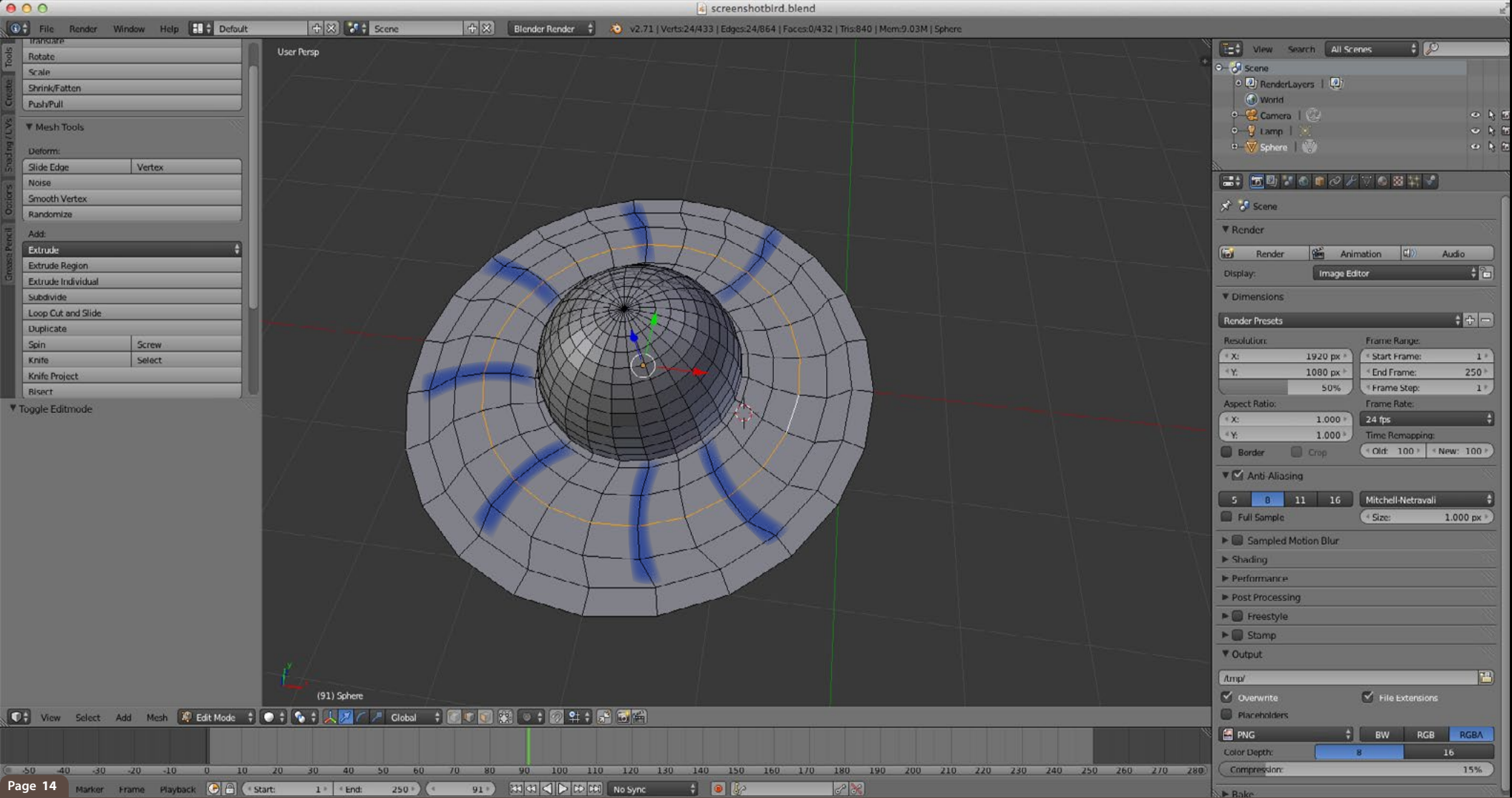
1. Select the 3 middle loops. Do so by Alt + Shift + RMB one edge of each loop.
2. Hit "R" to rotate. Hit "Z" to constrain rotation to the Z axis. Notice the blue Z axis which appears through the middle of the model. Rotate to around -2.5°. You may type the value.

Shortcuts Used:

Alt + Shift + RMB... multiple edge loops
 R..... rotate
 Z..... constrain to Z after hitting R

Why:

After hitting "Loop Cut and Slide" the purple loop indicates the midpoint of 2 loops. After clicking once, you may select a new location for your loop.



1. Select the center loop and rotate again as seen above
2. Notice the overall curvature of the Rice Owl which has been emulated in the 3D model.

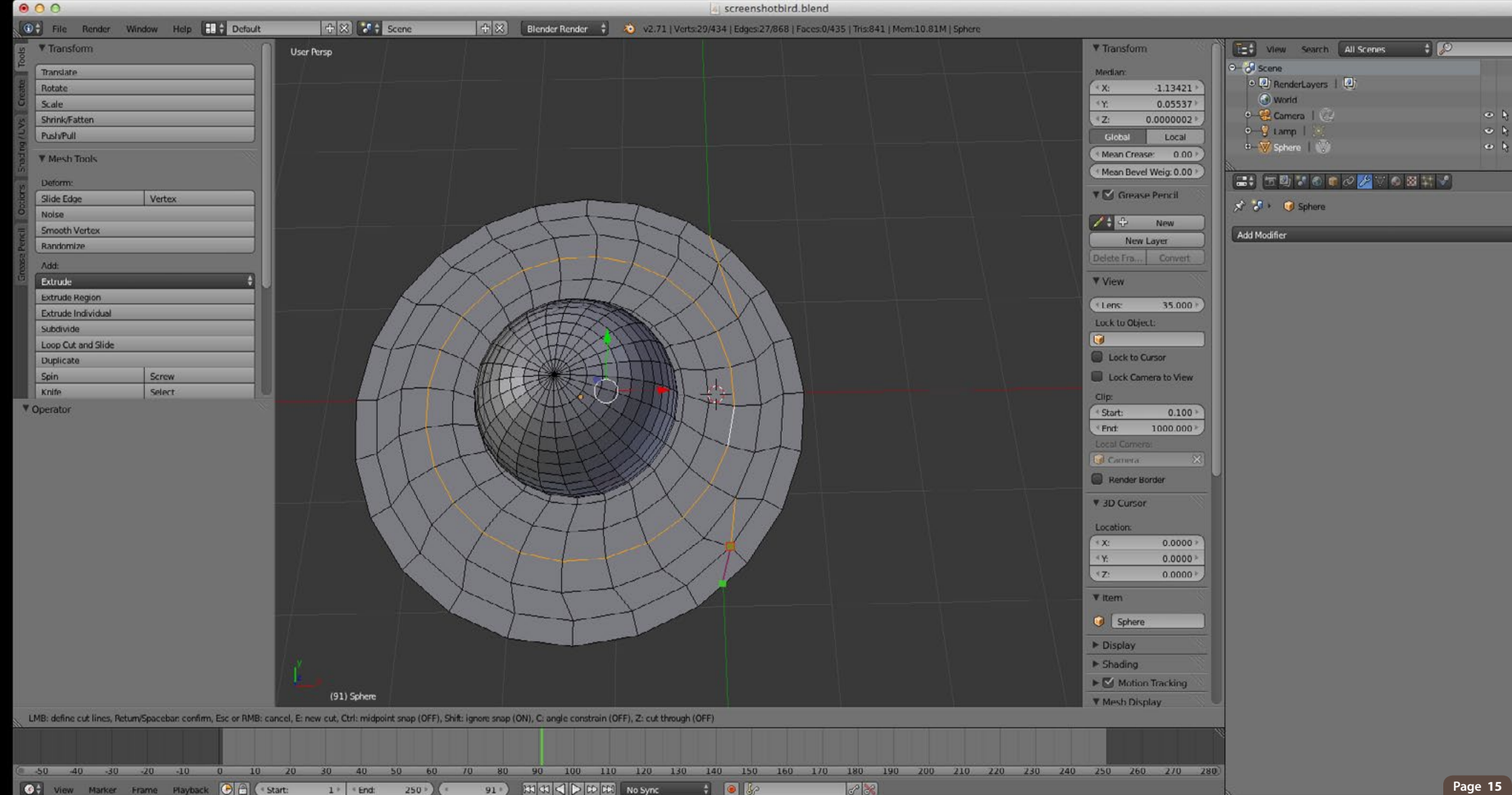


Shortcuts Used:

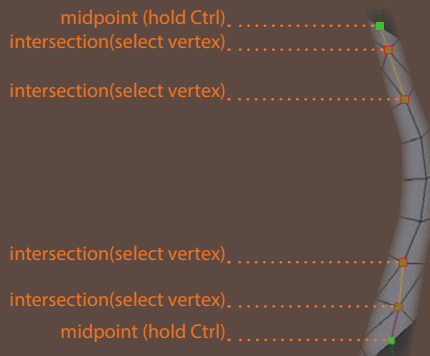
Alt + RMB..... select edge loops
 R..... rotate
 Z..... constrain to Z after hitting R

Why:

It is wise to establish the curvature at an early stage in the model. That will enable future geometry to build off the base.



- Important:** Hit Tab to go into object mode, move the model a little in the positive X direction (around global -1.15). Once the model is the same as above, hit Tab to go back into edit mode.
- Hit "K" for the knife tool.
Make the cuts pictured at right.
Hit enter when done.

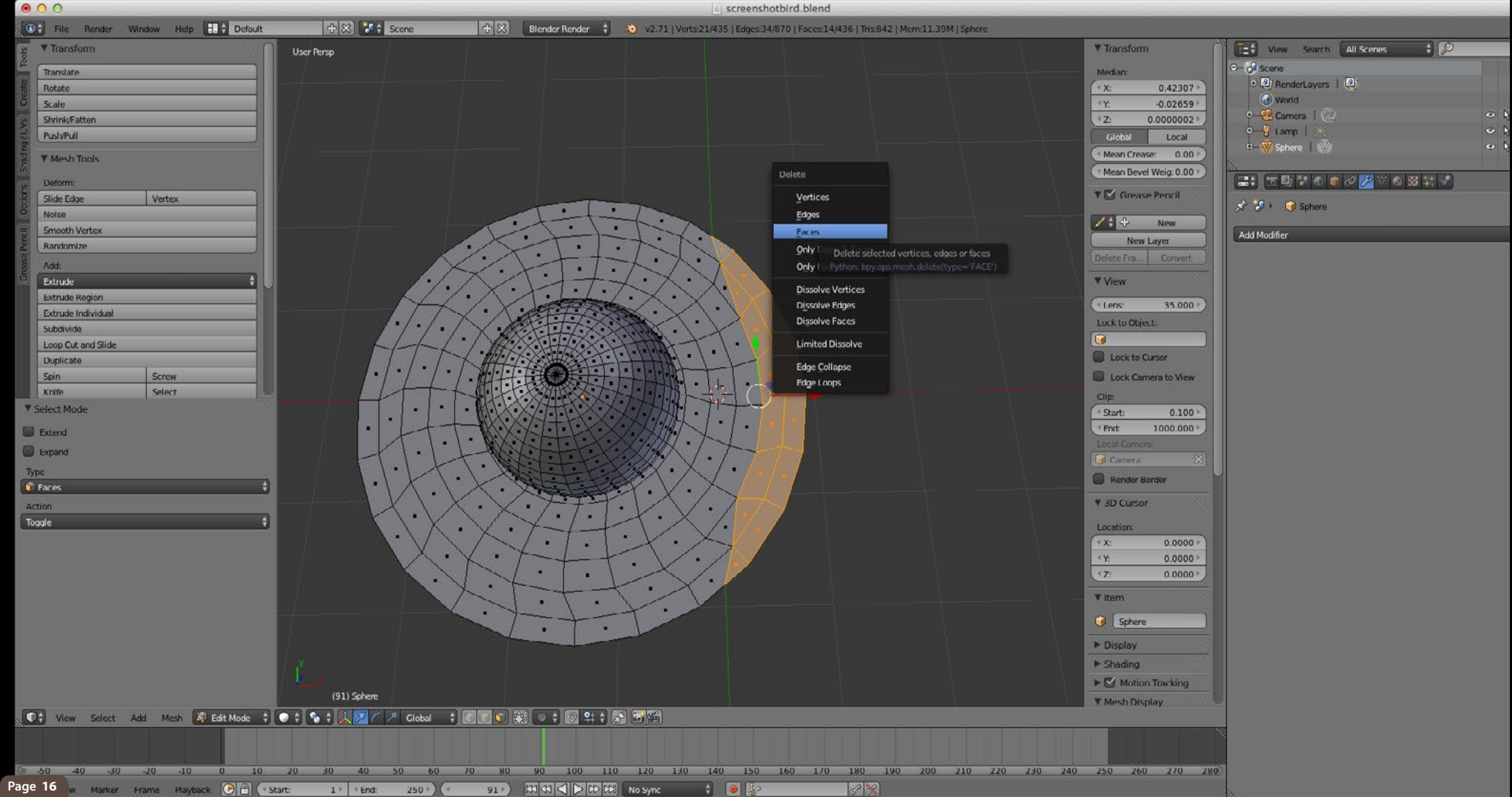


Shortcuts Used:

K.....knife
Ctrl (while using knife)snap to midpoint

Why:

If the cut intersects with a vertex, be sure to select the vertex. Otherwise a new vertex will be created and the cut will result in a very tiny triangle which is undesirable.



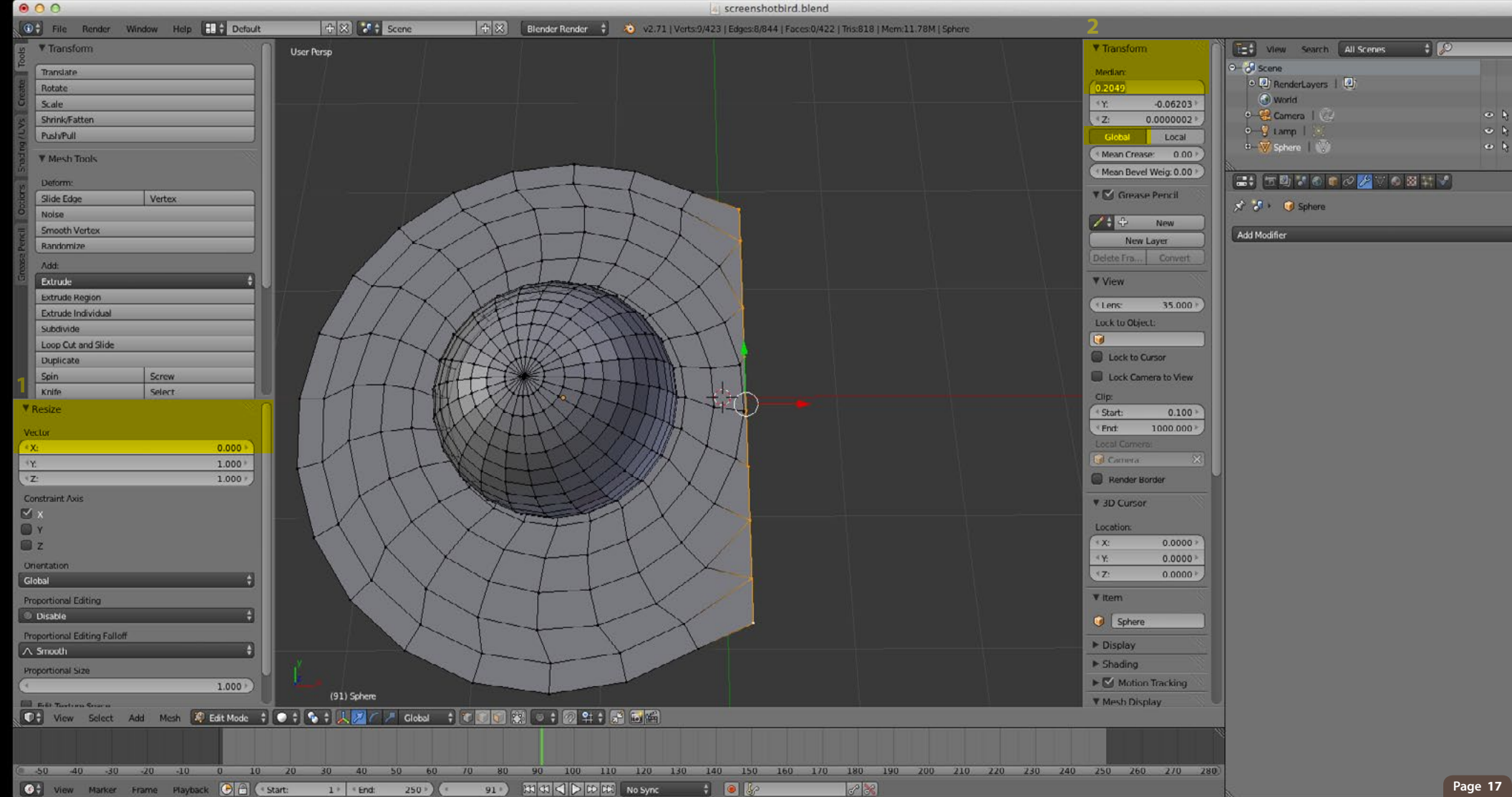
1. Shift RMB select the above faces and delete them with "X" or delete.

Shortcuts Used:

X.....delete

Why:

Right now we are preparing to mirror our geometry to get both eyes of the owl. First the geometry in the center must be prepared and end at global X=0. This will allow our old geometry and mirrored geometry to merge at the center.



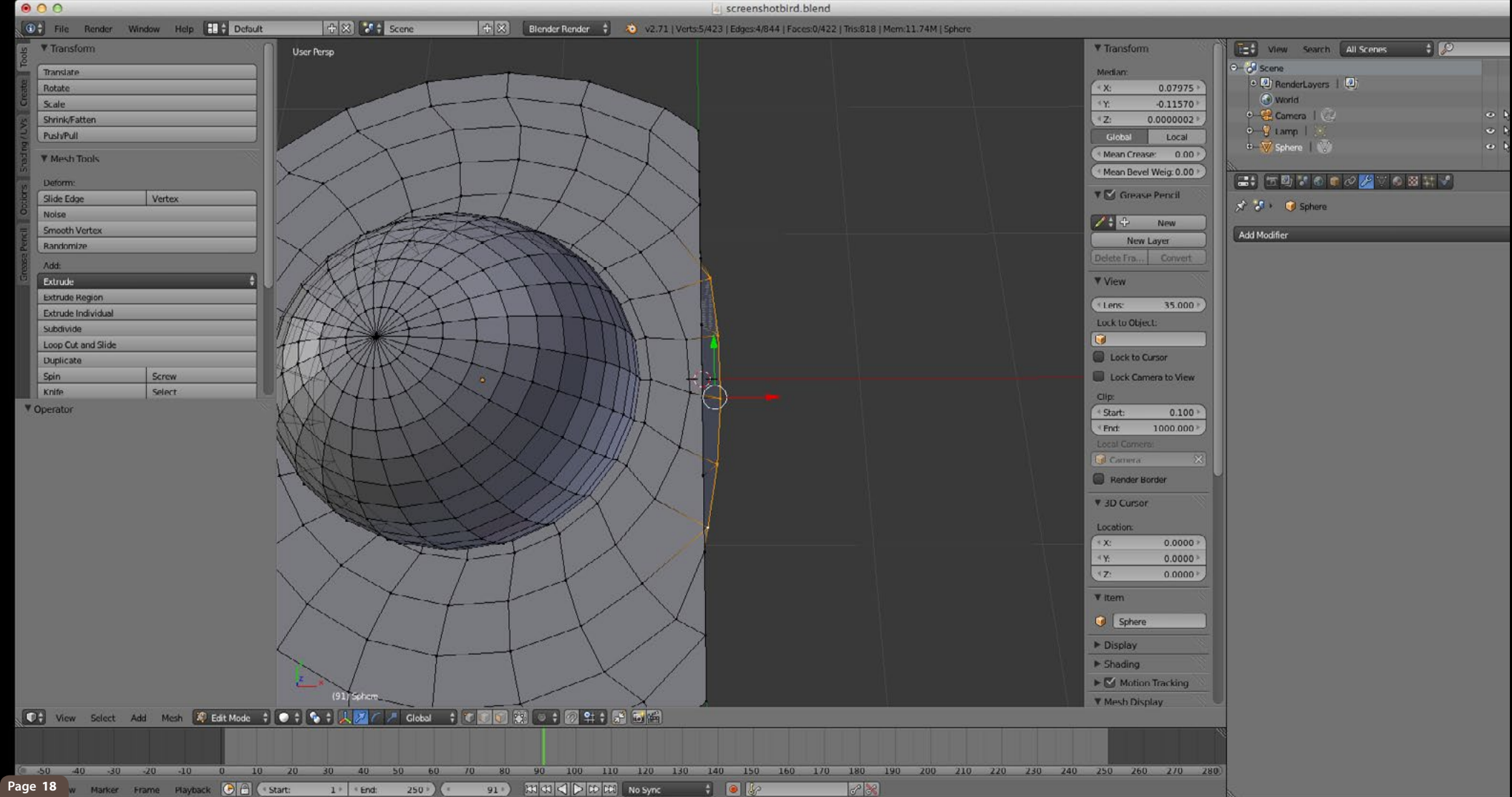
1. Shift RMB select the rightmost vertices (use Ctrl + Tab to switch components).
2. Hit "S" to scale then "X" to scale in X. Type in 0.
3. Move the vertices to global X=0.

Shortcuts Used:

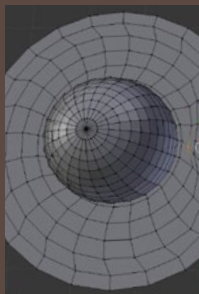
S.....scale
X(after hitting S).....constrain to X

Why:

If we move the selected vertices to global X=0 first, then they would still retain their relative scale to one another. That is why we set the scale to 0 before moving them to global X=0.



1. Shift RMB select the aberrant vertices and use "S" to scale them in X then move to a manageable location. Position and scale nearby vertices to match below:

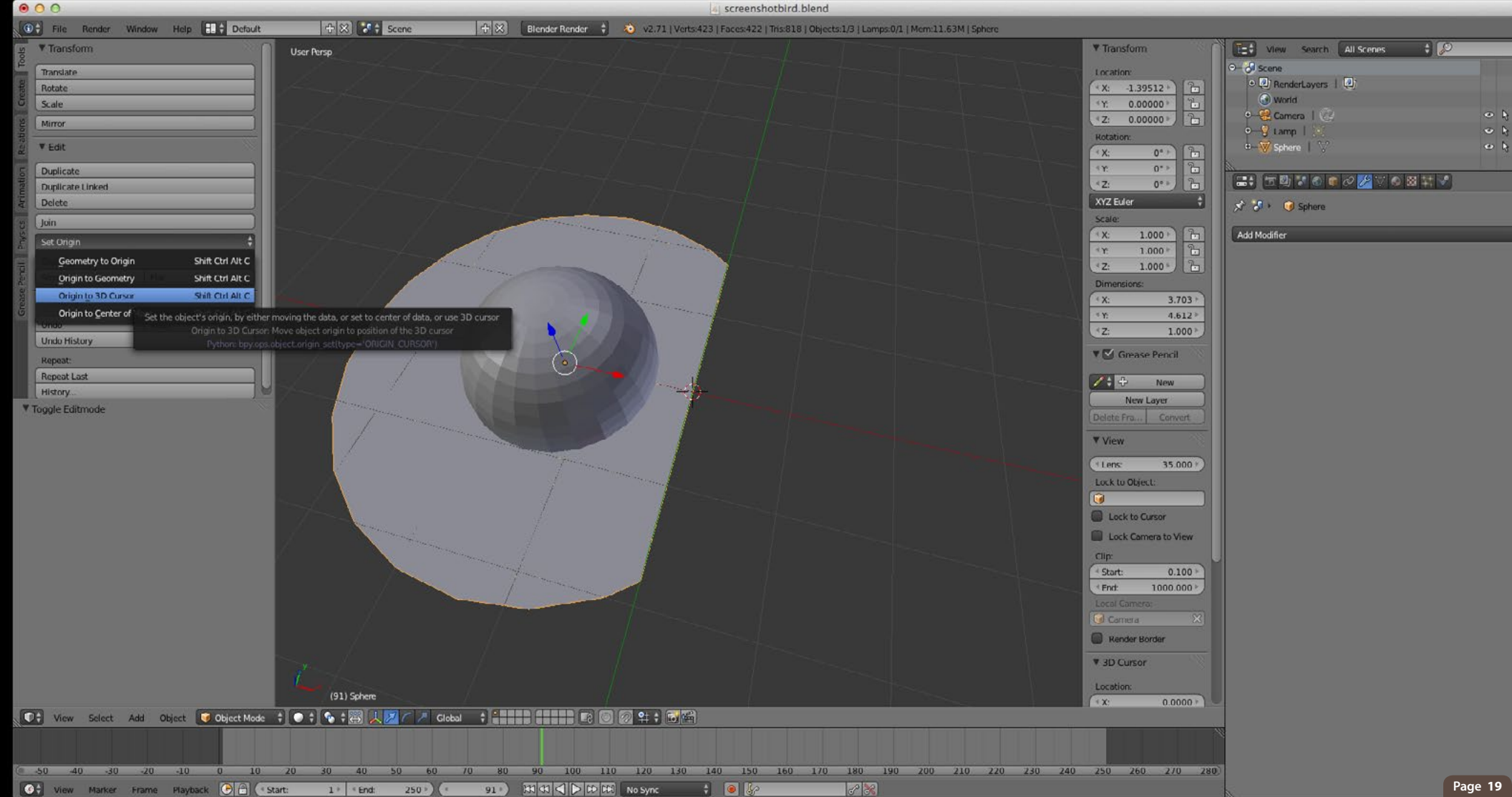


Shortcuts Used:

S.....scale
 X(after hitting S).....constrain to X

Why:

We are still preparing to mirror our geometry to get both eyes of the owl. First the geometry in the center must be prepared and end at global X=0. This will allow our old geometry and mirrored geometry to merge at the center.



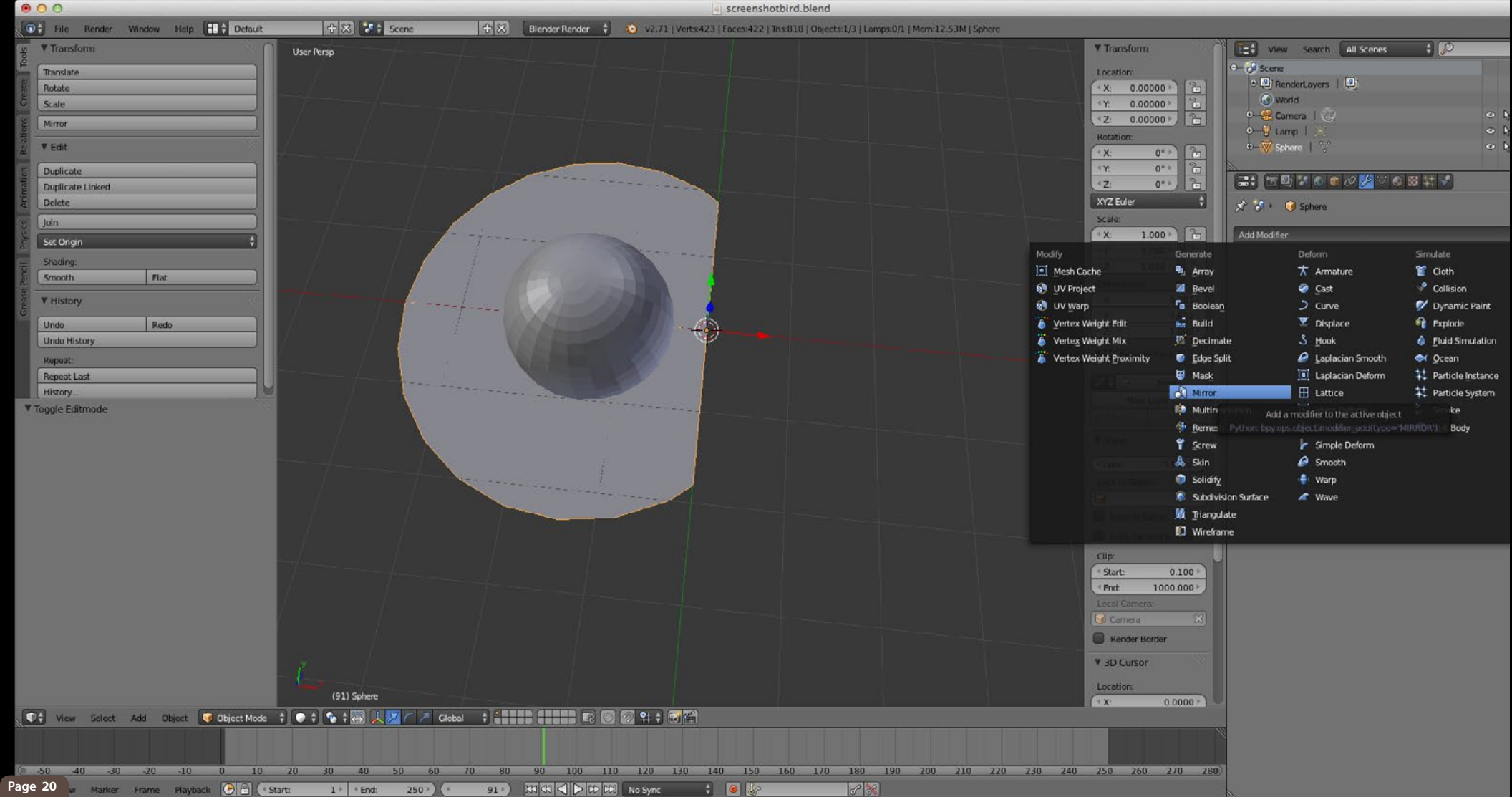
1. Hit Tab to toggle into object mode. Notice that the red, green and blue move handles are at the center of our original sphere. That is the model's origin.
2. First we must move the 3D cursor to the world center (0,0,0). Hold Shift + "S" to open snapping options. Select "3D cursor to center"
3. Move the model's origin: Select Tools>Edit>Set Origin> Origin to 3D Cursor. The model's origin is now at world center (0,0,0).


Shortcuts Used:

Tab toggle object/edit mode
Shift + S snap

Why:

One of the final steps before mirroring is to set the origin of the model. In this case we are moving the origin from the model's center to the world origin (0,0,0).

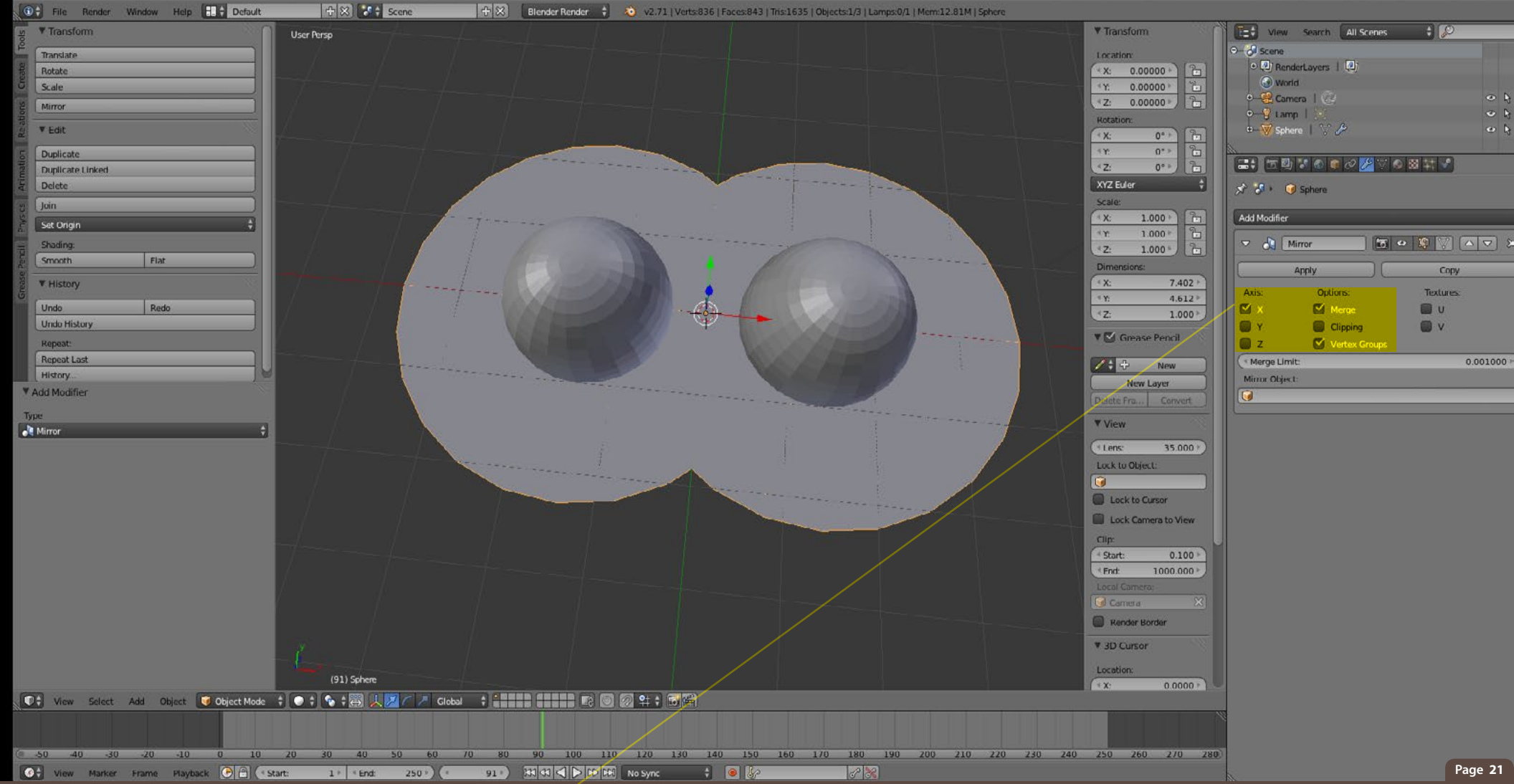


1. While still in object mode, select the add modifier button under the "modifiers"  panel of the properties editor. Navigate to Generate>Mirror

Shortcuts Used:

Why:

Right now we are preparing to mirror our geometry to get both eyes of the owl. First the geometry in the center must be prepared and end at global $X=0$. This will allow our old geometry and mirrored geometry to merge at the center.



1. Under the "Mirror" options, be sure that only the X axis is selected and "merge" is selected.
2. Notice the resemblance to the two eyes of the Rice Owl.

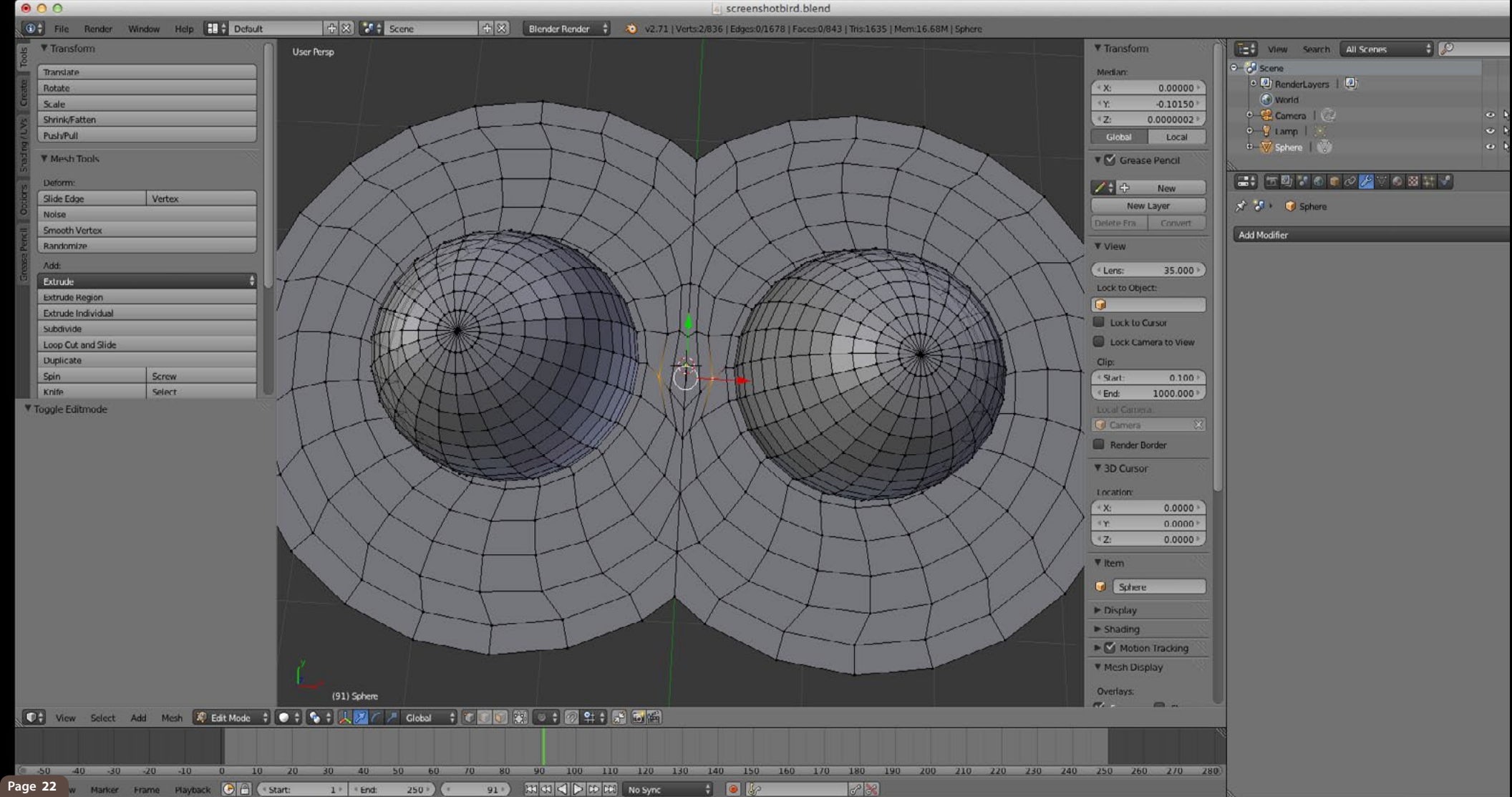


Shortcuts Used:

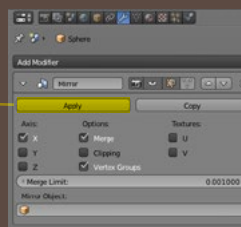
Tab toggle object/edit mode
 Shift + S snap

Why:

Be mindful of which axis the model is mirrored over. Play with the other two axis to see the results. Mirroring on more than one axis is not recommended.



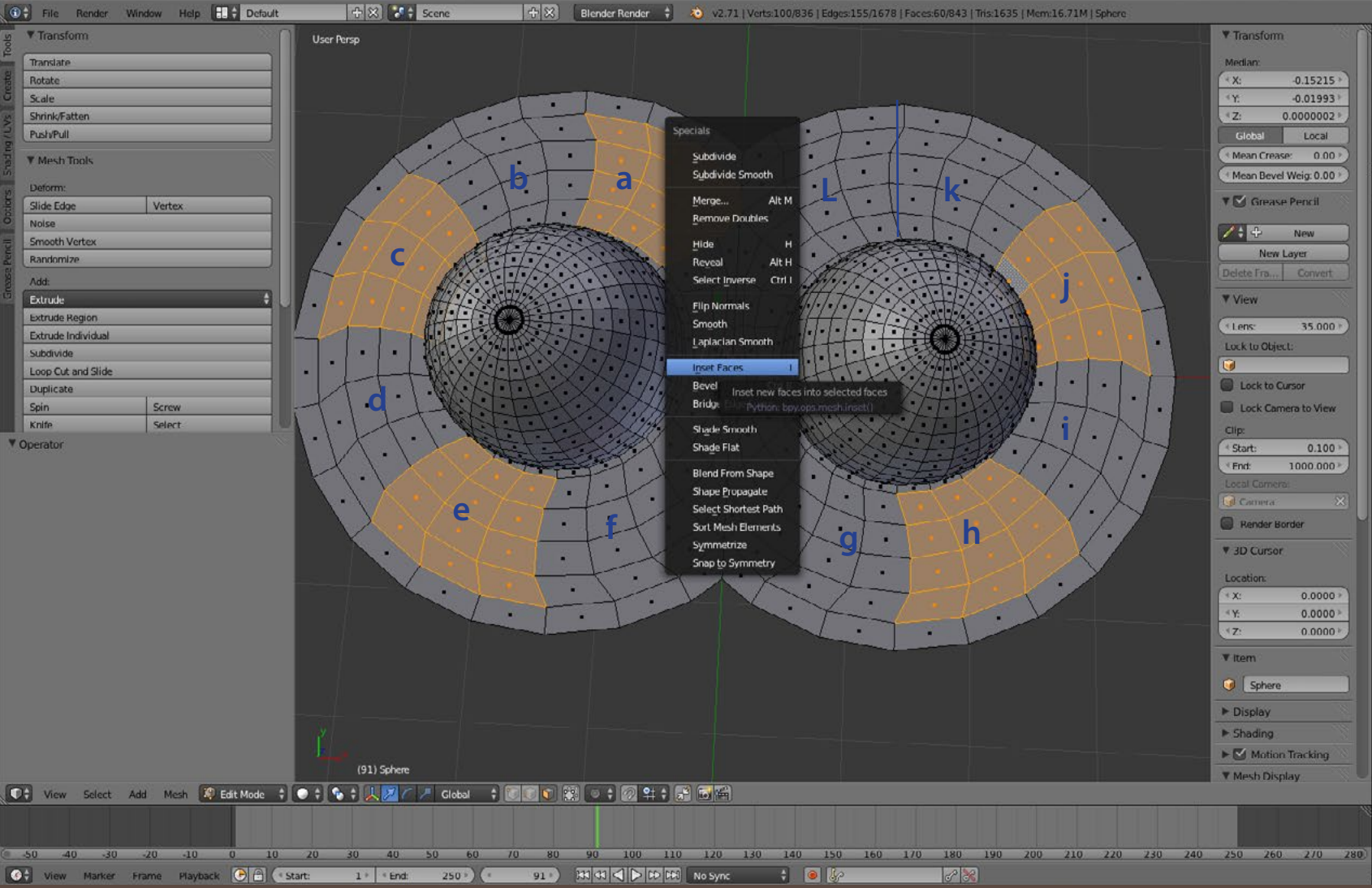
1. Apply the mirror operation to the geometry by hitting the apply button in the modifier panel. This creates editable polygons. Hitting apply is an irrevocable operation.
2. Adjust the vertices by using scale X and move.



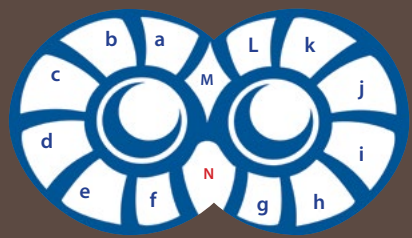
Shortcuts Used:

Why:

With the mirror modifier active, any changes made to the original geometry will be mirrored over to the instanced geometry. Once the modifier is applied, the mirrored becomes a real mesh. This adds polygons to our model and thus increases the file size.

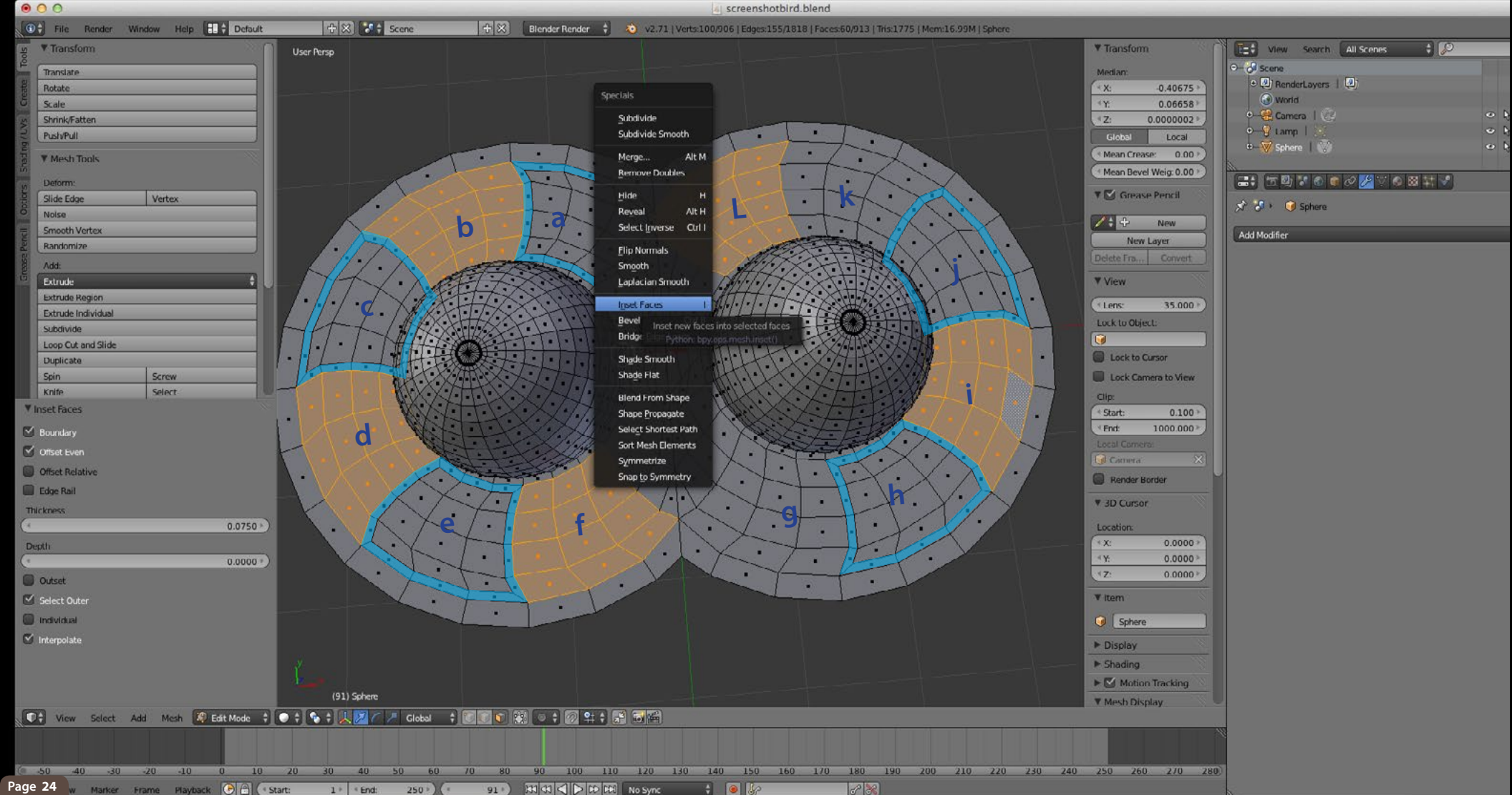


1. Shift RMB select the 12 face sections seen above (a, c, e, h, j). Notice that section "L" is not included. This will become clear on the next page.
2. Note the resemblance to the Rice Owl logo on the right.
3. Once selected, hit "W" for a list of special operations. Scroll down and select "Inset Faces", type .075 for the thickness.

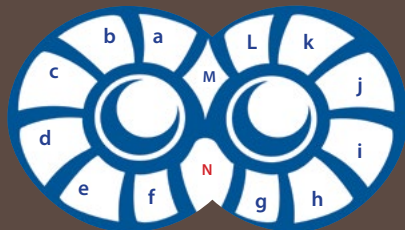


Shortcuts Used:
 W specials

Why:



1. Shift RMB select the 12 face sections seen above (b, d, f, i, L). Hit "W" for specials, select inset faces, type .075 for thickness.
2. Repeat step 1 for Sections (g,k). Then repeat step 1 for section (M).
3. Sections a-M should now have added geometry from doing "inset faces". This extra geometry will separate and add body to the coming extrudes.

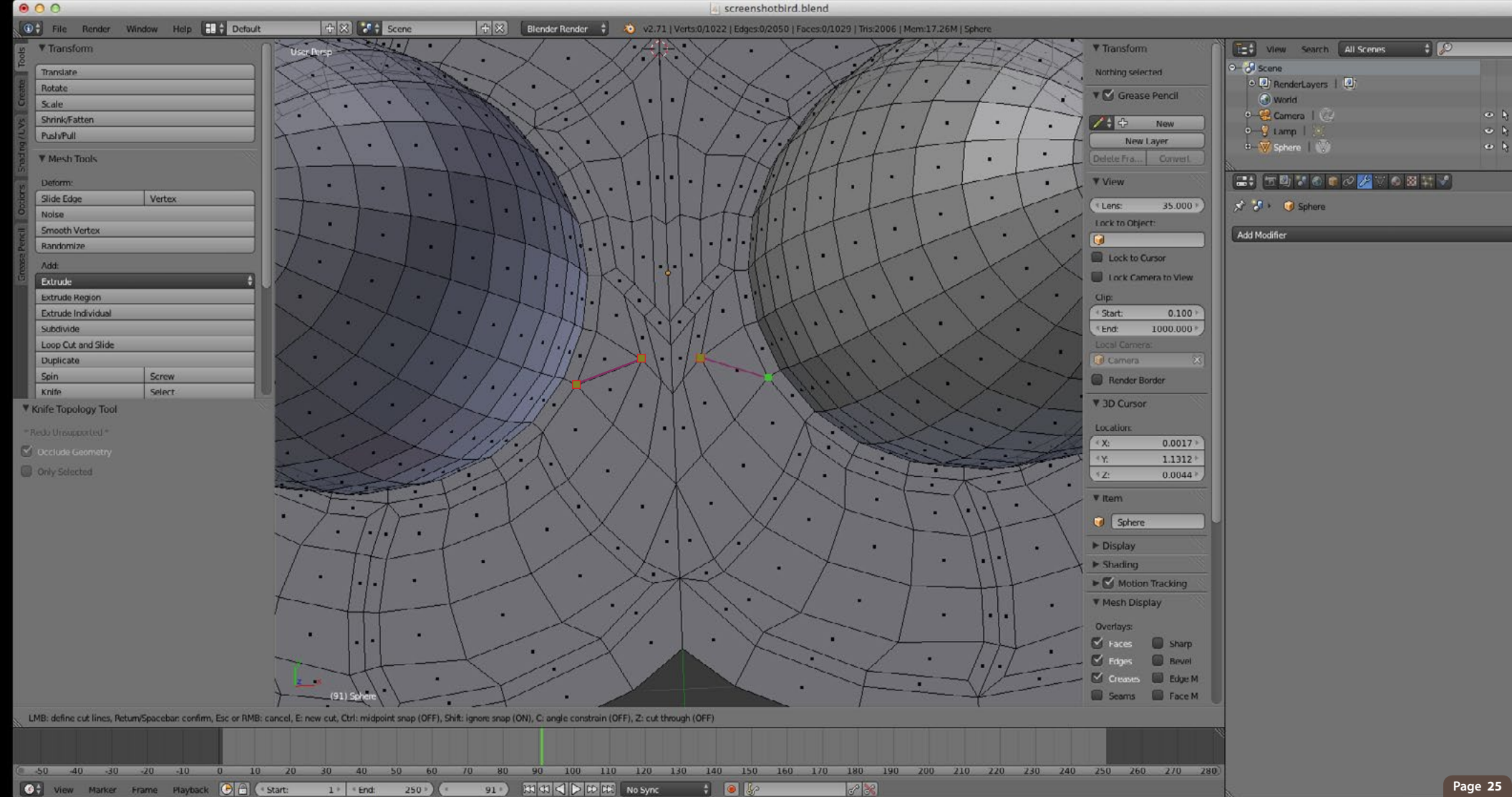


Shortcuts Used:

W specials

Why:

Creating Inset faces for sections a-M cannot be done in 1 step. As you can see this operation depends on which faces are connected.



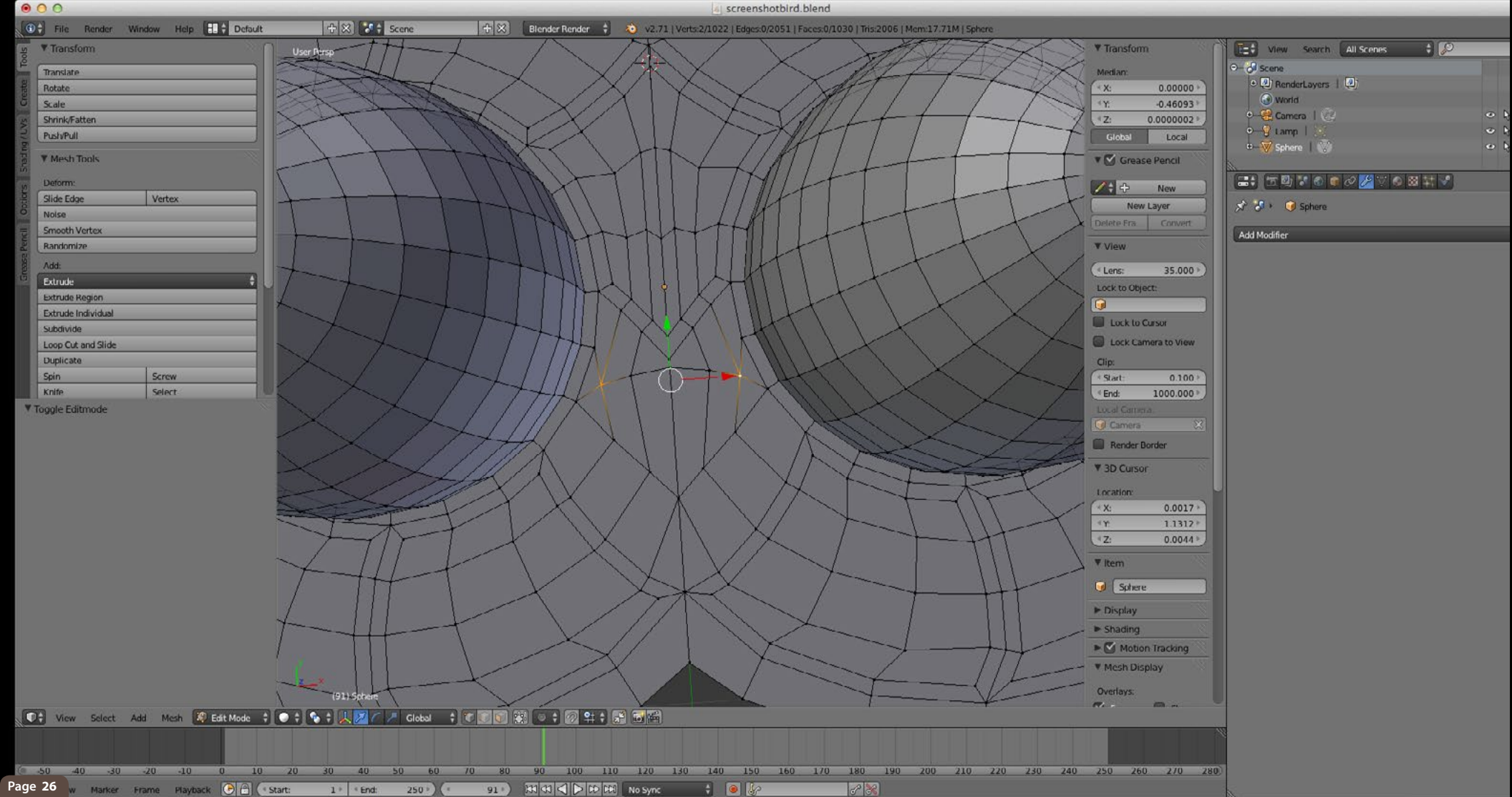
1. Using the knife tool, make 2 cuts as seen above. Section **N** will become the Rice Owl's beak.

Shortcuts Used:

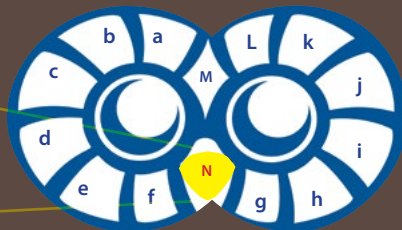
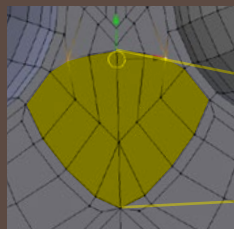
K.....knife tool

Why:

The knife tool will divide faces and thus add geometry. The next step is to move the vertices around to create a nice profile for the beak to be extruded from. Be mindful of the cuts. Some cuts will create triangles and some will create quads(4 sided polygons)



1. Shift RMB select the 2 vertices seen above. Use scale X and move to position them
2. This yellow profile will be the base of the bird's beak.

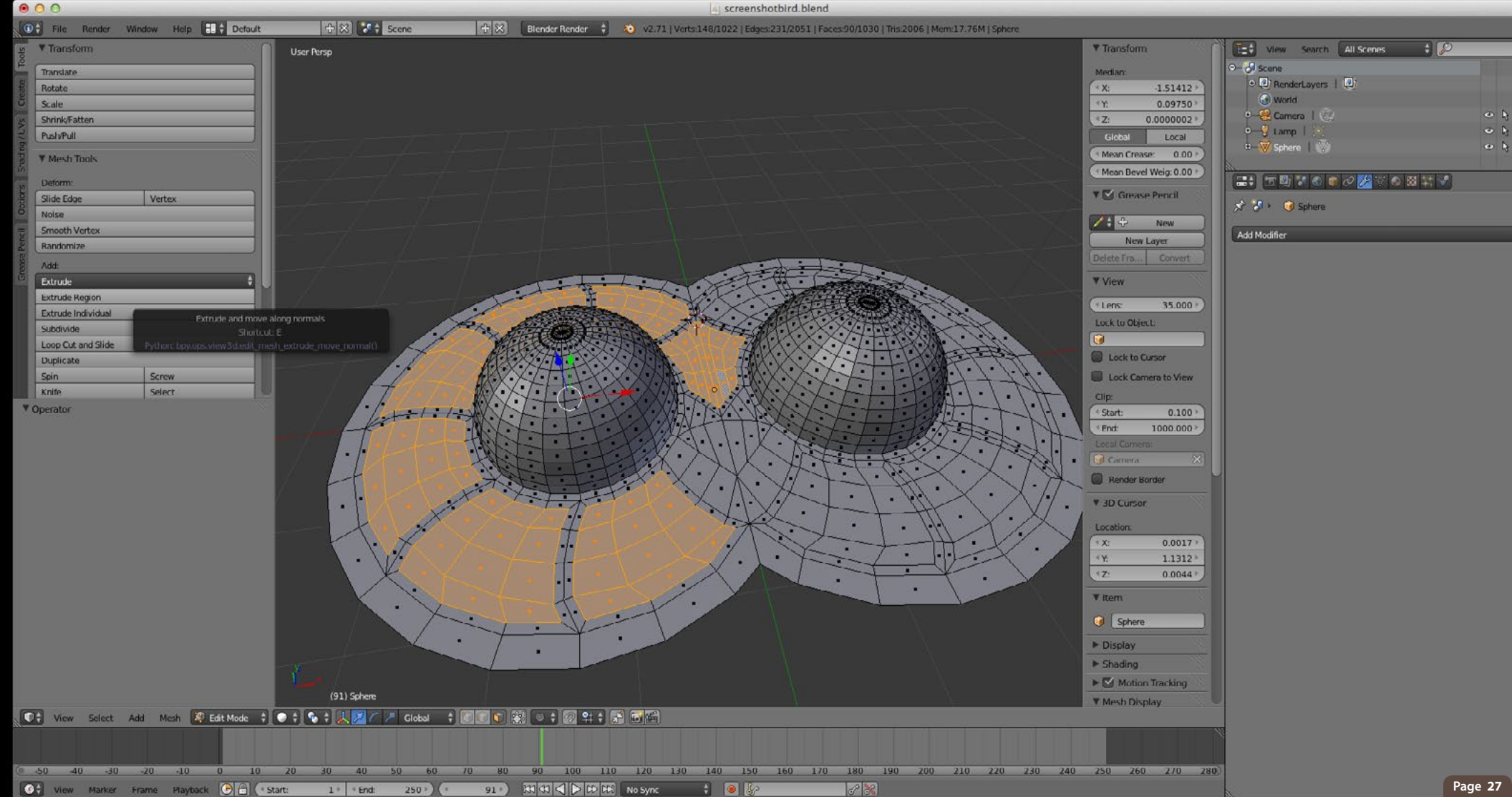


Shortcuts Used:

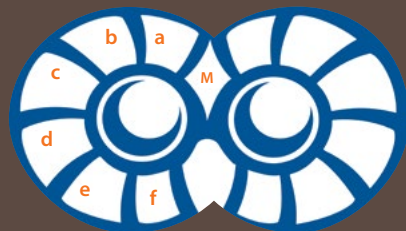
S.....scale
 X(after hitting S).....constrain to X
 G move

Why:

It is best to establish the curvature of the beak's profile at an early stage. Because the beak is a hooked 3D shape, changes to its profile would be more difficult if done after the extrude.



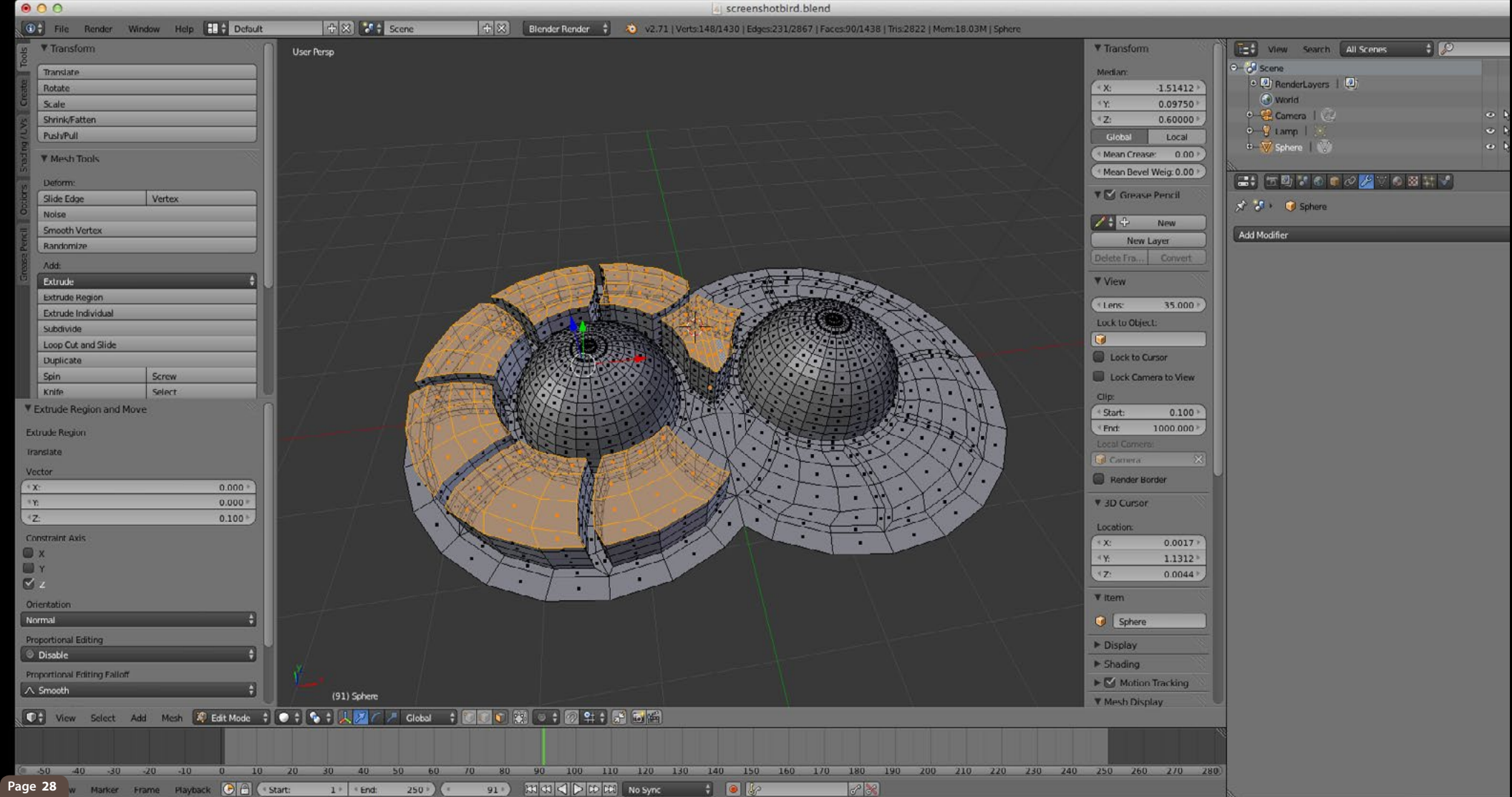
1. Shift RMB select sections (a-f) and (M)



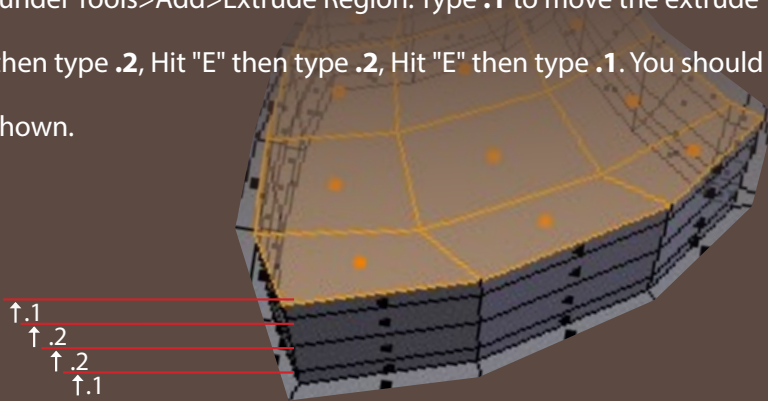
Shortcuts Used:

Why:

the next several steps will be done on one side. At a certain point half the model will be deleted and it will be mirrored for symmetry. This is a common workflow.



1. Hit "E" for extrude or select it under Tools>Add>Extrude Region. Type .1 to move the extrude up .1 units in Z space. Hit "E" then type .2, Hit "E" then type .2, Hit "E" then type .1. You should have a total of 4 extrudes as shown.

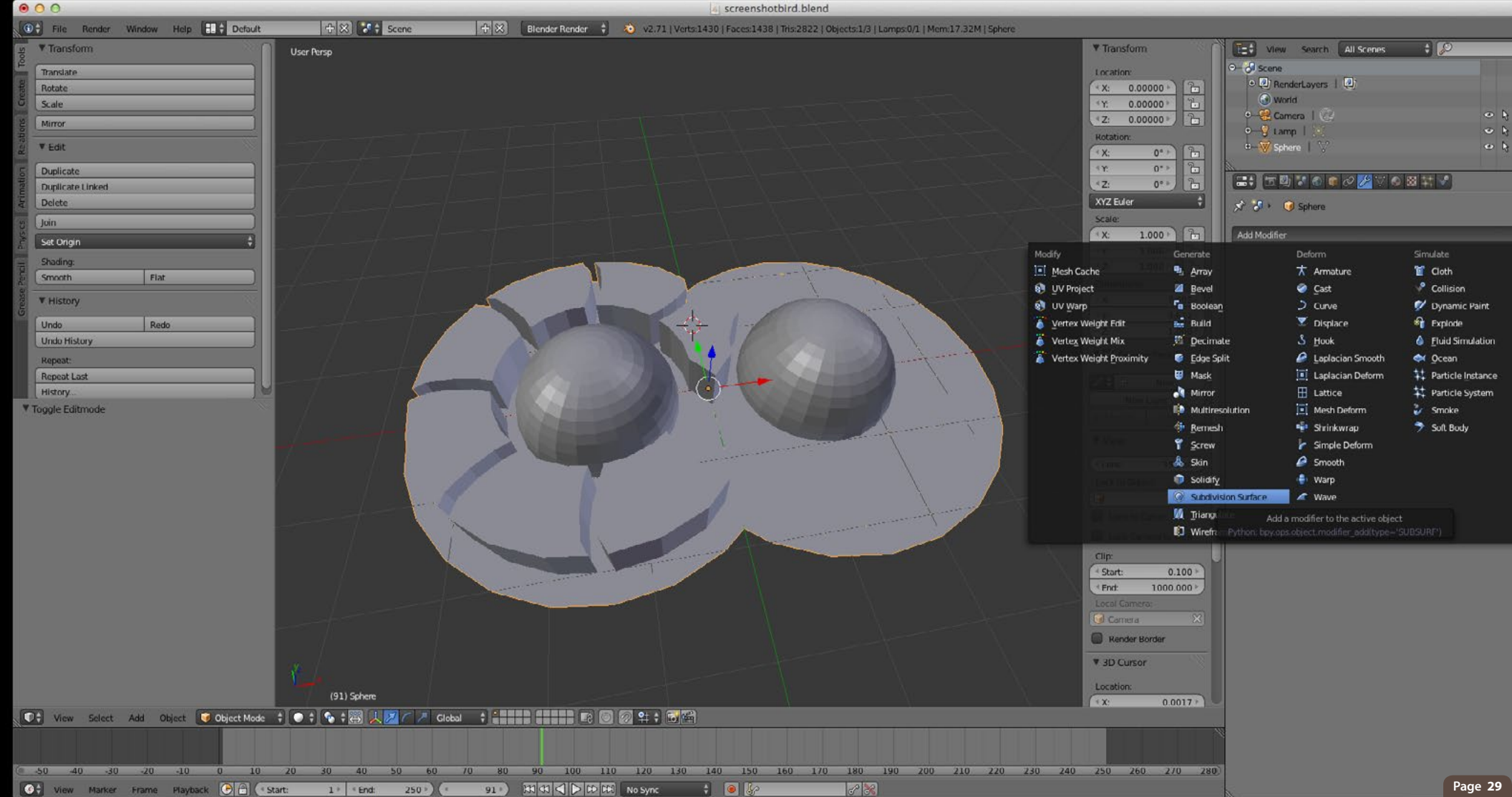



Shortcuts Used:

E.....extrude

Why:

By extruding multiple times edgeloops are created which will hold the model's shape when it comes time for a subdivision modifier. Extruding 4 times also gives a midpoint which makes it easier to find the center of this element.

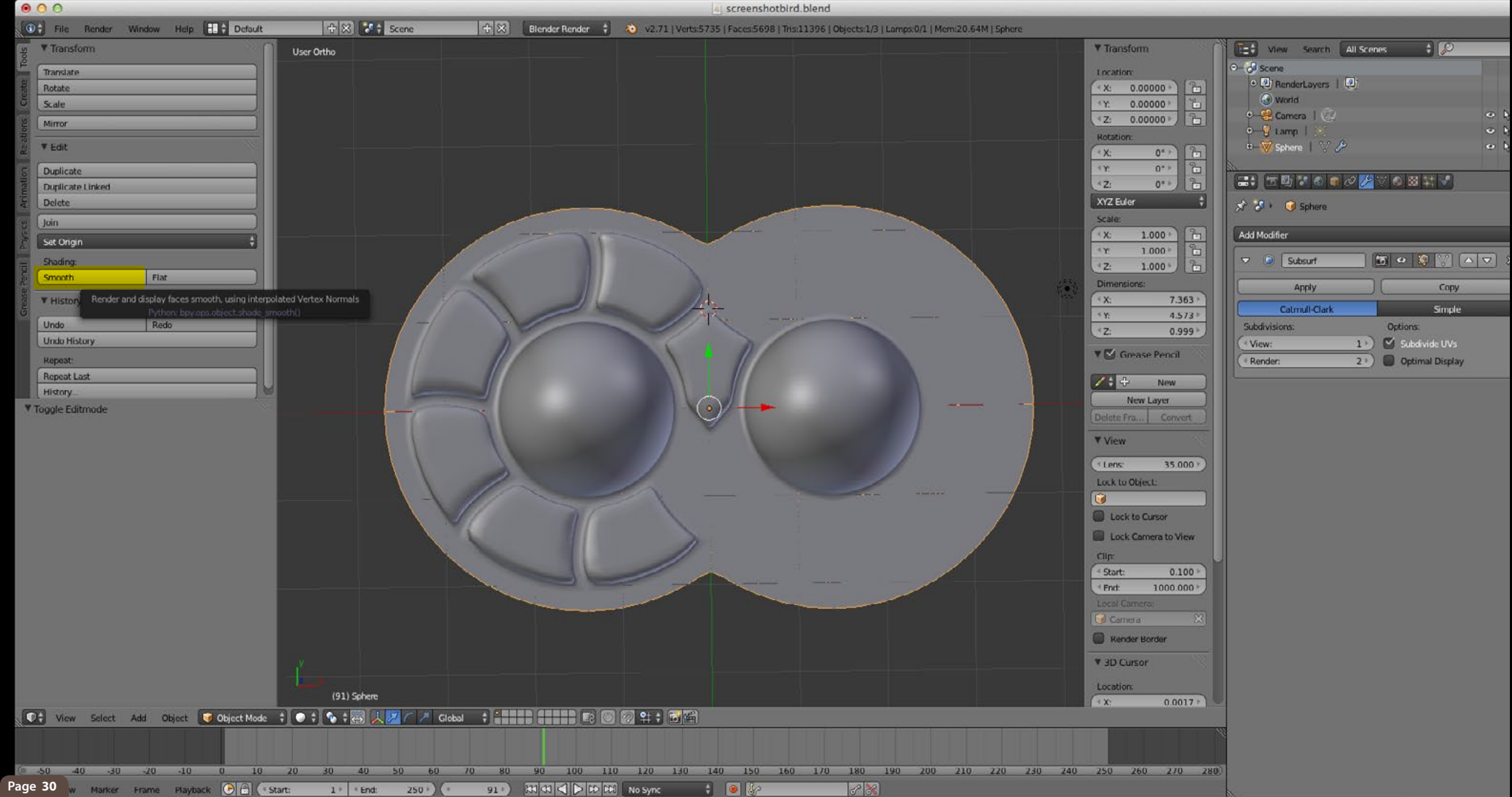


1. Hit Tab to toggle into object mode.
2. select the add modifier button under the "modifiers"  panel of the properties editor. Navigate to Generate>Subdivision Surface

Shortcuts Used:

Why:

The Subdivision Surface modifier subdivides each face which has a smoothing effect. Different smoothing levels can be specified for view and for render. Without applying the modifier we can leave it on the stack and get a preview of what the final polygon count will be.



1. Notice the smoothed result. The model will still look faceted. This is because the polygon normals are set to hard/flat.
2. To change the normal's angles to appear more smooth, select smooth under Tools>Edit>Shading>"Smooth"

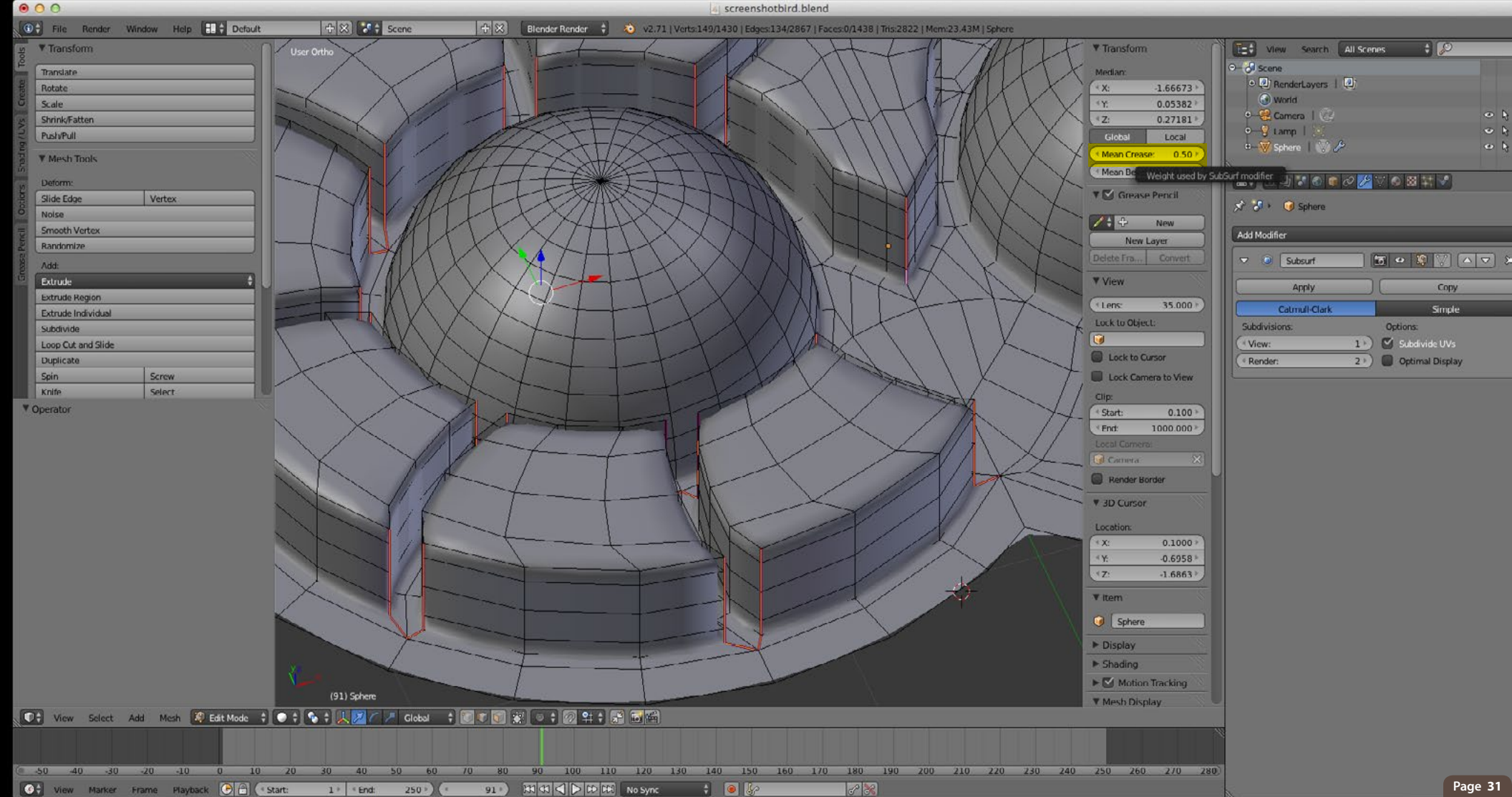
Shortcuts Used:

Why:

The subdivision surface modifier changes the polycount.

Setting the shading to smooth does not change the polycount.

Depending on the look you are going for flat or smooth shading may work better for you.



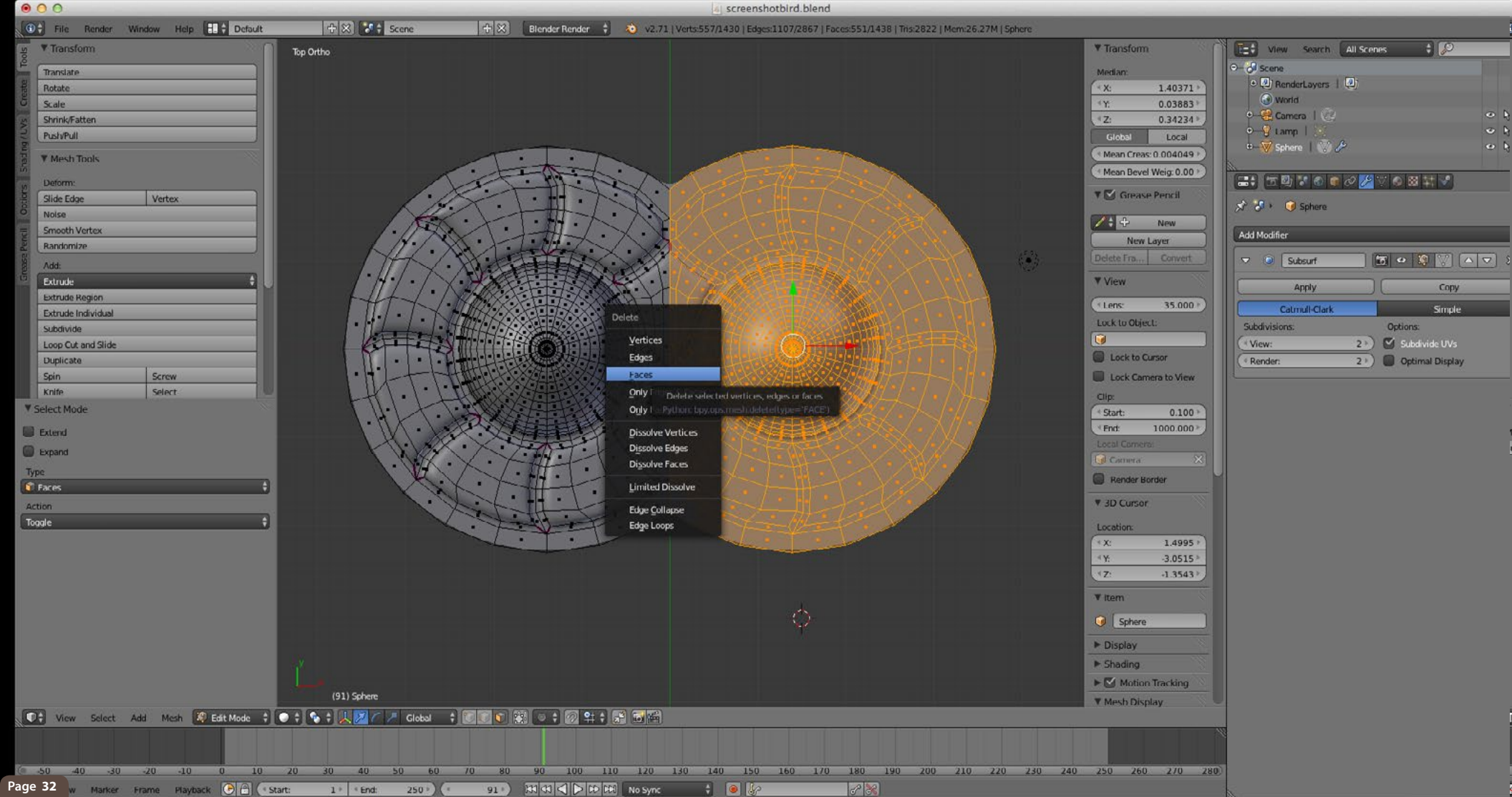
1. These next optional steps are to set a crease to the edges. Crease works in conjunction with the subdivision surface modifier by allowing a bias for the smoothing operation. Edges with a crease applied will retain their hard edge during subdivision
2. If not already open hit "N" to toggle on the properties panel in 3D view. Alt + Shift + RMB select all of the above edge loops (the four corners of each segment) and set the "Median Crease" to .5 in Transform>Mean Crease of the properties panel of 3D view.

Shortcuts Used:

Ntoggles properties panel(3D view)

Why:

A mean crease value of 1 will most resemble the hard edge of the original low polygon model.



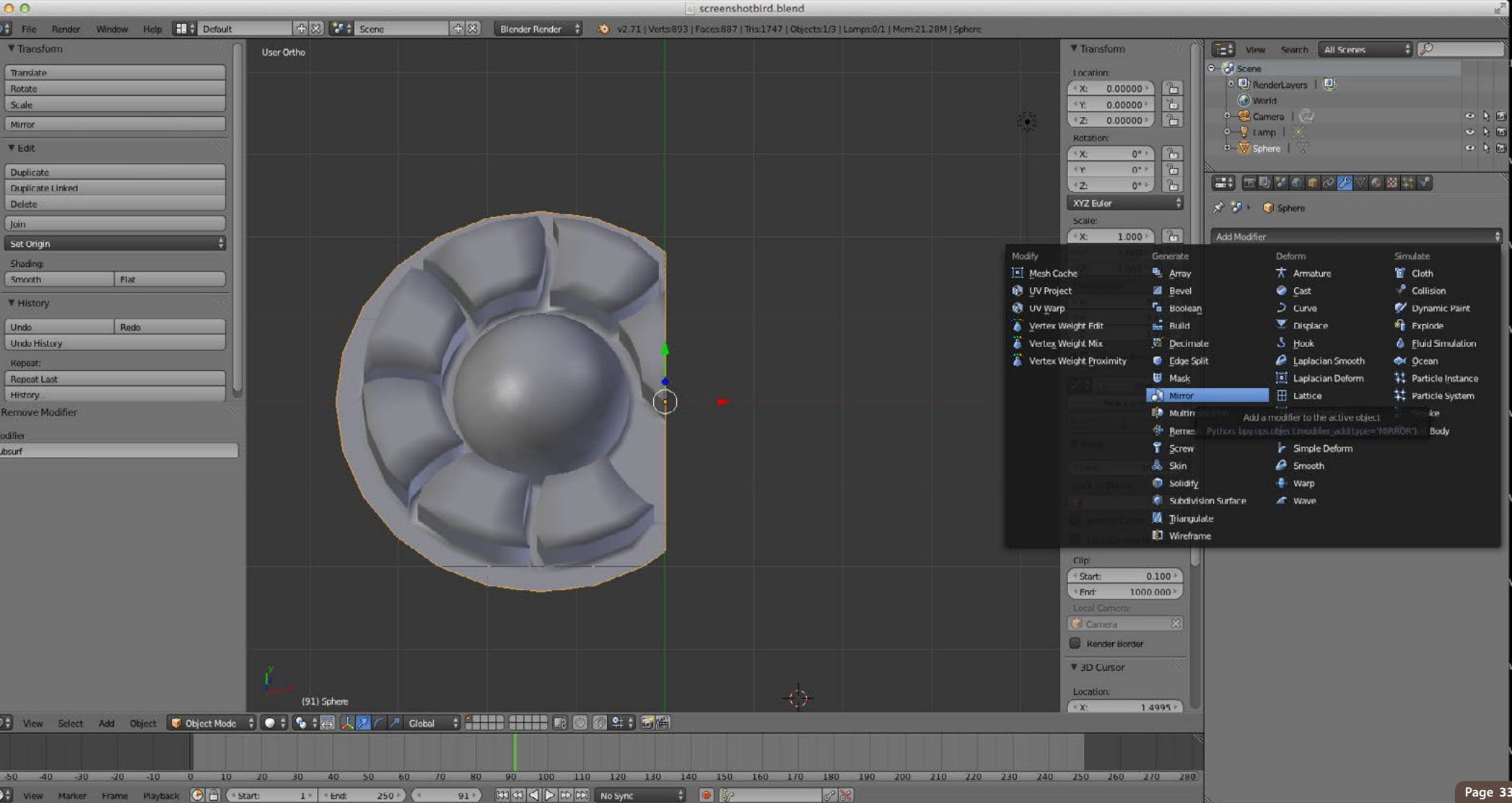
1. Hit "7" on the numeric keypad to go into top view, hit "5" to toggle into orthographic view.
2. Hit "B" to drag a box marquee over the right half polygon faces. Hit X to delete them.

Shortcuts Used:

- 7 top view
- 5 orthographic view
- B box marquee
- X delete

Why:

Once again we are deleting half of the model and mirroring it over. The newly assigned creases will be copied over.



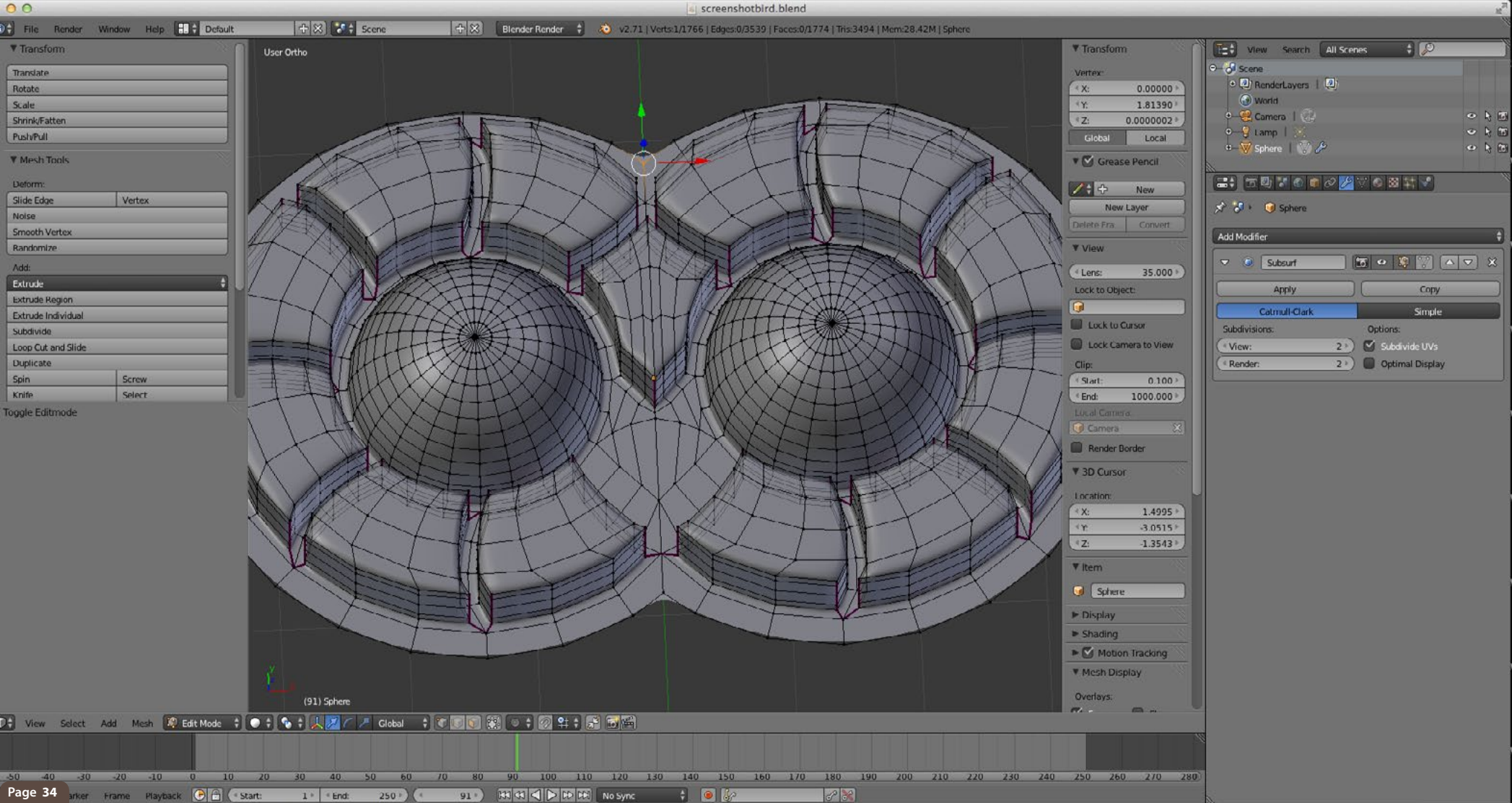
1. The origin of the geometry should still be at (0,0,0) from the last origin change. Hit Tab to toggle into object mode.
2. Find the mirror modifier under Add modifier>Generate>Mirror

Shortcuts Used:

Tabtoggle edit mode

Why:

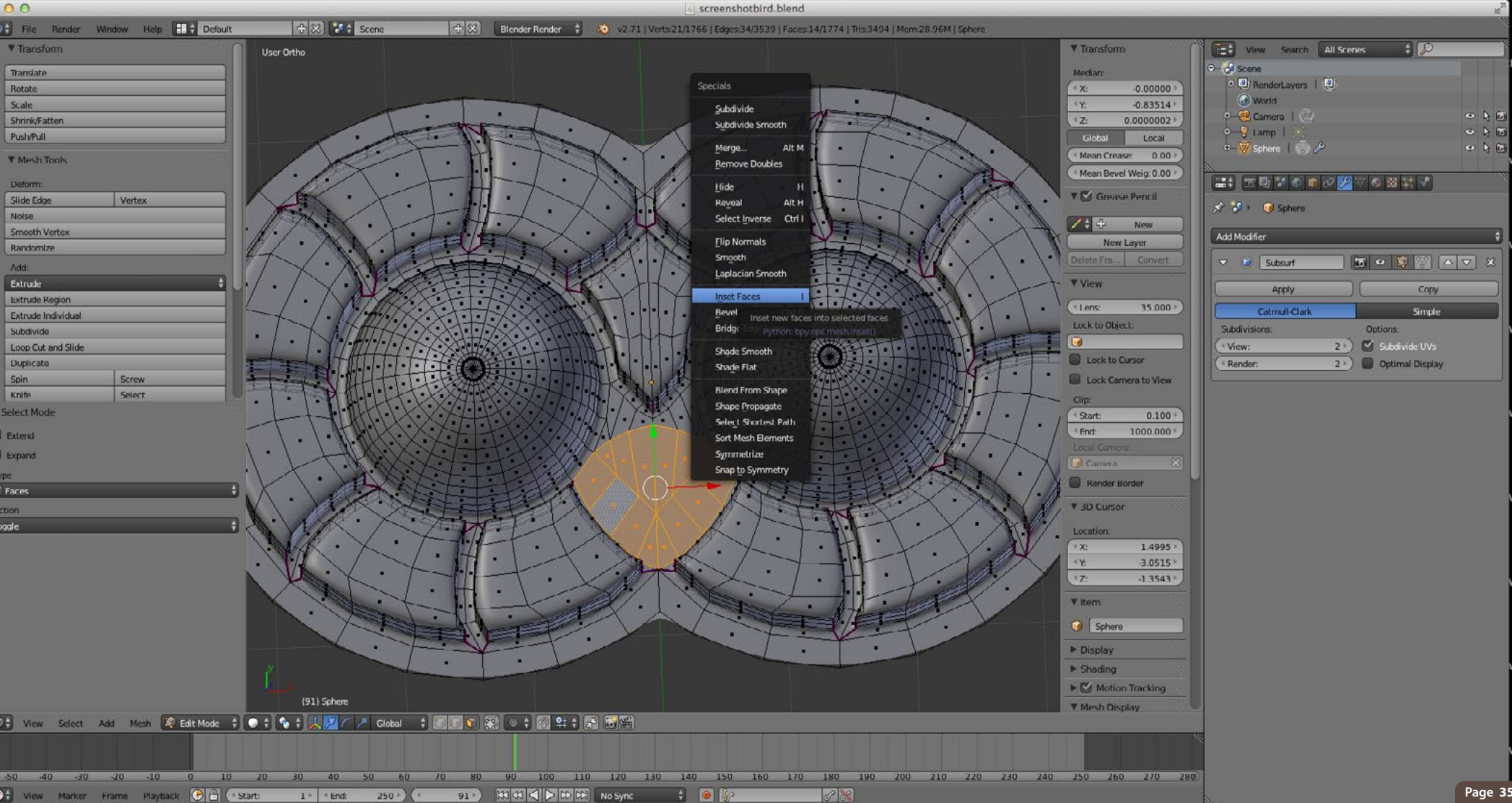
There may be different stages in making a model when mirroring or waiting to mirror at the end is the better option.



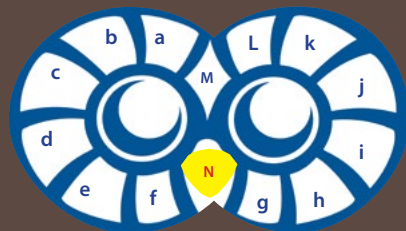
1. Mirror on X axis and keep "merge" selected
2. Notice the difference when making edit mode changes either before or after applying the mirror modifier. When you are done hit apply to match the image above. Once applied, the mirrored half will be available for edit.

Shortcuts Used:

Why:



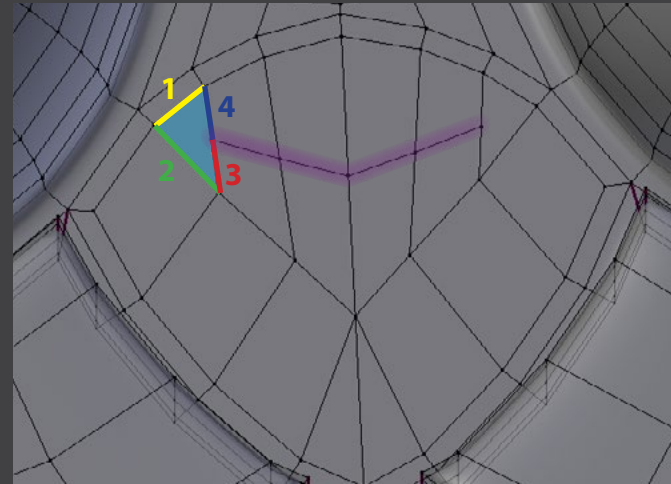
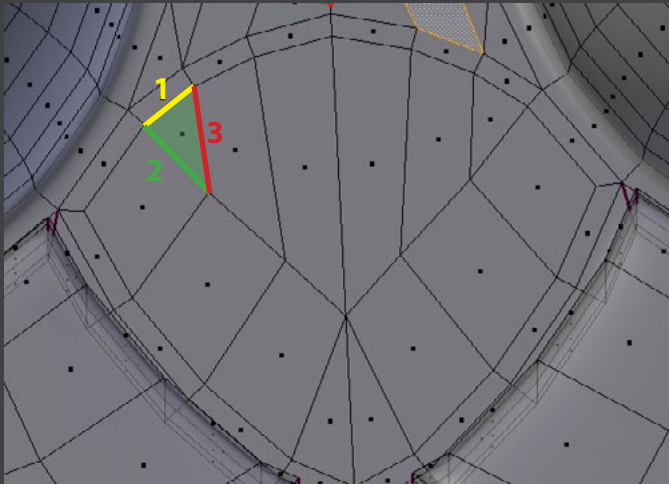
1. Shift RMB select the faces that make the beak (section "N" in diagram).
2. Hit "W" to open the specials menu. Select "inset faces" and set thickness to .075.



Shortcuts Used:

W specials

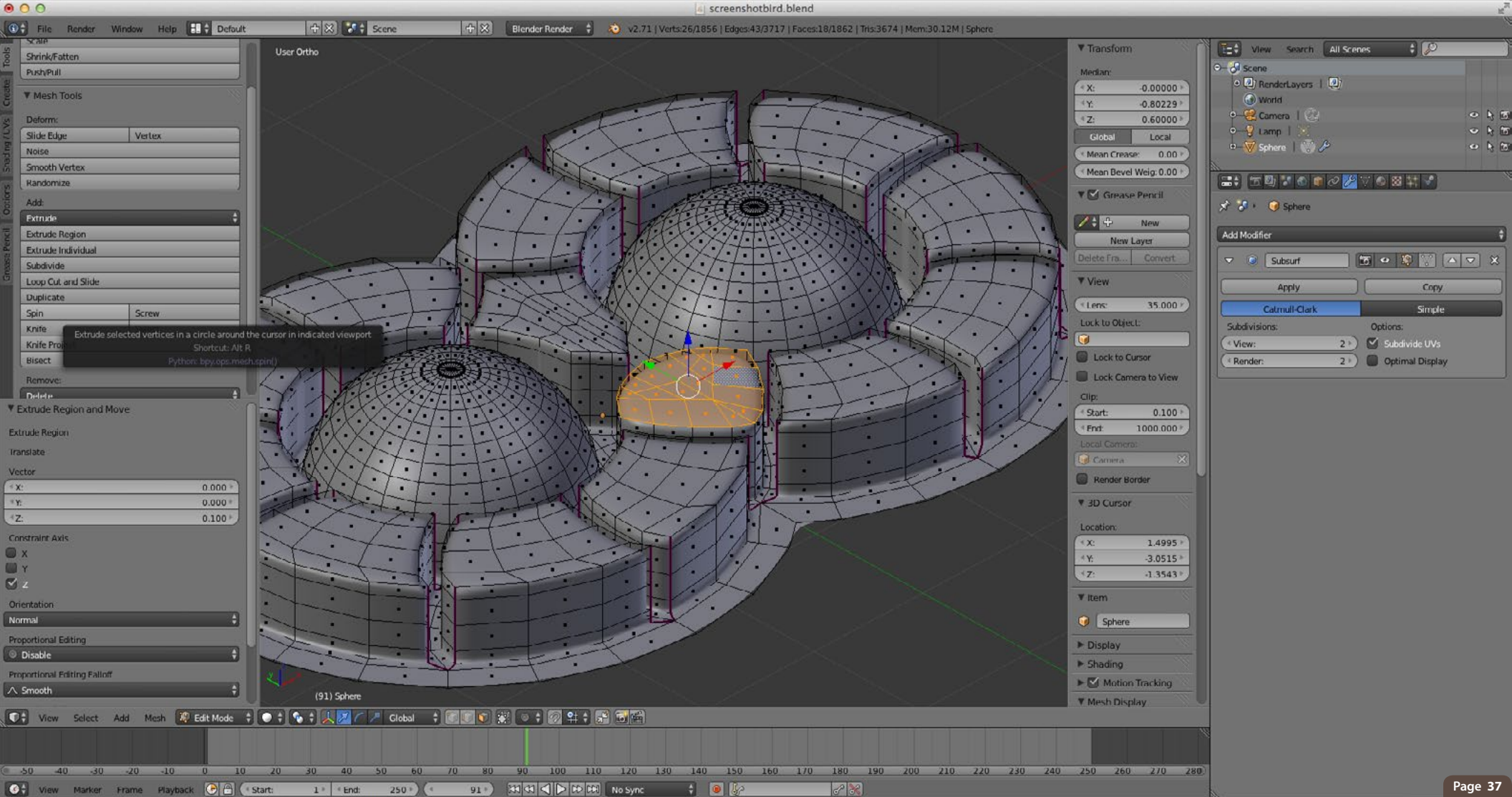
Why:



1. This page is optional but shows the different changes that can be made to the topology of the model. In the above example an edge is added which bisects one edge of the highlighted triangle thus turning the triangle into a quadrilateral (four sided shape).

Shortcuts Used:
K.....knife

Why:
The topology of the polygon faces will impact the final use of the model. Triangular meshes are used in videogames and 3D printing and quadrilateral meshes work best for animation.

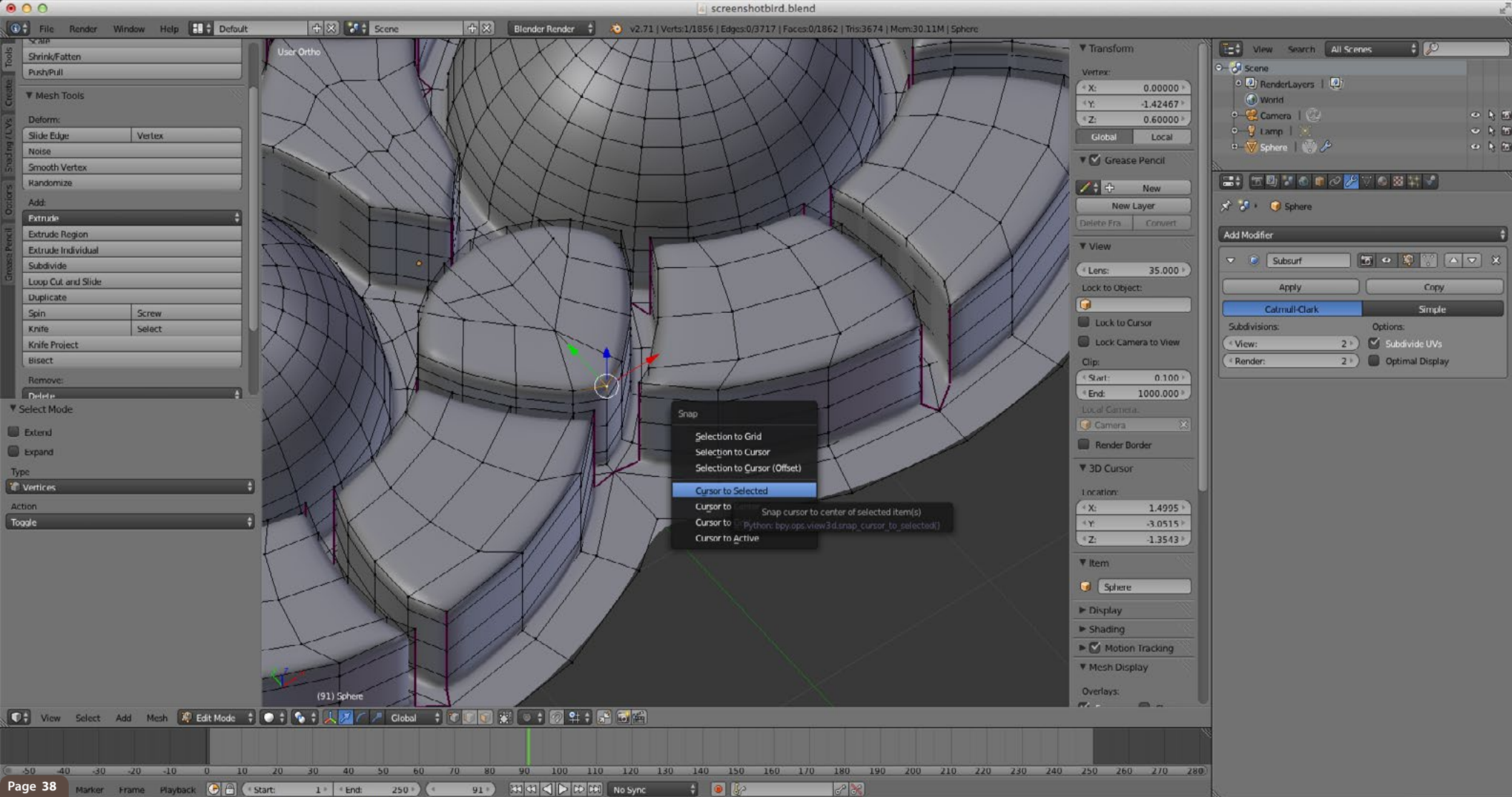


1. Shift RMB select the faces of the beak and extrude them 4 times with the following Z translation as before: .1, .2, .2, .1

Shortcuts Used:

E..... extrude

Why:



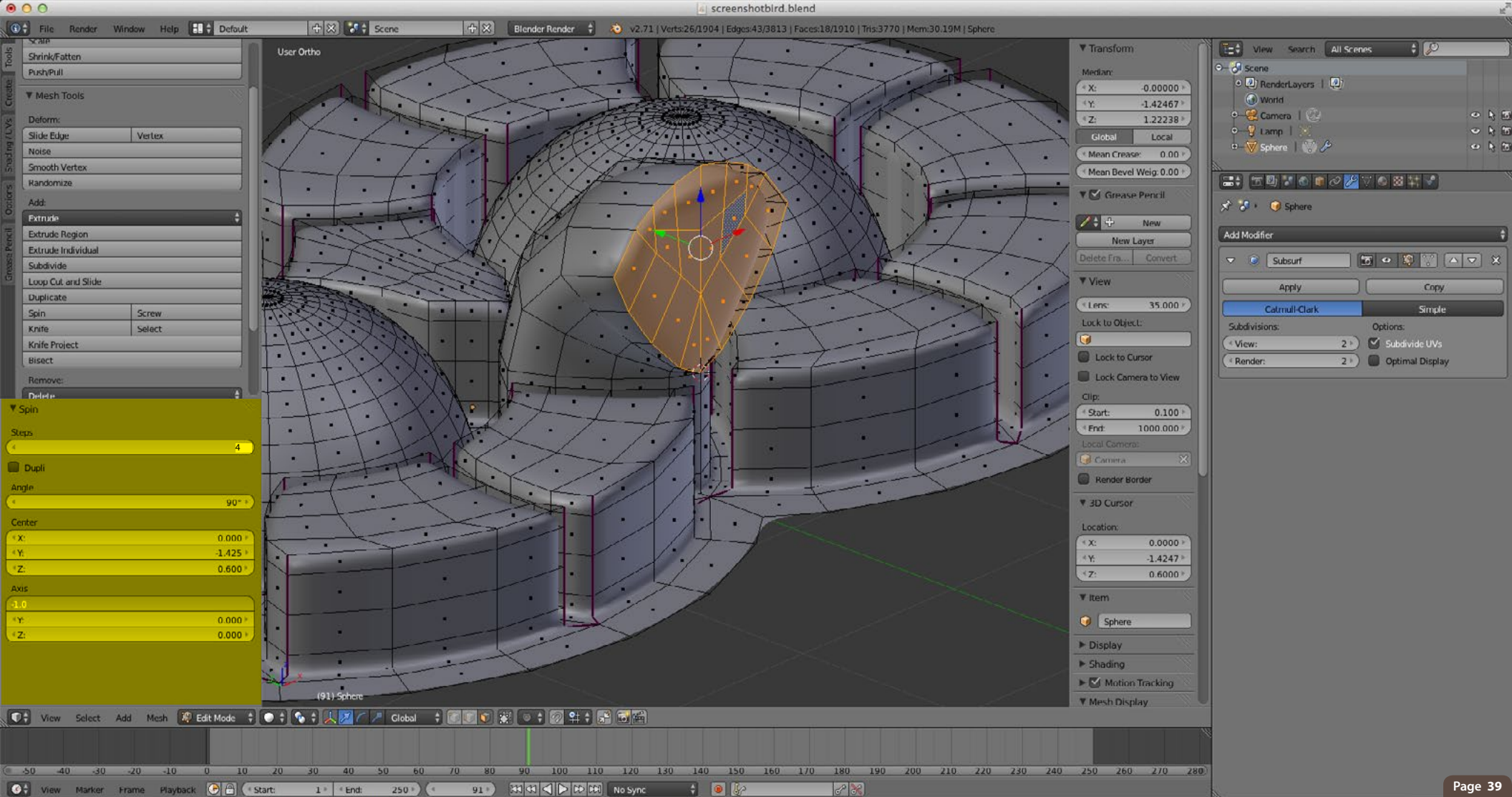
1. The next modeling operation takes into account the location of the 3D cursor. Select the vertex shown above.
2. Hit Shift + S to open the snapping options. Select "Cursor to Selected".

Shortcuts Used:

Ctrl + Tab..... switch components
Shift + S.....snapping

Why:

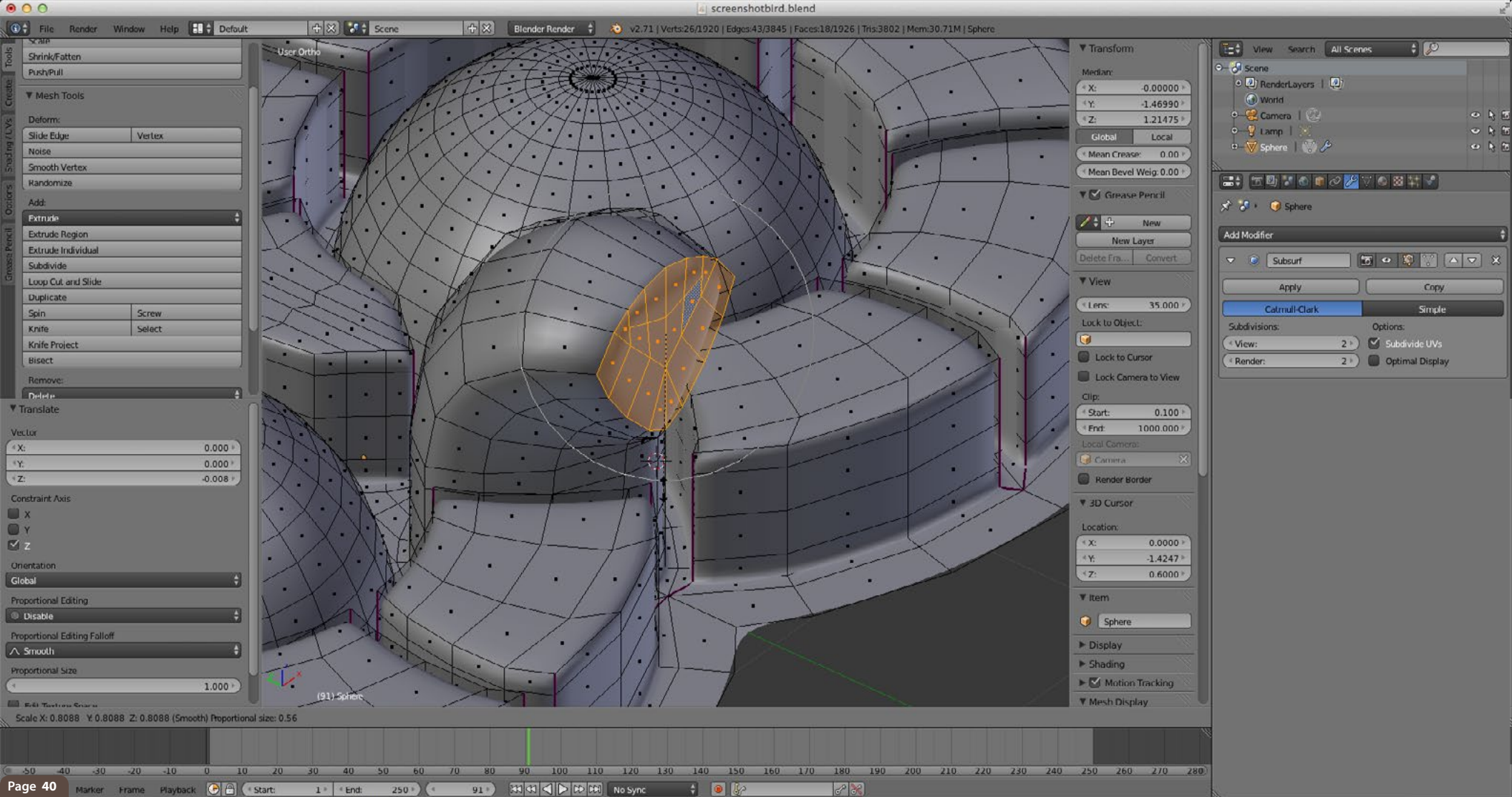
Right now we are preparing to use the Spin operation which will extrude and rotate around the 3D cursor.



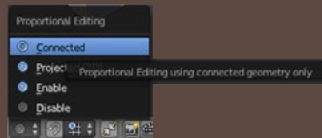
1. With the "beak" faces selected, find "Spin" under Tools>Mesh Tools>Add>Spin
2. The initial setting will create undesirable results. type in the hilgited settings. Notice that the"Center" inputs are taken from the 3D cursor. Entering -1 for the X axis will spin the geometry around the X axis

Shortcuts Used:

Why:



1. To add a tapering effect to the beak the "proportional editing" optional will be toggled.
2. Select the circular icon next to the snapping icons in the 3D view editor.
Set proportional editing to "Connected".
3. Now any move, rotate and scale adjustments will not only effect the selected faces but the connected faces. The move, rotate and scale operations will have a lesser effect the further away they are from the active selection. Use page up/down to change falloff radius.

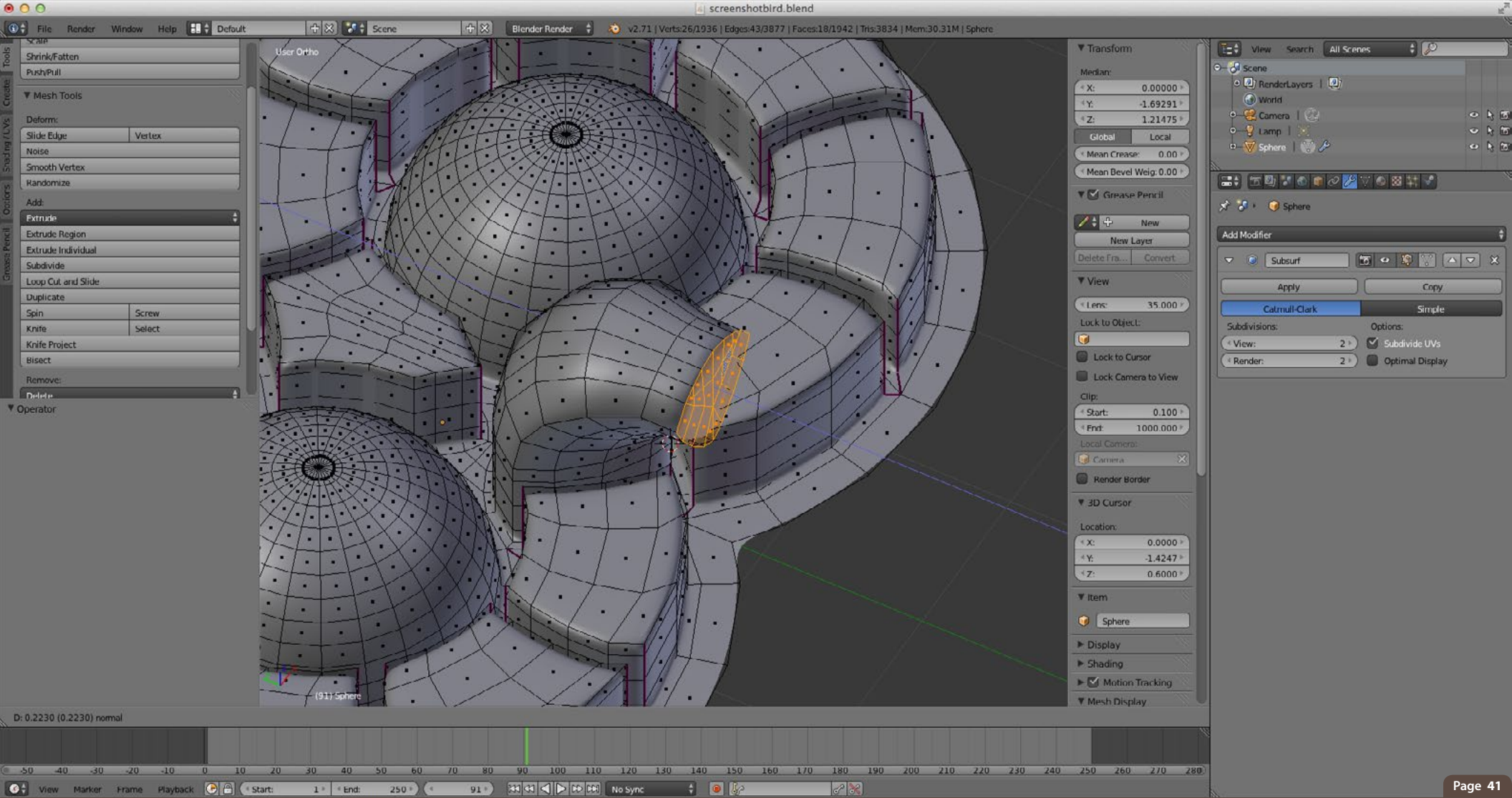


Shortcuts Used:

page up.....Increase falloff
page down..... decrease falloff

Why:

Proportional editing makes creating organic forms easier and quicker.



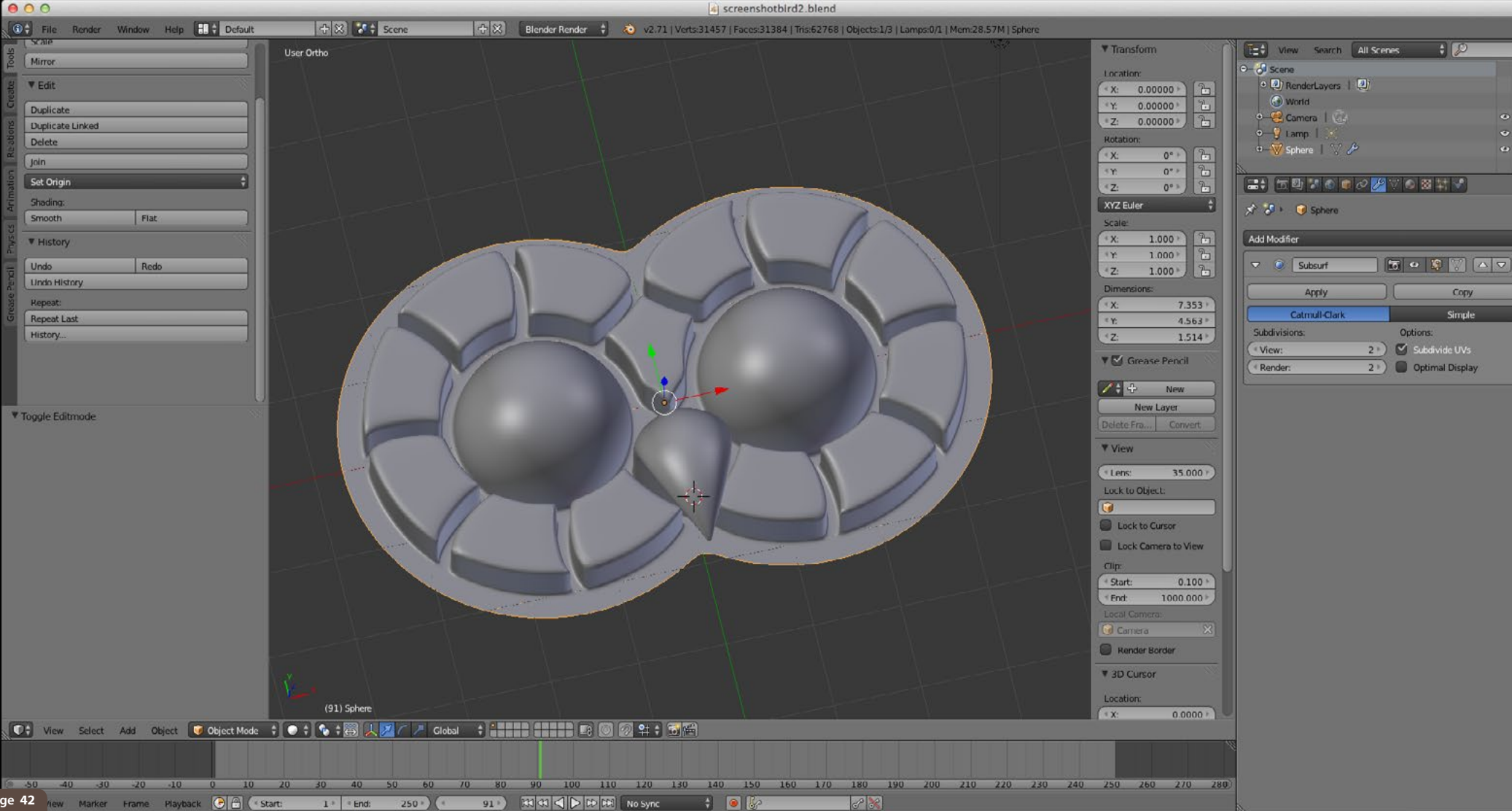
1. To finish up the beak, simply extrude "E", move it in the desired direction and then scale it down "S". Repeat this several times until the beak tapers into a sharp point.

Shortcuts Used:

E..... extrude
S..... scale

Why:

Using shortcuts allows for fast creation of 3D elements.



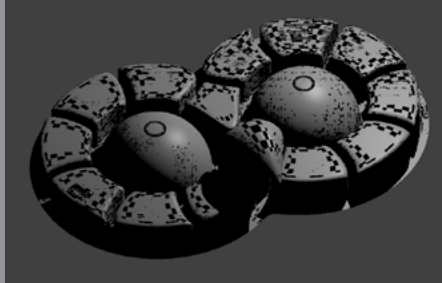
Congratulations. The face of the owl is complete.

Shortcuts Used:

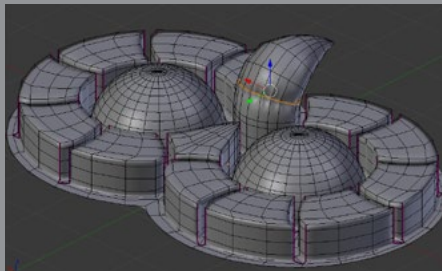
Why:

Pitfalls

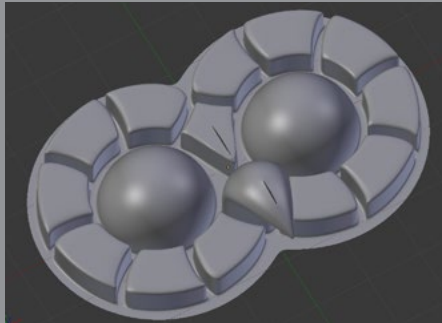
Problem



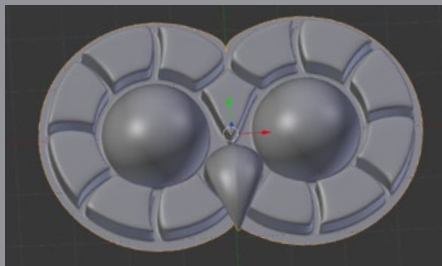
Odd clipping when rendering



Gnarly ridges in geometry with Subdivision Surface modifier



Holes in center of model



unexpected forms down center of model

Why

Duplicate geometry in same place.

Solution: look in outliner and delete duplicated geometry

non-manifold geometry where one edge is shared by 3 or more faces

Solution: Delete offending geometry

Some vertices were not at the center before mirroring

Solution: move vertices to center. If mirror has already been applied, merge the offending vertices

Subdivision modifier is before mirror modifier on the stack

Solution: move mirror modifier up on the stack before subdivision modifier

