

# Tutorial: 3D Scan and Repair Broken Parts

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## Intro:

Through a tragic vacuum forming incident, the CNC carved balsa wood face lost its nose. In this tutorial we will be 3D scanning the broken face with the HP Sprout and reconstructing its nose in Blender so we could 3D print a replacement.

## Step one: Scan the broken face

The 3D scanner we are using is the HP Sprout. You should have read the reference guide to have a basic idea on how to use the HP Sprout.

Initially the capture stage should not be on the mat. Open the sprout workspace from the desktop. We want to 3D Scan our broken face so on the projected screen (bottom), select "3D capture".

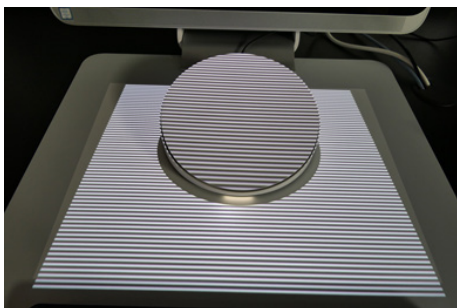
On the top screen select "3D capture" because we want a full 3D model of the face from all directions and not a snapshot from one direction.

We have the capture stage so select "Automatic scan" on the top screen.

Following the directions on screen, plug in the capture stage then place it on the mat. Align the capture stage with the projected blue circle and have the cord facing the back.



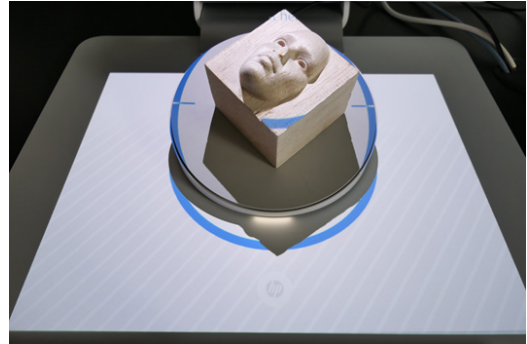
In the bottom right hand corner of the top screen, select "Scan background". Keep your hands and other objects away from the mat while the background is scanned.



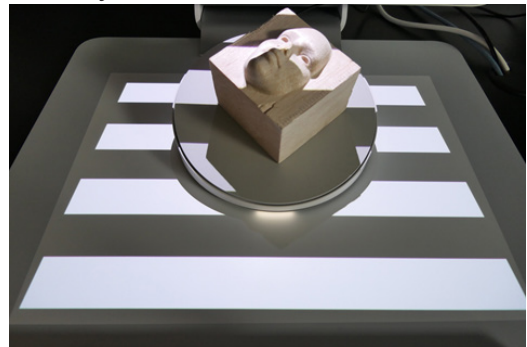
After the background is scanned we can choose between

"Tilted" and "Flat" stage positions. The tilted position provides a better scan. Since the block of balsa the face is in has a wide base it stays on the tilted capture stage without falling over. If your object keeps falling over, use blu tack or switch to the flat option. We will use "Tilted".

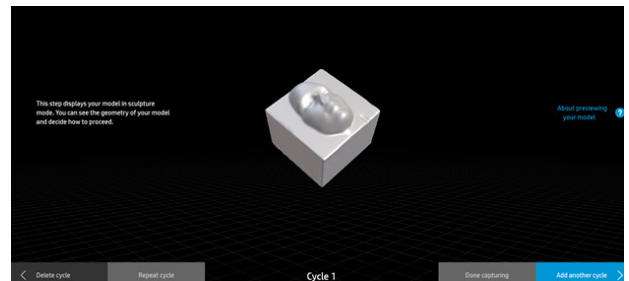
Place the balsa face onto the stage with the face facing face-up. (That was fun to say)



Click "Start Scan" and keep your hands and other objects out of the way.



The stage will rotate multiple times. Dark and light bands will be projected on the face which is seen by the camera and used to create a 3D model by reading the contours of the light and dark bands. The software will tell us when the scanning is done. Now we can see the 3D model. If we rotate it by clicking and dragging with the left mouse button we will see that it has not base! In our case this does not matter because we will either 3D print the whole model with the fixed nose or just print a nose to be glued back onto the model. Click "Done capturing".

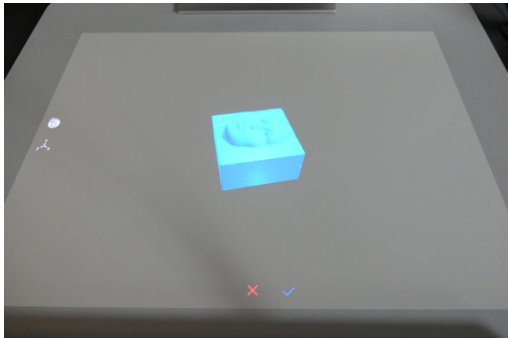


There is an option to preserve the gaps which in our case will leave the bottom of the model open because it was never scanned. The other option is to close the gaps which will take away any holes in the model. In our case



it will close up the bottom of the model. We want a closed 3D model to make 3D modeling we do later a lot easier. Select "Close gaps".

Remove the stage and model from the mat. There will be some options projected onto the mat. Most of these are irrelevant for us like changing the texture and colour. On that is relevant is the icon on the left hand side just above the "XYZ" icon and below the "2D" icon. It looks like a solid circle with some particles. When you click the icon the model and any artifacts that were picked up during scanning will turn red. Select the main face object only. It will turn blue. Then click the tick at the bottom of the screen to delete any artifacts.



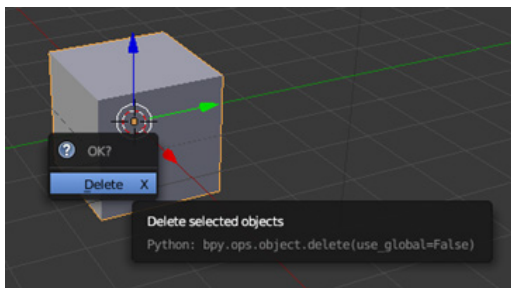
Now export the 3D model as a .obj by using the top right menu. Save it to a flash drive so you can transfer the model to a computer that has blender.

## Step two: Reconstructing the nose

To reconstruct the nose we will use some free open source software called Blender. Blender is downloaded on all the Unleash Space computers in the 3D printing area. You can use one of these computers or download Blender onto your own computer at [blender.org](http://blender.org).

Open blender. It is easiest to find it on the desktop. Click anywhere to close the starting menu.

Right click on the starting cube to make sure it is selected with an orange outline then press the "delete" key on your keyboard and "enter" to confirm. The cube should disappear.

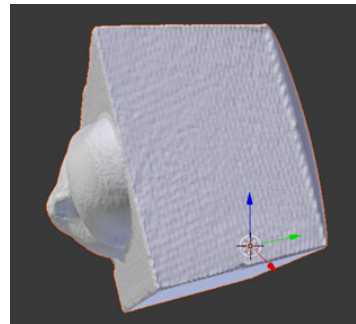


Importing the file:

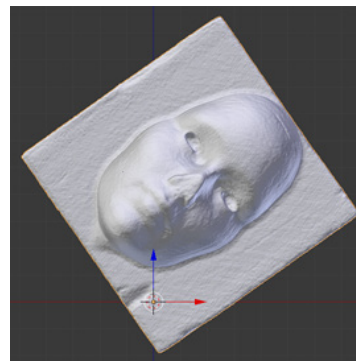
Click "File" in the top left corner then "Import" then "Wavefront(.obj)". On the left side of the screen find your

flash drive, click on it, then double click on the .obj file to open it.

You will find that you are way too far zoomed in and inside the 3D model. Use the scroll wheel to zoom out until the entire model is in the view window.

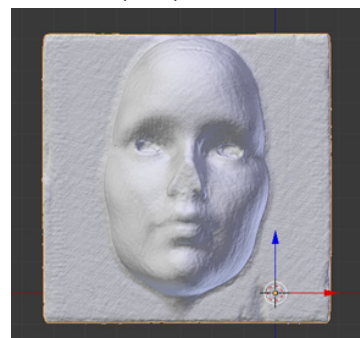


Click and hold down the scroll wheel on your mouse (Yes, you can click the scroll wheel!) and drag your mouse to rotate your view around the model. If you press the "1" key on the numpad you will be brought into front view (looking directly at the model). We are currently in perspective mode which is more realistic but can make it difficult to view and align things. Set the view mode to orthographic by pressing "5" on the numpad.

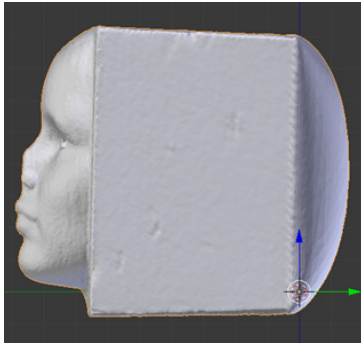


The background grid will show up if you have correctly entered front view and orthographic mode.

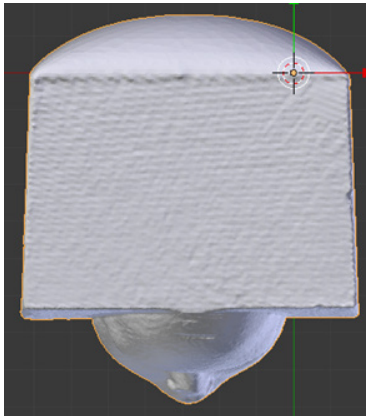
You can see that the model is not aligned with the axis at all. Having everything aligned with the axis's makes things a lot easier. To rotate the model press "r" on your keyboard and move the mouse until the model lies aligned with the X axis (red) and Z axis (blue).



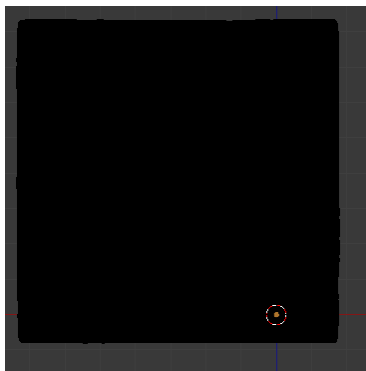
Now that the model is aligned in front view we need to align it in side view. Press “3” on the numpad to move into side view. You can rotate it again with the “r” key to align the model but I found mine was pretty good in side view.



Now for top view! Press “7” on the numpad to move into top view. Mine was pretty well aligned in top view too so I didn’t do anything. If your model is not aligned, again, use the “r” key to rotate it.



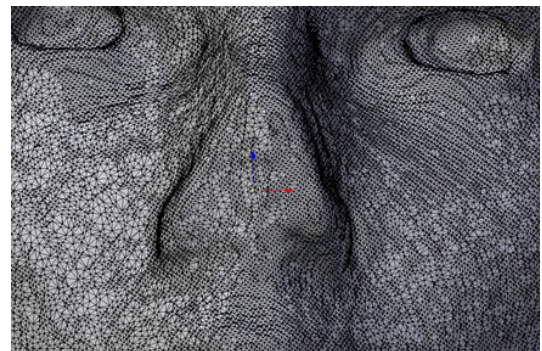
3D models are made of connected points called vertices (singular = vertex). Move into front view with “1” on the numpad. Press the “Tab” key to go into edit mode. This allows you to see the vertices. You will see either an almost orange model or almost black model depending on if your model is selected or not. If the model is orange, press the key “A” to deselect all the vertices. You should end up with an almost solid black model. This is because all the vertices are so close together.



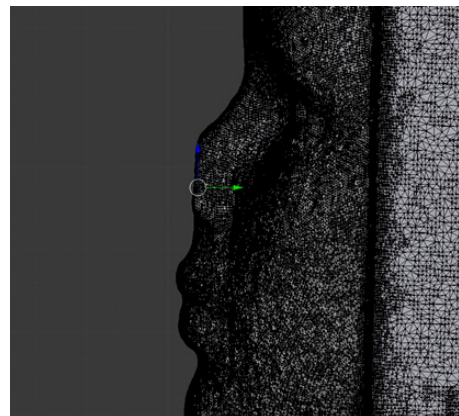
We want to select a vertex at the very center of the broken nose. Zoom with the scroll wheel and pan with “Shift”+“Scroll wheel button” to position yourself near the nose.



Select one of the center-most vertices of the broken nose by right clicking it. It will turn orange and a circle with arrows will appear around it when it is selected.

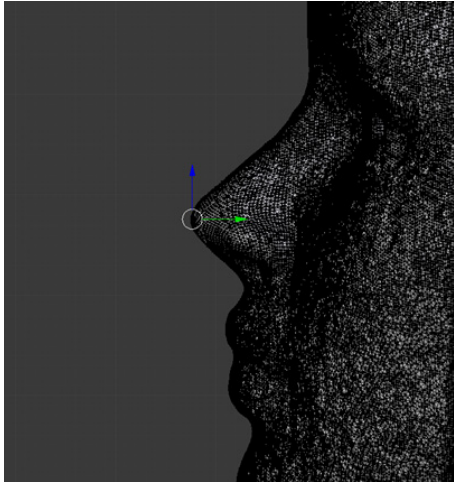


Move into side view by pressing “3” on the numpad. Zoom with the scroll wheel and pan with “Shift”+“Scroll wheel button” to center the face.



Press “o” on the keyboard and drag the horizontal arrow (yours may be red) away from the face. While still holding the arrow use the scroll wheel to select how many vertices around the model you want to effect. You want to effect an amount of pixels that will make the nose look natural.





And you're done! Now you can export the file as a .stl and 3D print the reconstructed face!



