**Making the brain slice 3D objects**

1. Open 3D slicer
2. Load data into slicer
   * This can be done by clicking on the Data --> Choose File(s) to add and browsing for folder or by simply dragging and dropping file into slicer.
   * Brain files are in the BrainModels folder on the desktop in the folder named Brain Scan Data
   * Always use MNI data, never the other set
3. Go to the Module drop down menu and select Segment Editor
4. Add a segment by pressing the green plus sign
5. Go to threshold and adjust the threshold range until only the desired brain part is highlighted, then apply this change.
   * Make sure that when this is done, there are not too many floating particles highlighted as having these makes it harder to edit the model later in the process.
6. Click on Show 3D, this will show you the 3D model.
   * If the model does not show up right away, just wait. The brain file is so big that it takes a while for some things to be done, if you attempt to do it again while it is loading the program will likely crash.
7. Determine the thickness of each slice
   * After 3D model is visible, the thickness of each slice should be determined by taking the highest mm limit ( found on top of each view ) and taking the lowest mm limit visible, taking the absolute value of both and finally adding these numbers together. This number will give you the total amount of mm which tells you exactly how big the model is. Divide this number by 12 or 13 (depending on the type of view) this will ensure you have 12 or 13 evenly divided slices. Always test out how thick each slice will be before deleting anything on the model. Make sure to document the division of each slice as this information will be useful later.
8. When the model is visible in 3D and you are ready to begin making the first slice, navigate to the scissors tool and use it to cut off any unnecessary pieces of the model.
   * Be careful when doing this, make sure that you are certain the piece you are getting rid of is completely irrelevant. Give yourself a wide margin of error.
9. After cutting unnecessary pieces off, use the eraser tool under Segment Editor module and begin erasing everything below the lower limit of the first slice.
10. After you have erased about 10 layers by hand, you can change the viewer to Red Slice only and use the scissors tool to get rid of the rest of the model.
11. Make sure to save the model as a Slicer file now
12. Now that the first limit is set, you can go to the upper limit and repeat steps 8-11
13. After the slice is made, make sure to clean up the model. This can be done in two ways:
    * The Islands option in the Segment Editor menu enables you to get rid of small floating pieces of the model that may be harder to see.
    * The scissors tool is helpful when getting rid of jagged edges and bigger floating pieces.
14. Save the model as a Slicer file now.
15. To save the model as an STL file go to the Segmentations module and scroll down to the Export to files option and make sure the destination folder is correct. Lastly, double check that the file format is STL then click on export. Always double check that the STL file was saved to the correct folder.

**How to capture 2D image and clean it up**

1. Open 3D slicer and navigate to the exact high limit where the top of the slice is. This should be in mm.
2. Change the view to show only the Red Slice Only, Green Slice Only, or Yellow Slice Only depending on what type of brain slices these will be.
3. To take a screenshot of the screen press “Fn + Alt + Insert” or “Window key + Shift + S” which will allow you to choose what part of the screen you wish to capture.

**In Gimp (or Photoshop)**

1. Under File, choose Create from Clipboard
2. Inspect image for any stray material that isn’t directly part of the brain image and use the eraser tool.
3. Once any debris is removed, choose the fuzzy select tool and click on the black background, then hit delete and that will render the background as transparent.
4. Export the image as a .png or .jpg for use in Blender.

**Putting 2D Images on 3D models**

1. Open Blender
2. Delete preset cube, camera and light in the middle of the screen by clicking on it and hitting the delete button on the keyboard.
3. Import the 3D model as an STL file
   * File-> Import -> Stl (.stl)
4. The model must be edited before an image is placed on it.
   * First, the STL file must be decimated. To do this, click on the wrench icon under the Editor Type menu near the right side of the screen. Select Add Modifier-> Decimate and enter “.05” in the Ratio box. Click apply.
   * Cleaning up the model can be done by switching to Sculpt Mode and using the tools on the side to smooth out and remove any bumps or hard edges.
5. After the model is cleaned up make sure to export file as an OBJ then switch back to Object Mode
6. Click on the icon showing two squares called “ Show X-Ray” near the top right side of the editing box.
7. Switch to Edit Mode
8. Use one of the preset viewpoint circles on the side to get the model to lay flat. This is done to select a very thin layer of the top or bottom where the 2D image will be attached.
9. Once the model is flat, simply draw a selection box through a very thin layer of the top or the bottom of the model.
10. Go to the UV tab and select Unwrap
11. Go to the UV tab once again and select Cube Projection
12. Create a new material. To do this:
    * Go to the Material option under the Editor Type menu on the right side of the screen.
    * Click on the plus sign at the upper right corner of the box
    * Click on + New button
    * Assign material
13. Go to Shading menu across the top of the screen
14. Add texture
    * Click on Add -> Texture -> Image Texture
    * Place menu besides the green box names Principled BSDF
    * Open an image texture in the brown Image Texture box. This should be the 2D image that corresponds to the face on the model.
    * Drag the yellow circle besides Color on the brown box and connect it to the yellow circle called Base Color in the green box.
15. Go to the UV editing option across the top of the screen
16. The thin slice of the model that was selected should appear highlighted in Orange and the 2D image should be underneath it. Use viewpoint shading to see the texture in the main window on the right. Use the settings on the left side to rotate and scale the Orange model to fit the 2D image.
17. Once you believe the model is lined up with the 2D image, go back to the Shading menu and double check that the model and image look right.
18. If the slice is two sided, repeat steps 6-17.
19. Make sure to save Blender file in the same folder as everything corresponding to the specific slice you are working on. Also save slice with 2D overlay as an OBJ.