3D Slicer

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What is Slicer

- http://www.slicer.org; 3.6.x
- Mac, Linux, Windows
- 3D slicer gallery: http://www.slicer.org/publications/gallery
- SlicerWelcome is useful at the beginning
## Step 1: Loading data

- **Brain atlas atlas.img/hdr (DICOM)**
- **91 labeled regions**

| 1. medial front-orbital gyrus right | 69. lingual gyrus left |
| 2. middle frontal gyrus right | 70. superior frontal gyrus left |
| 3. lateral ventricle left | 72. nucleus accumbens left |
| 4. insula right | 73. occipital lobe WM left |
| 5. precentral gyrus right | 74. postcentral gyrus left |
| 6. lateral front-orbital gyrus right | 75. inferior frontal gyrus right |
| 7. cingulate region right | 80. precentral gyrus left |
| 8. lateral ventricle right | 83. temporal lobe WM left |
| 9. medial frontal gyrus left | 85. medial front-orbital gyrus left |
| 10. superior frontal gyrus right | 86. perirhinal cortex right |
| 11. globus pallidus right | 88. superior parietal lobule right |
| 12. globus pallidus left | 90. lateral front-orbital gyrus left |
| 13. putamen left | 92. perirhinal cortex left |
| 14. inferior frontal gyrus left | 94. inferior temporal gyrus left |
| 15. putamen right | 95. temporal pole left |
| 16. frontal lobe WM right | 96. entorhinal cortex left |
| 17. angular gyrus right | 97. inferior occipital gyrus right |
| 18. subthalamic nucleus right | 98. superior occipital gyrus left |
| 19. nucleus accumbens right | 99. lateral occipitotemporal gyrus right |
| 20. uncus right | 100. entorhinal cortex right |
| 21. cingulate region left | 101. hippocampal formation left |
| 22. fornix left | 102. thalamus left |
| 23. frontal lobe WM left | 104. parietal lobe WM right |
| 24. precuneus right | 105. insula left |
| 25. subthalamic nucleus left | 106. postcentral gyrus right |
| 26. PCCICPL* | 107. lingual gyrus right |
| 27. PCCICPR* | 108. medial frontal gyrus right |
| 28. hippocampal formation right | 109. amygdala left |
| 29. inferior occipital gyrus left | 110. medial occipitotemporal gyrus left |
| 30. superior occipital gyrus right | 111. anterior limb of internal capsule right |
| 31. supramarginal gyrus left | 112. middle temporal gyrus right |
| 32. anterior limb of internal capsule left | 113. occipital pole right |
| 33. occipital lobe WM right | 114. corpus callosum |
| 34. occipital pole left | 115. amygdala right |
| 35. middle occipital gyrus left | 116. inferior temporal gyrus right |
| 36. middle temporal gyrus right | 117. superior temporal gyrus right |
| 37. supramarginal gyrus right | 118. middle occipital gyrus left |
| 38. superior temporal gyrus left | 119. angular gyrus left |
| 39. inferior temporal gyrus right | 120. lateral occipitotemporal gyrus right |
| 40. superior parietal lobule left | 121. thalamus right |
| 41. caudate nucleus right | 122. background |
| 42. caudate nucleus left | 123. occipital pole left |
| 43. caudate nucleus left | 124. fornix right |
| 44. amygdala right | 125. subarachnoid cerebro-spinal fluid |
Step 1: Loading data

- **File** ⇒ **Add Data** ⇒ choose atlas.hdr (check Centered if applicable) ⇒ Click Apply.
  note: .img files always go with .hdr, at this step .hdr should be chosen.

- **Result:** the data is loaded and you can see it in the three windows (directional)
Step 1: Loading data
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Step 2: Creating Volume

- **Volumes** module ⇒ choose volume name: atlas ⇒ Apply
- *Result*: the volume created
Step 2: Creating Volume
Step 3: Creating Models

- **Editor** module $\Rightarrow$ choose **Master Volume** (depends on Slicer version)
- in **Edit Selected Label Map** window choose Level number and color
- click **Threshold** $\Rightarrow$ choose range (on the right you can see what areas are within this range) $\Rightarrow$ click **Apply**
- click **MakeModel** $\Rightarrow$ choose **Name** $\Rightarrow$ check **Smooth Model** (if applicable)
- **Result:** The model is built with the pre-chosen color.
Step 3: Creating Models

- The first model is corpus callosum labeled 133 (Threshold: 133:133), color: blue
- The second model is frontal lobe WM right labeled 17 (Threshold: 17:17), color: green
- The third model is frontal lobe WM left labeled 30 (Threshold: 30:30), color: red
- The last model is the whole brain (Threshold: 1:255), color: grey
Step 3: Creating Models
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Step 4: Playing with the Models

- **Models** module shows the created models
- you can change visibility, opacity, set new color (in a much more convenient way), play with other things
- The brain opacity can be set to see the other regions
Step 4: Playing with the Models
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Step 5: Saving the Scene

- **Save** ⇒ Select scene (.mrml) and the volumes (.vtk) included into the scene
- Once the scene is save you can load it later
Step 5: Saving the Scene
What is Slicer

- Awesome, duh.
Getting Data in

- Bring in data
  - DICOM/Analyze/NIFTI : File → Add Volume
  - NIFTI : File → Add Data
  - You can bring in Analyze with Add Data if selecting .hdr file
- Generally need a brain image (structural / functional / template) - needs to be in same space as labels
- This makes up a scene (pretty much a project)
Labels

- Label map is surprisingly a map of labels.
- We’ll be looking at categorical labels (thresholded or different structures).
- We need to construct a “model”, which essentially is a 3D construction of the data.
- We go to Editor Module (upper left of panel, around 10 o’clock)
Labels: Structures

- Go to Editor Module (upper left of panel, around 10 o’clock)
- Select the label map image in the data
- A pop-up dialog will ask you what label map (let’s just try generic colors - which are not that good, but default)
- Click structures (if not expanded)
- **Add Structures** and pick a color
- Go to **Threshold** button (Picture)
- Provide a range: if categorical, just make range 1 to 1 if label is coded as 1, for example
Labels: Make some models

- Once you’re done adding all your structures, then let’s build the model!
- **Merge all**
- **Merge and Build:** there should be an image now in the 3D viewer.
Zombie it up: give me brains!

- **Modules** (where Editor is) → **Surface models** → **Grayscale Model Maker**
- Select New Model, brain image (not the label), defaults, and then run (at the bottom).
- Mmm Brains
- It’s so dark!?!#$#
Tweak me

- **Modules** (where Editor is) → **Models**
- Grayscale Model (Scroll down)
- Change opacity/diffusion
- Try some presets, they are the shades spheres (come on, try it).
- Bottom left corner - click the axes for different views
- Click the eye to take off / put on axes and such
- Click two check boxes to see things spin!
Feeling Saucy? Record movie

- gtk-recordMyDesktop for Linux
- Jing for Mac
- Windows? - google
More applications: BOO

- Slicer can read in 4D data, but I haven’t explored.
- bioImageSuite - if trying to record a 4D movie, this does it
- Originally for Cardiac 4D movies - so pretty good.
- If you find something better, tell me!
Other visualization tools:

- **VisIt** [https://wci.llnl.gov/codes/visit/](https://wci.llnl.gov/codes/visit/); open source, scalable to petascale visual data analysis.
- **VTK** - Visualization ToolKit: 3D Slicer, VisIt, ParaView.

Visualized is a sectional view of the rupturing of a steel container that is filled with a plastic bonded explosive and heated by a fire. copyright: VACET presentation
Other visualization tools:

- **VisIt**  https://wci.llnl.gov/codes/visit/

![VisIt Image](image-url)
Other visualization tools:

- VisIt https://wci.llnl.gov/codes/visit/

Copyright: VisIt manual
Other visualization tools:

- **ParaView** [www.paraview.org](http://www.paraview.org); open source

Copyright: [http://wiki.multiscaleflows.mecheng.strath.ac.uk](http://wiki.multiscaleflows.mecheng.strath.ac.uk)