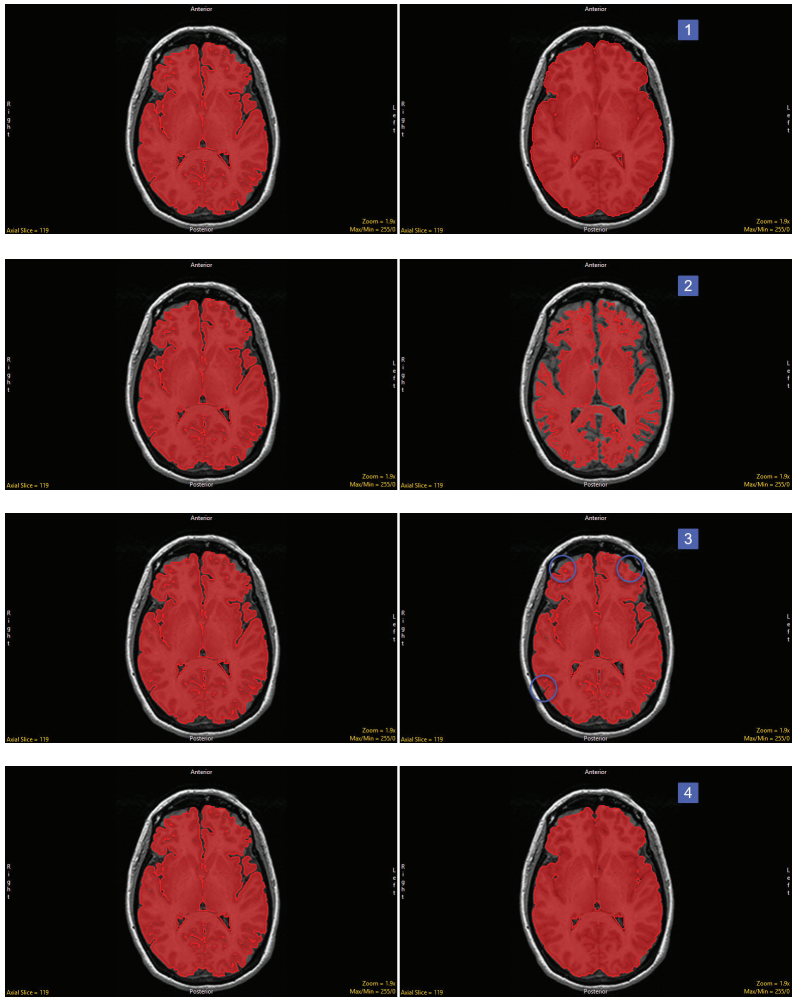
Morph Objects

The Morph Objects option allows users to apply rudimentary morphological operations to objects. The operations available are dilate, erode, open and close. Additional morphological operations are accessible from the Morphology tool in Process. The following Morph Objects options are available:

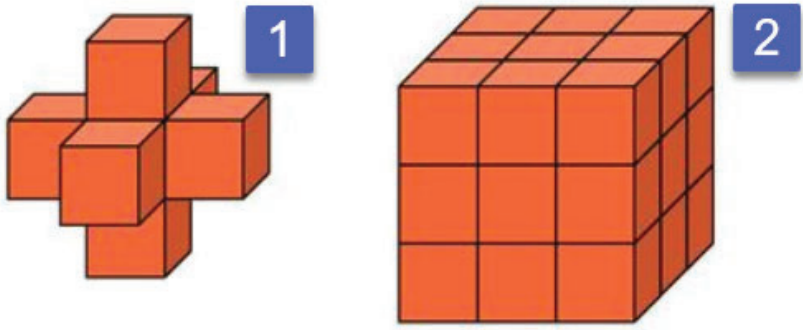
Operation: The operation drop-down menu allows users to select the morphological operation to perform. Choose from:

- Dilate: Adds a layer of voxels to an object, increasing the size of the object by increasing the objects boundaries while reducing the size of holes in the object [1].
- Erode: Removes a layer of voxels from an object, decreasing the size of the object by eroding the objects boundaries and increasing the size of holes in the object [2].
- Open: Performs an erode followed by a dilate [3]. In general, an open is less destructive than an erosion. The effect of the operation is to preserve voxels that have a similar shape to the structuring element, while removing other regions from the object. The effect on the image can be subtle as indicated in the image below.
- Close: Performs an dilate followed by a erode [4]. The close operation is similar to the dilate operation in that it tends to increase the object boundaries and shrink holes within the object. However, the close operation is less destructive of the original object boundary.



Morph Objects (continued)

Element Shape: Allows users to choose between a jack [1] or box [2] shaped element.



- Jack: A jack-shaped structuring element includes only the orthogonal elements to the center voxel of the structuring element. In a 3x3x3 jack-shaped structuring element, there are 7 voxels - one center voxel surrounded by the 6 orthogonal neighbors. The diagonal voxels are not part of this structuring element [1].
- Box: A rectilinear structuring element is a solid rectangle (or cube) of the given size in X, Y, and Z. For example, a 3x3x3 rectilinear structuring element is a 27-voxel cube - one center voxel surrounded by 26 orthogonal and diagonal voxels [2].

Element Size: The element size, sometimes referred to as kernel size, allows users to set the X, Y, and Z dimensions of the selected element shape that will be used in the chosen morphological operation.

- X: The X option allows users to specify the width of the structuring element. Select 1, 3, 5, 7, 9, or enter an odd numbered value into the text entry field.
- Y: The Y option allows users to specify the height of the structuring element. Select 1, 3, 5, 7, 9, or enter an odd numbered value into the text entry field.
- Z: The Z option allows users to specify the depth of the structuring element. Select 1, 3, 5, 7, 9, or enter an odd numbered value into the text entry field.

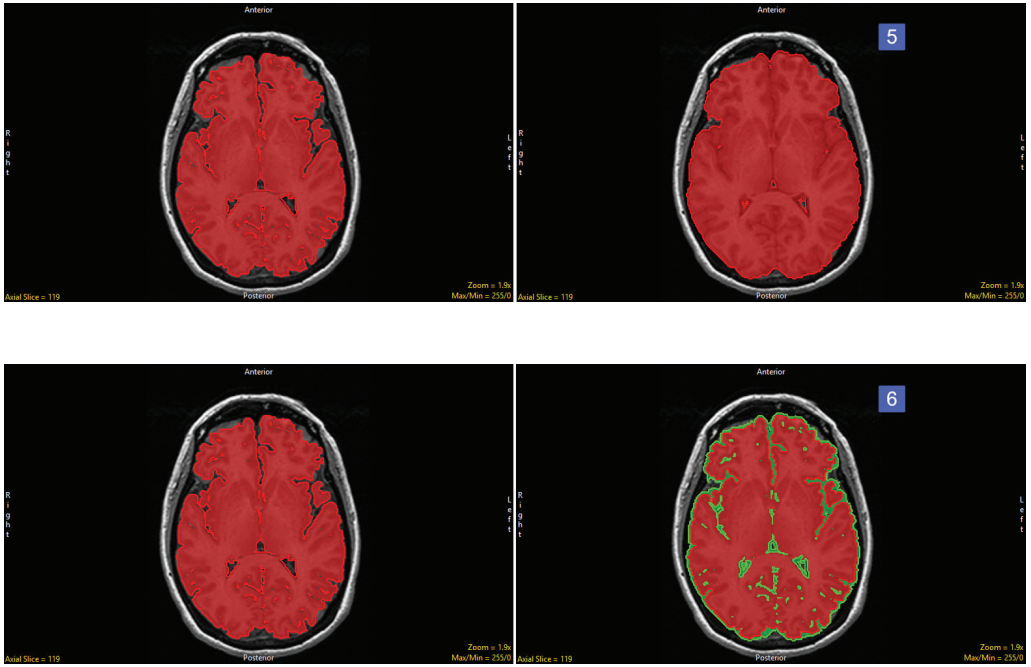
Note, to specify a 2D element set any of the dimensions to 1. A 3x3x3 jack-shaped structuring element will erode away or dilate (add) a single layer of voxels on the structure, a 5x5x5 structuring element will generally take away or add two voxels, etc.

Morph Objects (continued)

Use Conditional Volume: The use conditional volume option is only available for the dilate operation. When selected the option allows a user to limit the dilation of the current object, conditioning the results with a volume selected from the workspace. The voxels that exist in the conditional volume define a 'mask' for voxels to be processed in the current volume. When selected the following options are available to choose the conditioning volume:

- Workspace: Allows the user to select the workspace that contains the conditional volume.
- Name: Allows user to select the volume to use as the conditional volume. Note volumes can be binary or grayscale.
- Drag and drop here: Allows users to select the conditional volume via drag-and-drop from the workspace.

Set Current Object to Selection: The Set Current Object to Selection option is only available for the dilate and close operations. The option allows users to enable (default) or disable setting the current object as the selected object for the output of the morphological operation, that is the voxels that will be added to the object once the dilate or close operation is complete. Keep this option enabled if you wish to assign the additional voxels to the same object [5], uncheck and disable this option if you wish to have assign the additional voxels to a different object, an object selected from the object list. [6]

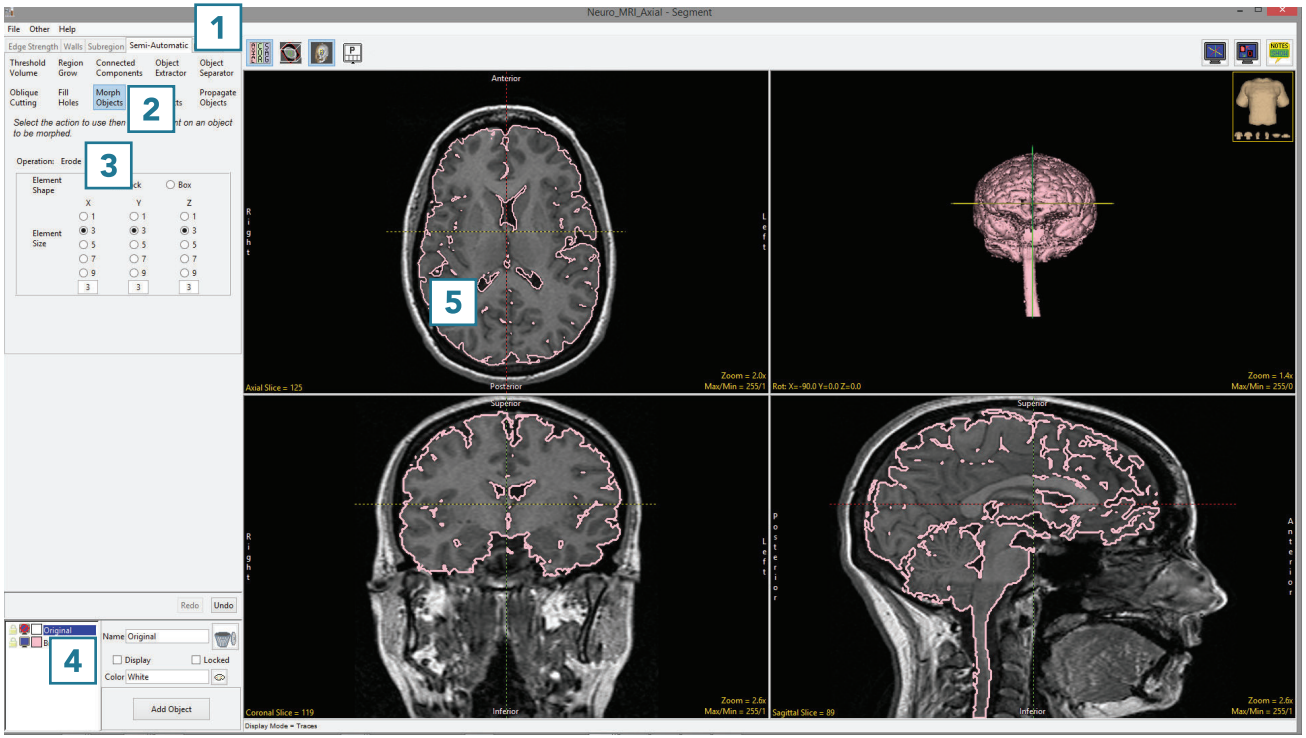


Using Morph Objects to Improve Segmentation

Here we will improve the segmentation of an object by applying rudimentary morphological operations to the object.

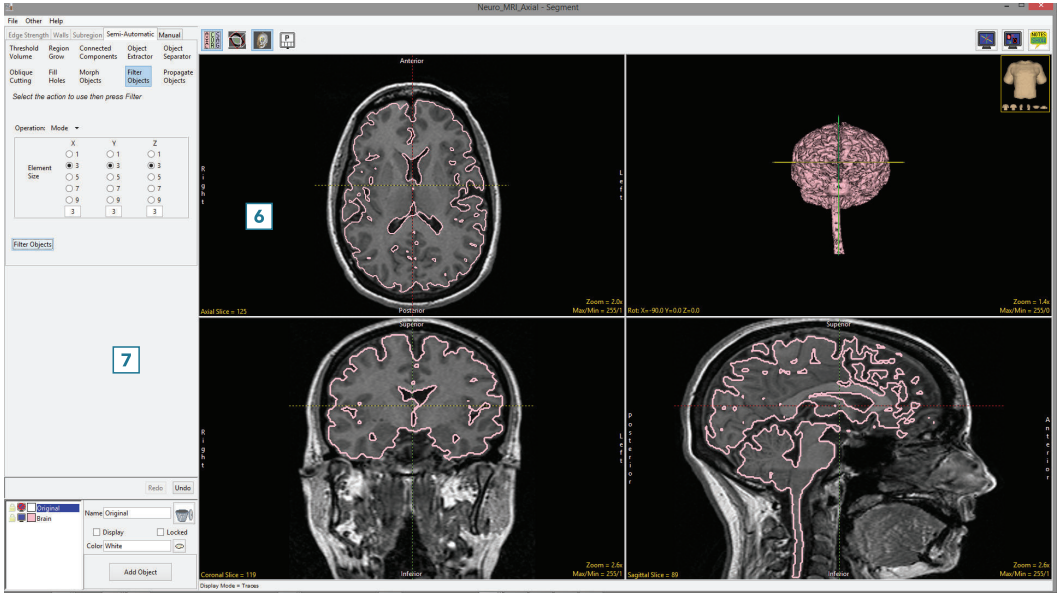
To follow along, download the data set MRI_3D_Head from analyzedirect.com/data and load into Analyze using Input/Output.

- Select the data set and open Segment.
- Select Semi-Automatic [1] and choose Object Extractor.
- Click on the image data to set a seed point.
- Adjust the minimum and maximum threshold values to define the structure and select Extract Object.
- Once the object is segmented, rename and update the color.
- Choose Morph Object [2] and set Operation to Erode [3].
- Leave the element size set to 3 X 3 X 3.
- Set the target object to Original [4]. This will specify that any eroded voxels will be reassigned to the Original object.
- Now click on the brain [5] to initiate the erosion.

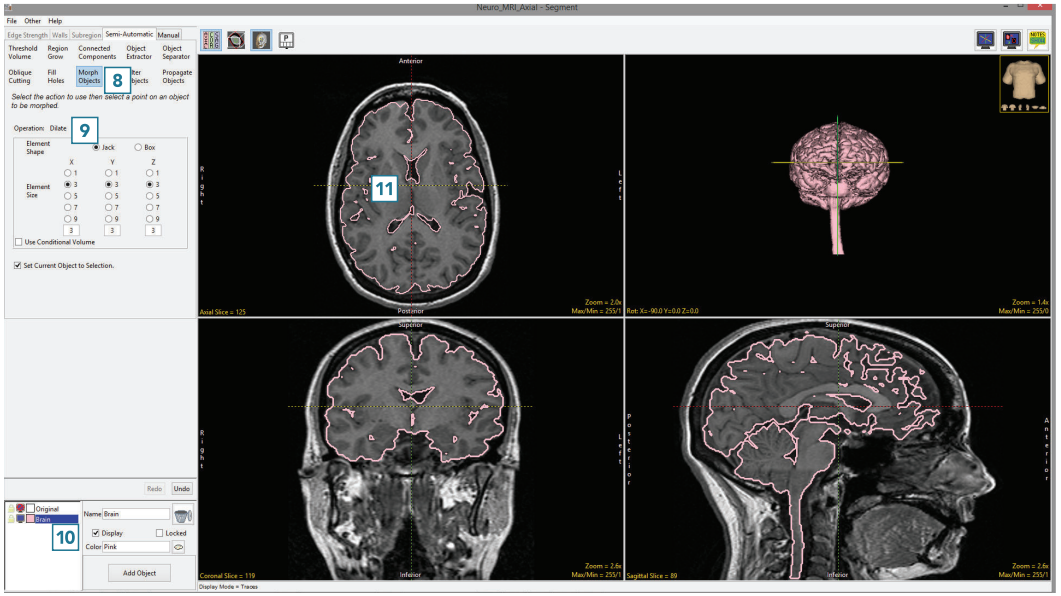


Using Morph Objects to Improve Segmentation (continued)

- Select Filter Objects [6] and apply a 3 X 3 X 3 Mode filter to the brain by clicking Filter Objects [7].



- Select Morph Objects [8] and set the Operation to Dilate [9].
- Select the Brain object [10] and click on the brain [11].



Using Morph Objects to Improve Segmentation (continued)

Note the difference between the pre [12] and post [13] processed brain objects.