

# Advanced normalization tools (ANTs) show-and-tell

# Outline

- Intro & scripts...
- How to build your own study-specific template
- Examples
- Pushing data into and out of template space
- Examples
- Normalization to standard space (e.g. MNI)

# Intro

- Package of .sh and binaries
- Handles common image formats:  
.nii, .nii.gz, .img/.hdr, .img.gz, .jpg!
- <http://stnavar.github.io/ANTs/>
- pdf of ‘documentation’: <https://github.com/stnavar/ANTsDoc/blob/master/ants2.pdf>
- Install: Download precompiled binaries, compile yourself, already on neuro cluster (be careful about version)

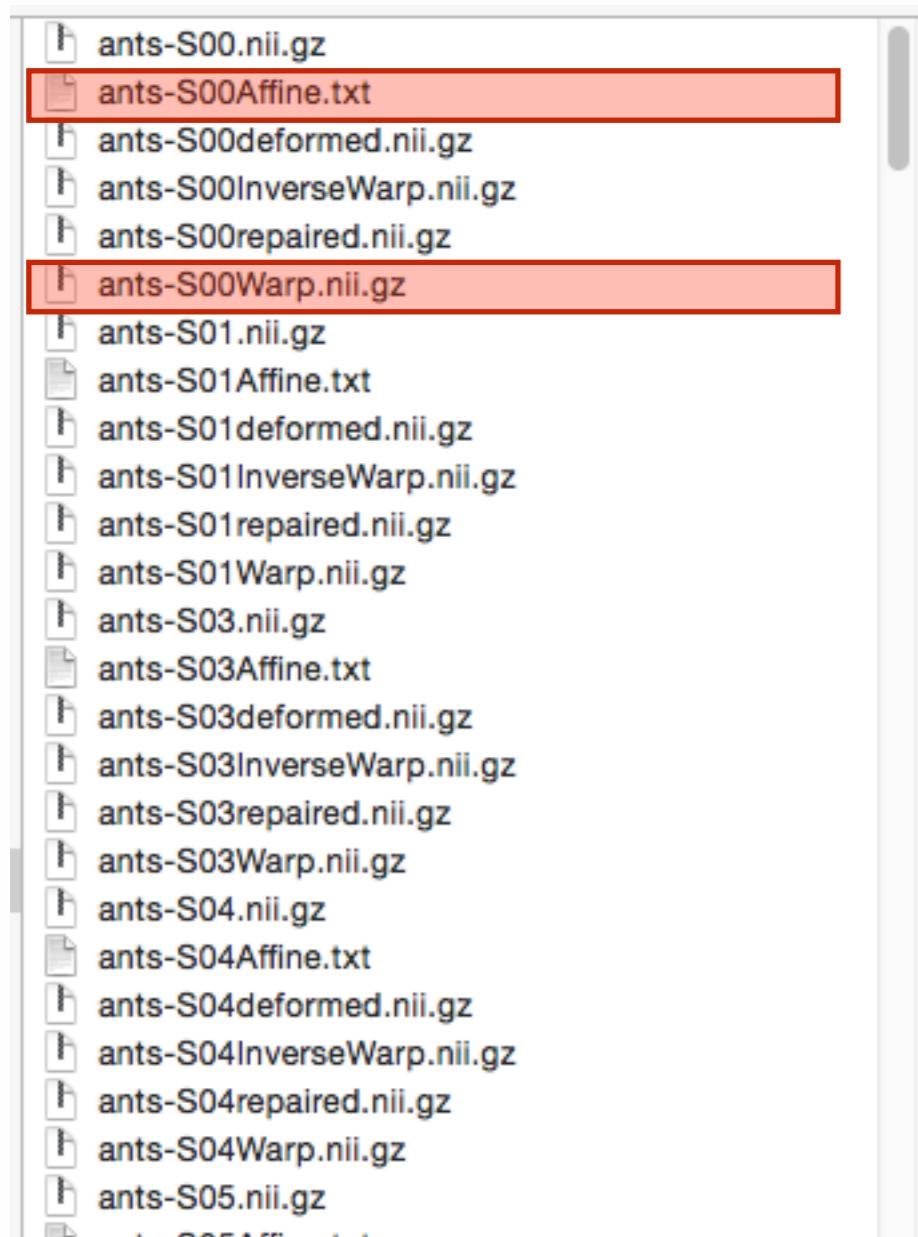
# Building a template

- Before: skull strip
- great resource: <http://miykael.github.io/nipype-beginner-s-guide/ANTS.html>

# Build template output

↳	ants-S00.nii.gz
↳	ants-S00Affine.txt
↳	ants-S00deformed.nii.gz
↳	ants-S00InverseWarp.nii.gz
↳	ants-S00repaired.nii.gz
↳	ants-S00Warp.nii.gz
↳	ants-S01.nii.gz
↳	ants-S01Affine.txt
↳	ants-S01deformed.nii.gz
↳	ants-S01InverseWarp.nii.gz
↳	ants-S01repaired.nii.gz
↳	ants-S01Warp.nii.gz
↳	ants-S03.nii.gz
↳	ants-S03Affine.txt
↳	ants-S03deformed.nii.gz
↳	ants-S03InverseWarp.nii.gz
↳	ants-S03repaired.nii.gz
↳	ants-S03Warp.nii.gz
↳	ants-S04.nii.gz
↳	ants-S04Affine.txt
↳	ants-S04deformed.nii.gz
↳	ants-S04InverseWarp.nii.gz
↳	ants-S04repaired.nii.gz
↳	ants-S04Warp.nii.gz
↳	ants-S05.nii.gz
...	... 205 files ...

# Build template output



# Build template output

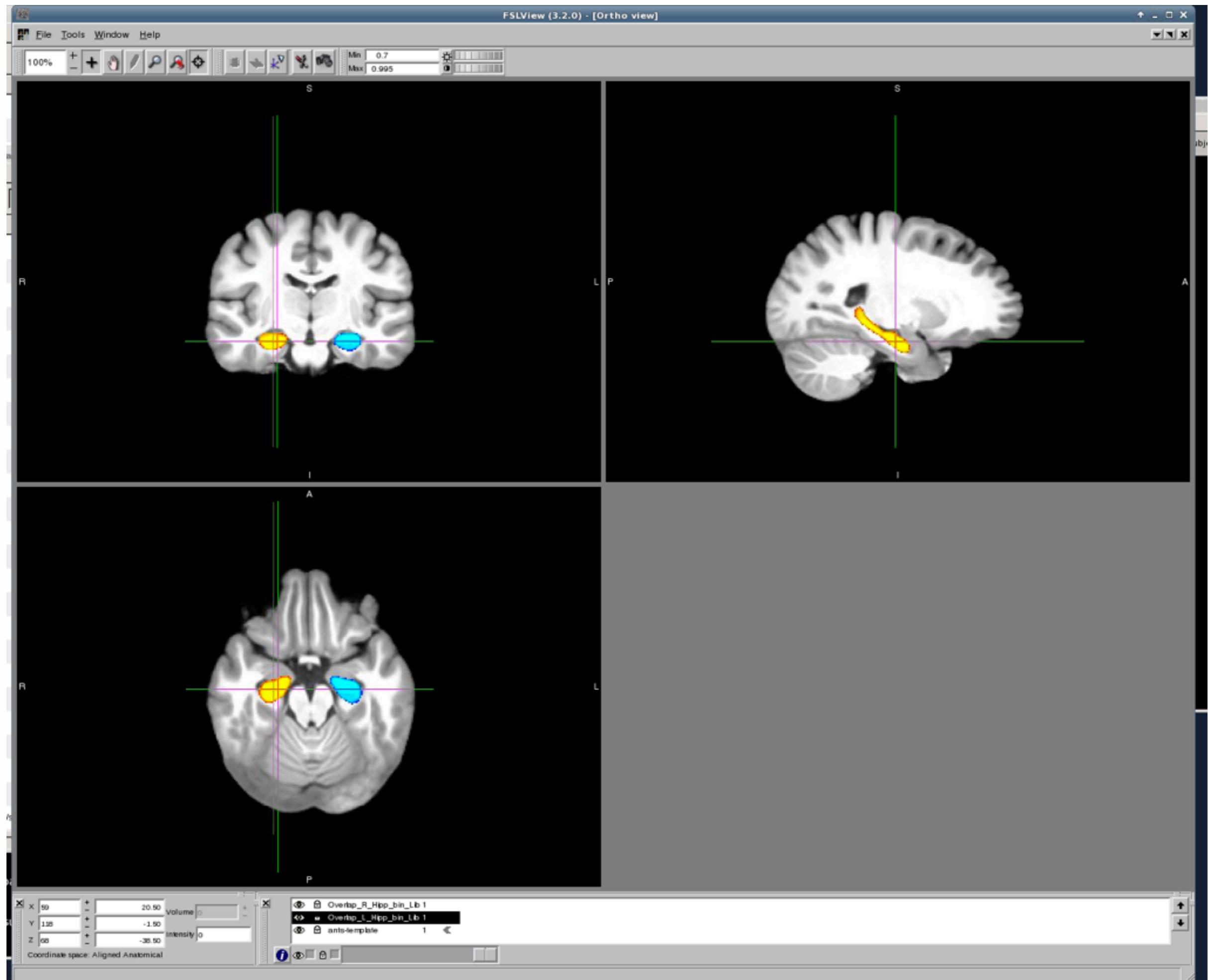


# Build template output

 ants-S69repaired.nii.gz
 ants-S69Warp.nii.gz
 ants-S70.nii.gz
 ants-S70Affine.txt
 ants-S70deformed.nii.gz
 ants-S70InverseWarp.nii.gz
 ants-S70repaired.nii.gz
 ants-S70Warp.nii.gz
 ants-template_InverseWarp.nii.gz
 ants-template.nii.gz
 ants-templateAffine.txt
 ants-templatewarp.nii.gz
 ants-templatewarplog.txt
 GR_iteration_0
 GR_iteration_1
 GR_iteration_2
 GR_iteration_3
 GR_iteration_4
 GR_iteration_5
 S00.cfg
 S00.nii.gz
 S01.cfg
 S01.nii.gz
 S03.cfg
 S03.nii.gz
 S04.cfg
 S04.nii.gz
 S05.cfg
 S05.nii.gz

# Example templates





# Pushing data

- WarplImageMultiTransform!

○ ○ ○ ants\_warp.sh UNREGISTERED

ants\_warp.sh \* ants\_inverse\_warp.sh \* encode\_singlesubject\_make\_RvsK\_vmps.m \*

```
1 #!/bin/bash
2
3 #example usage: source ~/scripts/ants_warp.sh orig_file output_file ants_directory ants_prefix ants_suffix ss
4
5
6 antspath=$HOME/antsbin
7 input_img=$1
8 output_img=$2
9 ants_dir=$3
10 ants_prefix=$4
11 suffix=$5
12 iss=$6
13
14 cmd="$antspath/WarpImageMultiTransform 3 $input_img $output_img \
15 -R $ants_dir/$ants_prefix"template.nii.gz" \
16 $ants_dir/$ants_prefix$iss$suffix"Warp.nii.gz" \
17 $ants_dir/$ants_prefix$iss$suffix"Affine.txt"""
18
19 eval $cmd
20
```

UNREGISTERED

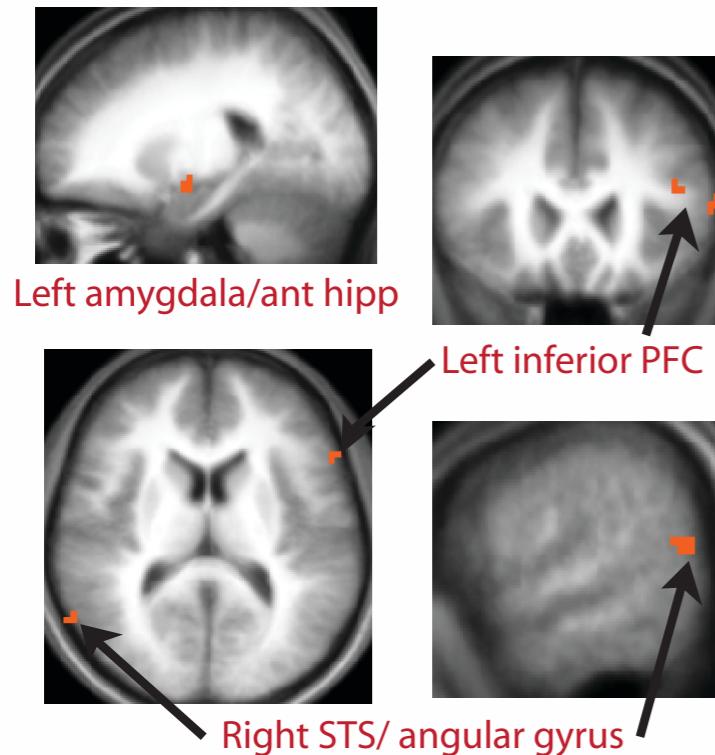
ants\_warp.sh \* ants\_inverse\_warp.sh \* encode\_singlesubject\_make\_RvsK\_vmps.m \*

```
1 #!/bin/bash
2
3 #example usage: source ~/scripts/ants_inverse_warp.sh orig_file output_file ants_directory ants_prefix ants_suffix ss
4
5
6 antspath=$HOME/antsbin
7 input_img=$1
8 output_img=$2
9 ants_dir=$3
10 ants_prefix=$4
11 suffix=$5
12 iss=$6
13
14 cmd="$antspath/WarpImageMultiTransform 3 $input_img $output_img \
15 -R $ants_dir/$ants_prefix$iss$suffix".nii.gz" \
16 -i $ants_dir/$ants_prefix$iss$suffix"Affine.txt" \
17 $ants_dir/$ants_prefix$iss$suffix"InverseWarp.nii.gz"""
18
19 eval $cmd
20
```

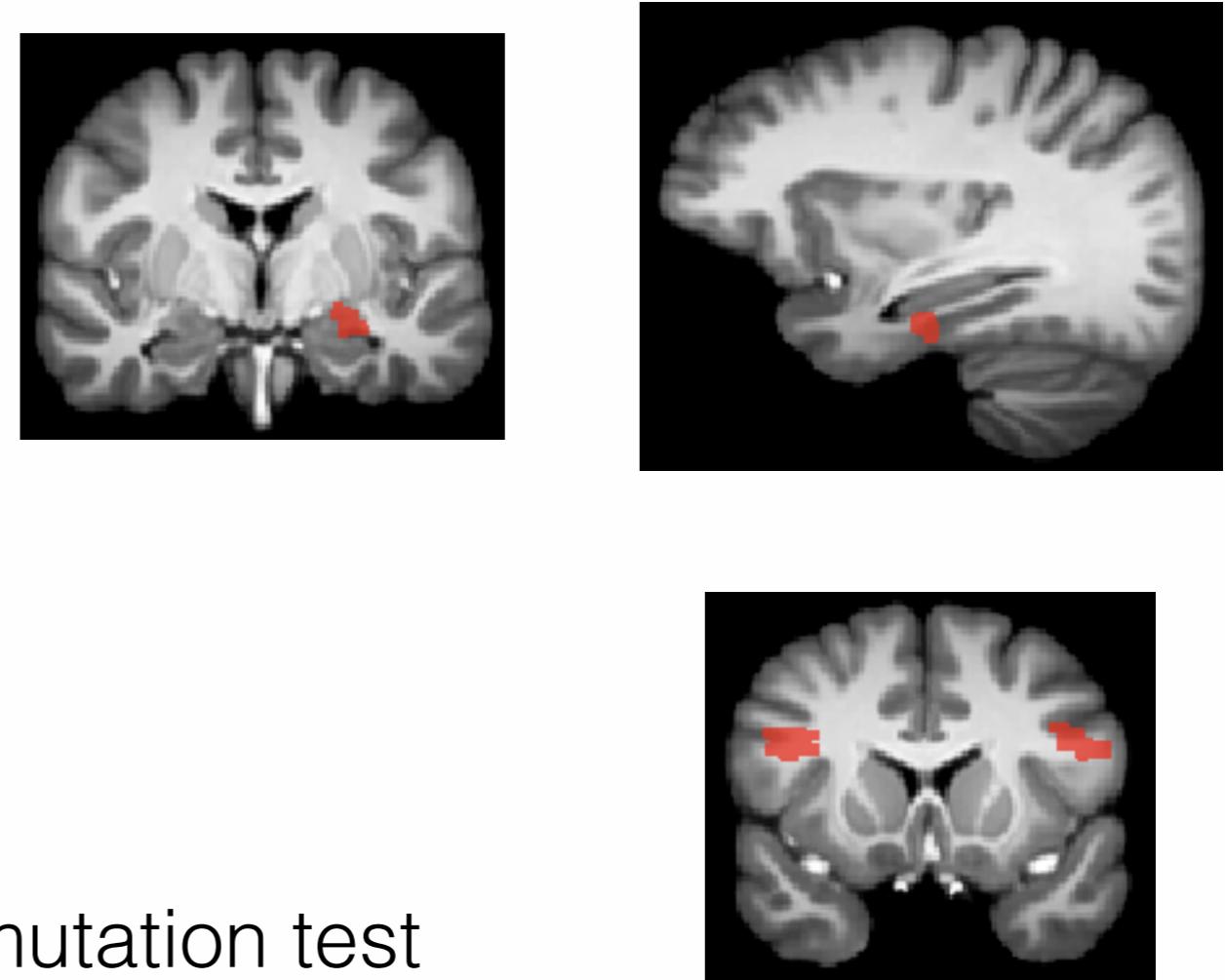
# Examples

# Examples

SPM



ANTs

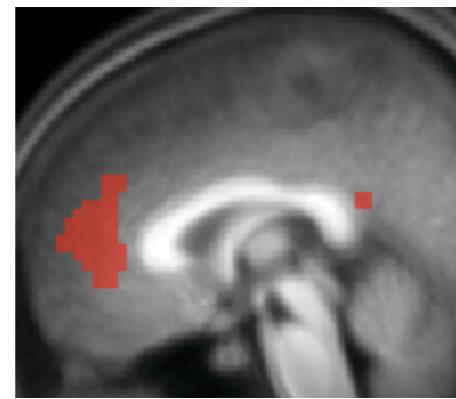
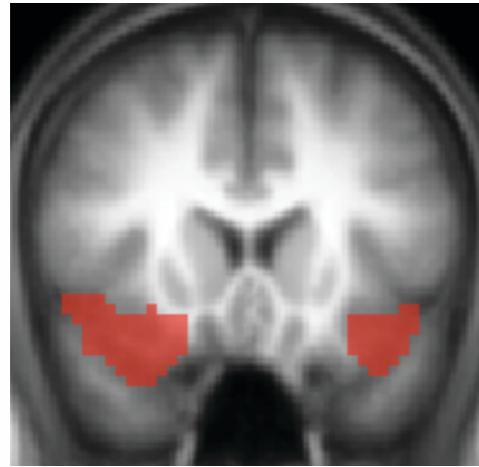


Both FWE corrected using permutation test

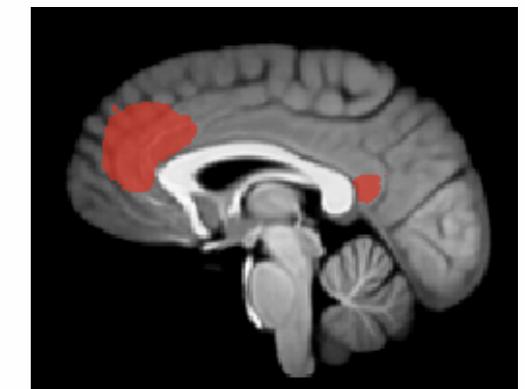
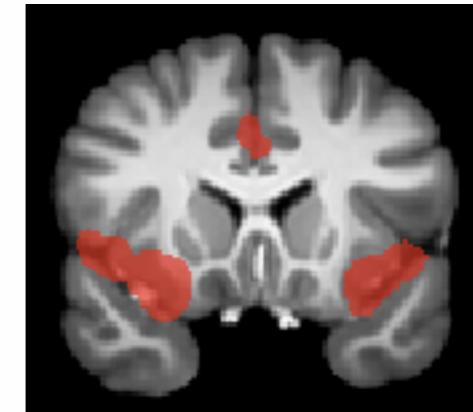
+4, -1 regions

# Examples

SPM



ANTs



Mean correlation ( $z$ ) > .25

Mean correlation ( $z$ ) > .4

# Normalizing to standard space

- Can separately align study-specific template brain to standard
- Can include standard brain in study-specific template creation