

# **MATLAB TUTORIAL**

## **How to Analyze EEG on SPM**

---

Independent Study in Psychology  
Fall 2011

# EEG Dataset

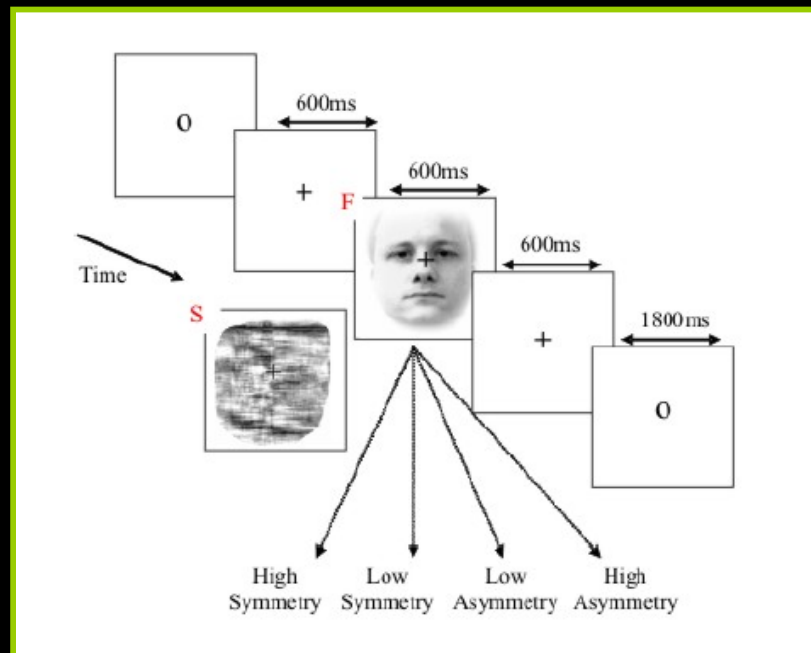


Multimodal face-evoked dataset:

<http://www.fil.ion.ucl.ac.uk/spm/data/mmfaces/>

# Paradigm

- Randomized presentation of 86 faces and 86 scrambled faces, both matched for low-level visual properties
- Each face required a four-way, left-right symmetry judgment



# EEG Data

---

- 128-channel ActiveTwo system
  - 32 A (Back)
  - 32 B (Right)
  - 32 C (Front)
  - 32 D (Left)
- One right earlobe electrode and one left earlobe electrode
- Two bipolar channels measured HEOG and VEOG
- Sampled at 2048 Hz

# EEG Data Files

---

- Biosemi raw data files (data acquired in the two runs of the protocol)
  - EEG/faces\_run1.bdf
  - EEG/faces\_run2.bdf
- Text file (list of condition labels in the same order as the trials appear in the two files - “faces” for presentation of faces and “scrambled” for presentation of scrambled faces)
  - EEG/condition\_labels.txt
- ASCII file (electrode locations, fiducials and headshape points measured with a Polhemus digitizer)
  - EEG/electrode\_locations\_and\_headshape.sfp

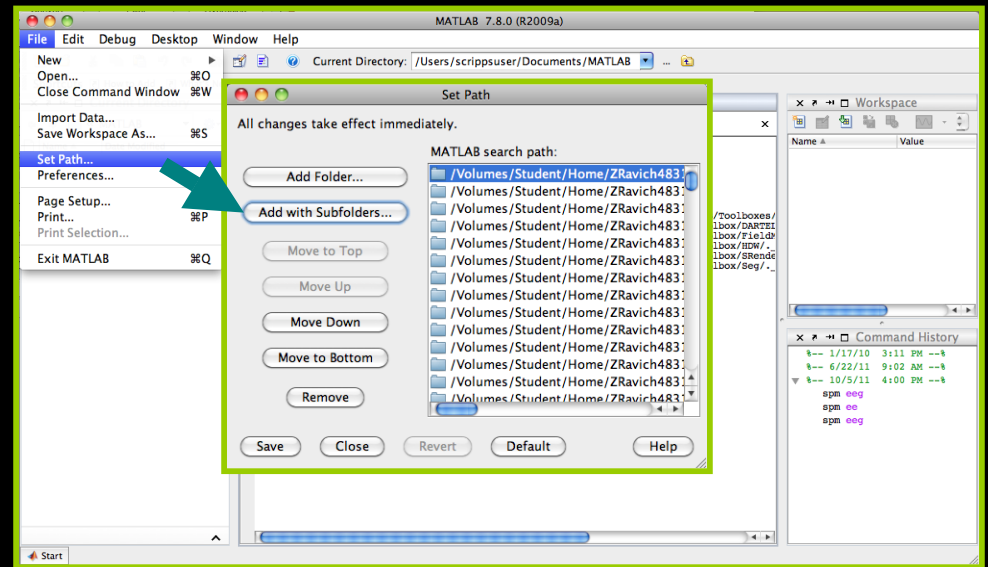
# EEG Data Analysis



# Step 1

## Getting Started

- Open up MATLAB
- Go to “File” → “Set Path” → “Add with Subfolders” → Select the dataset folder (i.e., Home\ZoeRavich4831\MATLAB\Datasets)
  - “Do you you want to save this path for future reference?”; Click “No”
- Go to the Command Window and type “spm eeg” to open up the EEG GUI



# Step 2

## Convert

---

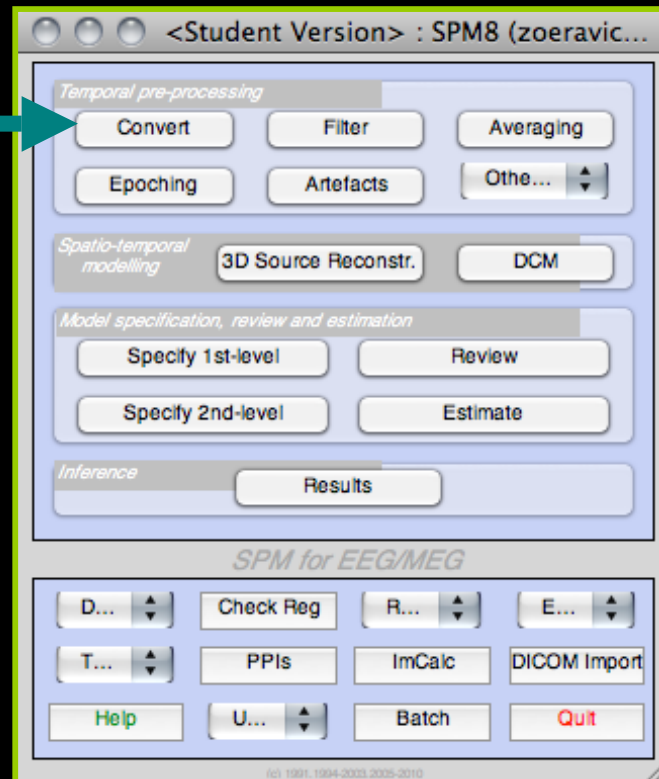
- Press the CONVERT button
  - Select the faces\_run1.bdf file
  - “Define settings?”; Click “Just read”
- New files: spm8\_faces\_run1.mat and spm8\_faces\_run1.dat
- The “Info” tab will appear
  - “History” tab (lists processing steps that have been applied to the file)
  - “Channels” tab (lists channels in the file and their properties)
  - “Trial” tab (lists the trials or events)
  - “Inv” tab (reviews inverse solutions; if you click on the “EEG” tab, you will see the raw EEG traces)

# Step 2

# Convert

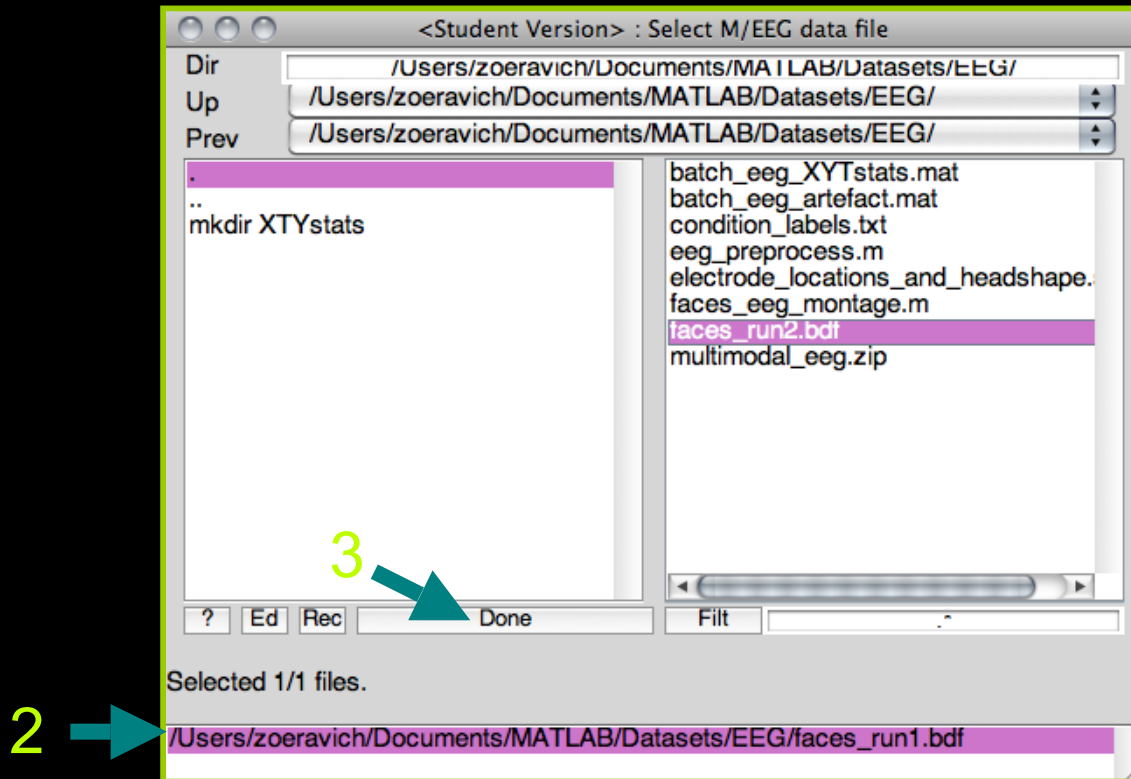
---

1



# Step 2

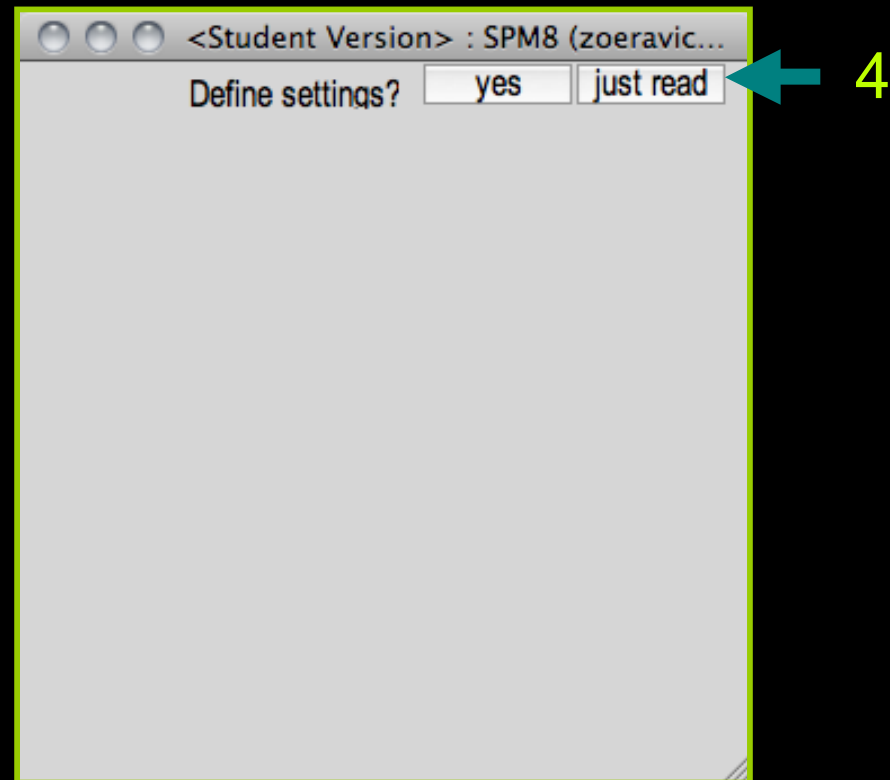
# Convert



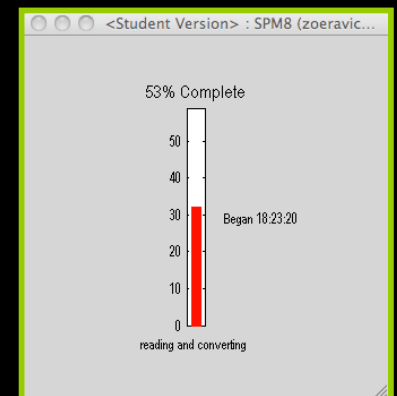
# Step 2

# Convert

---



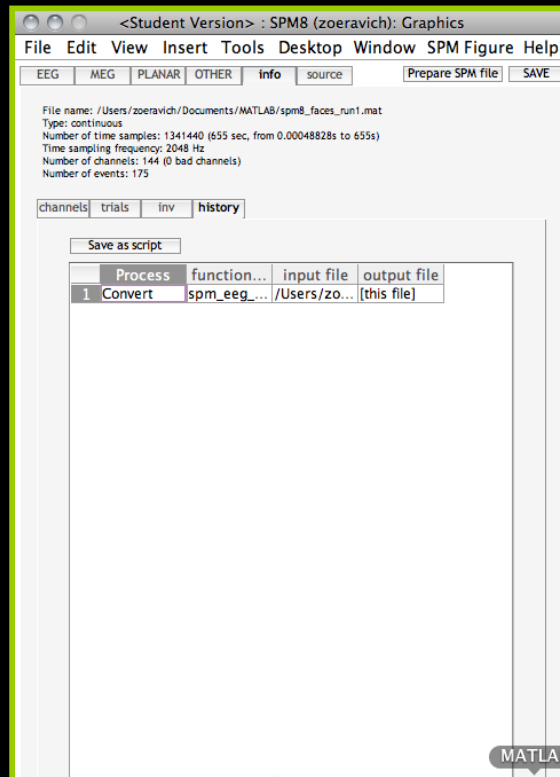
Processing...



# Step 2

# Convert

---



# Step 3

## Downsample

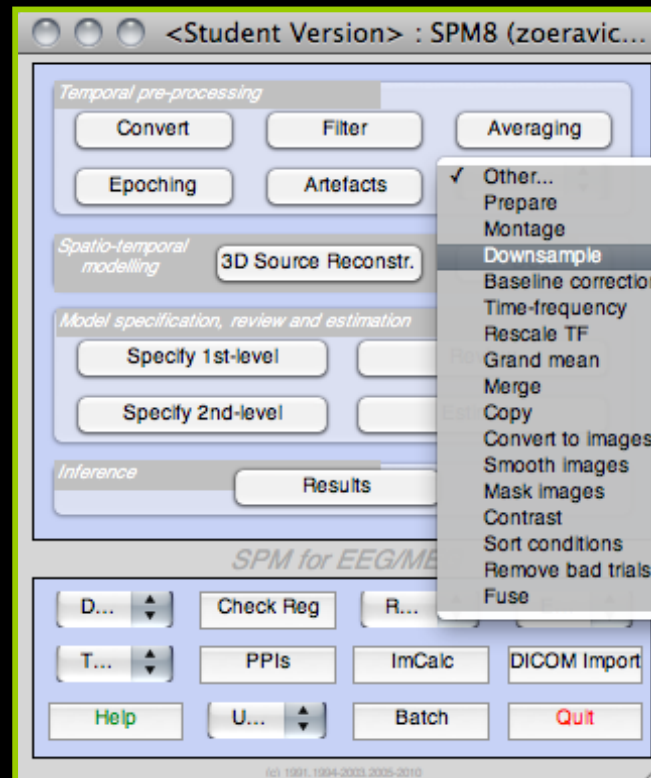
---

- Select DOWNSAMPLE from the “Other” drop-down menu
  - Select the spm8\_faces\_run1.mat file
  - “New sampling rate”; Type “200” (Hz)
- New files: dspm8\_faces\_run1.mat and dspm8\_faces\_run1.dat

# Step 3

## Downsample

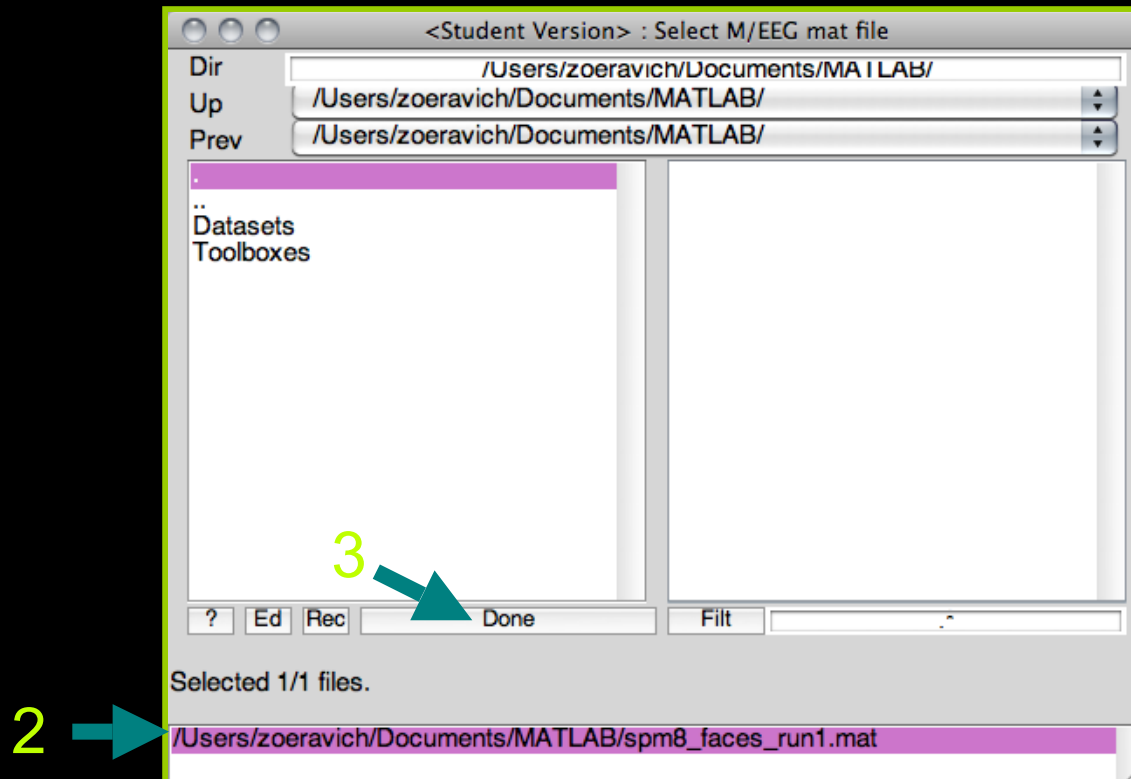
---



# Step 3

## Downsample

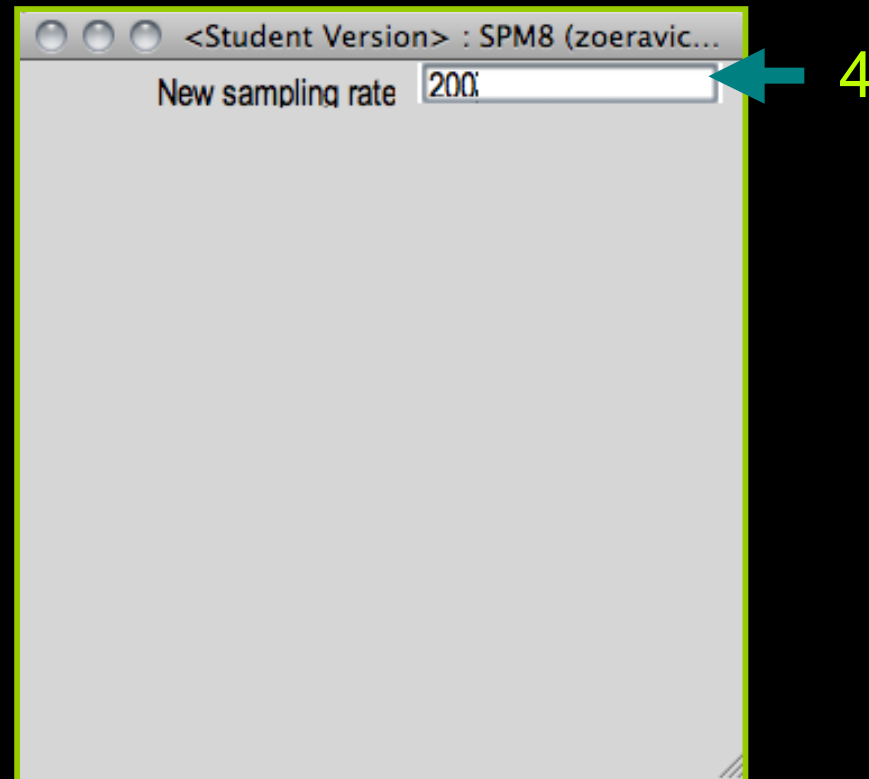
---



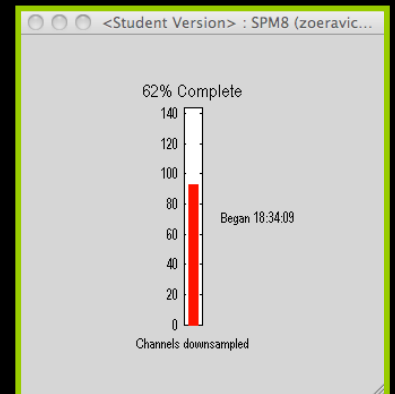
# Step 3

## Downsample

---



Processing...



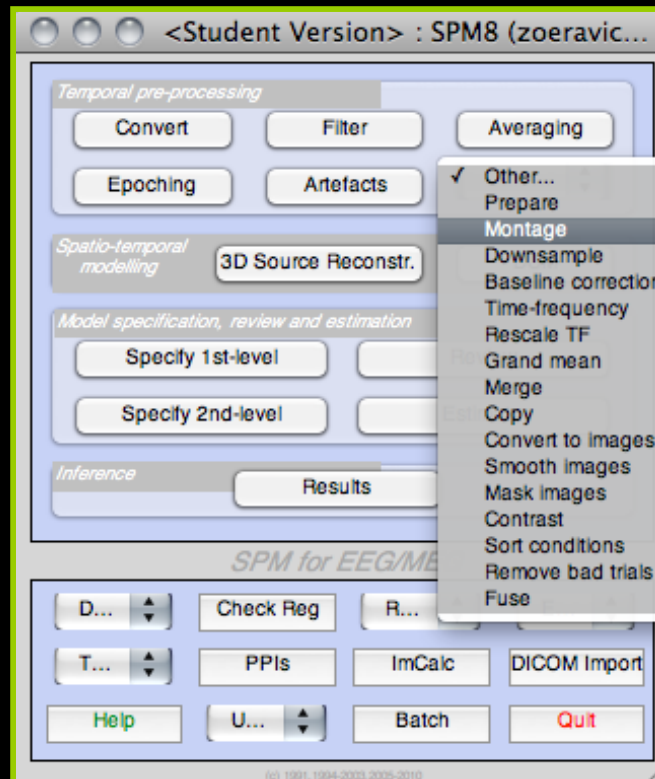
# Step 4

## Montage

---

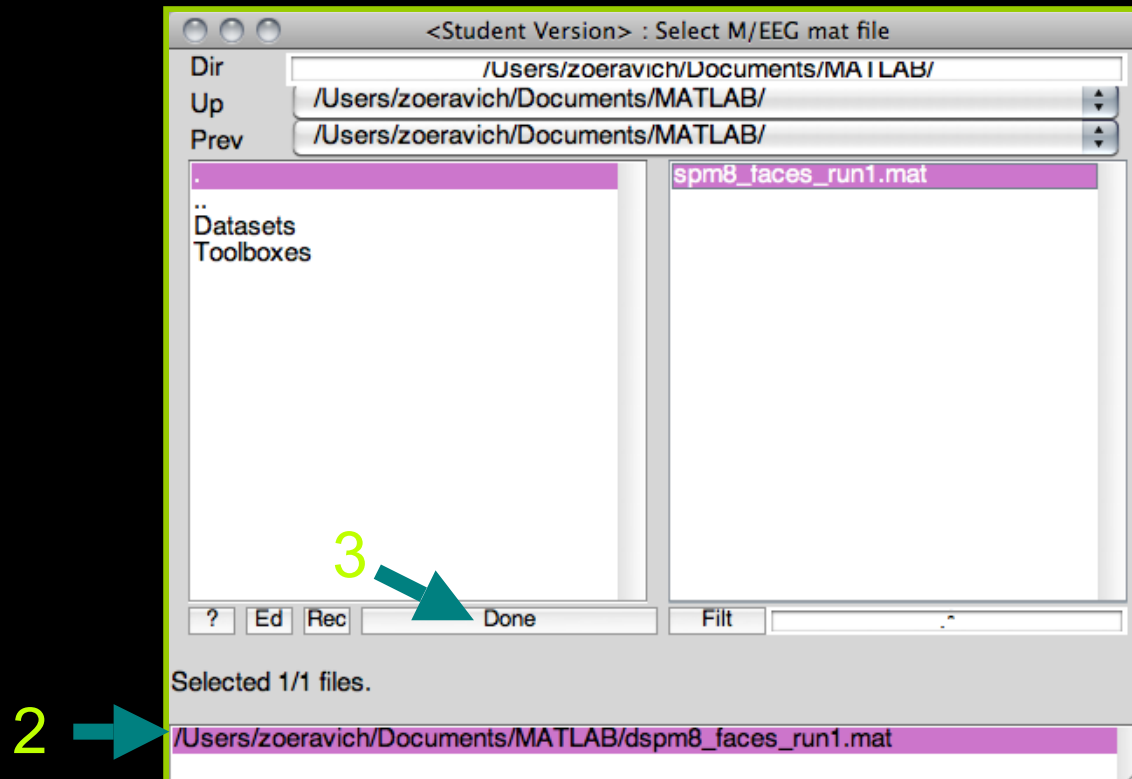
- Select MONTAGE from the “Other” drop-down menu
  - Select the dspm8\_faces\_run1.mat file
  - “How to specify the montage?”; Click “File”
  - Select the generated faces\_eeg\_montage.mat file
  - “Keep the other channels?”; Click “No”
- New files: Mdspm8\_faces\_run1.mat and Mdspm8\_faces\_run1.dat

# Step 4 Montage



# Step 4 Montage

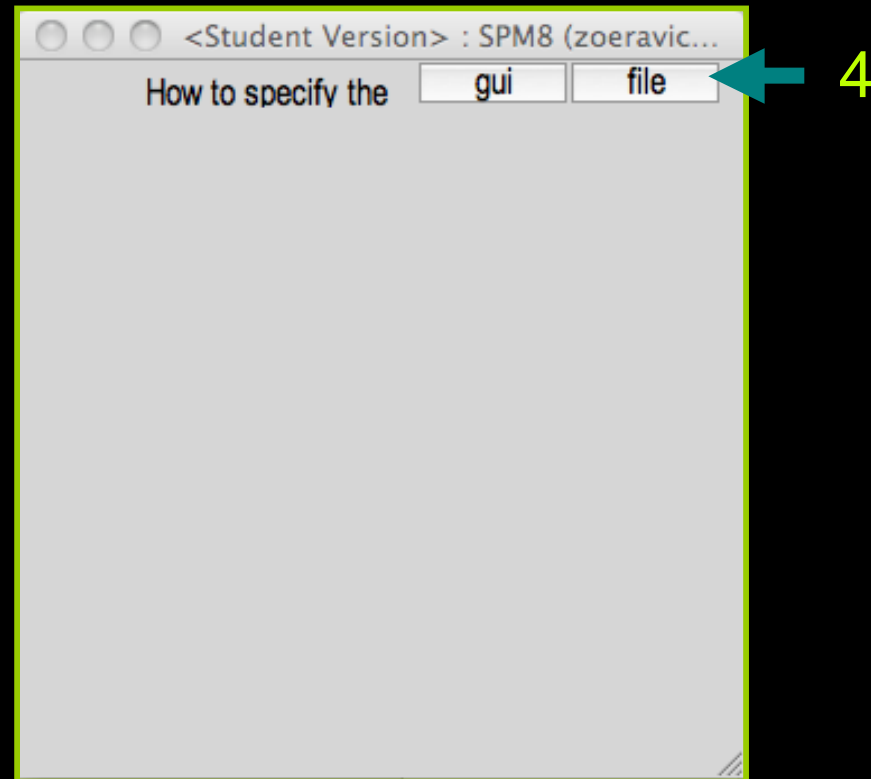
---



# Step 4

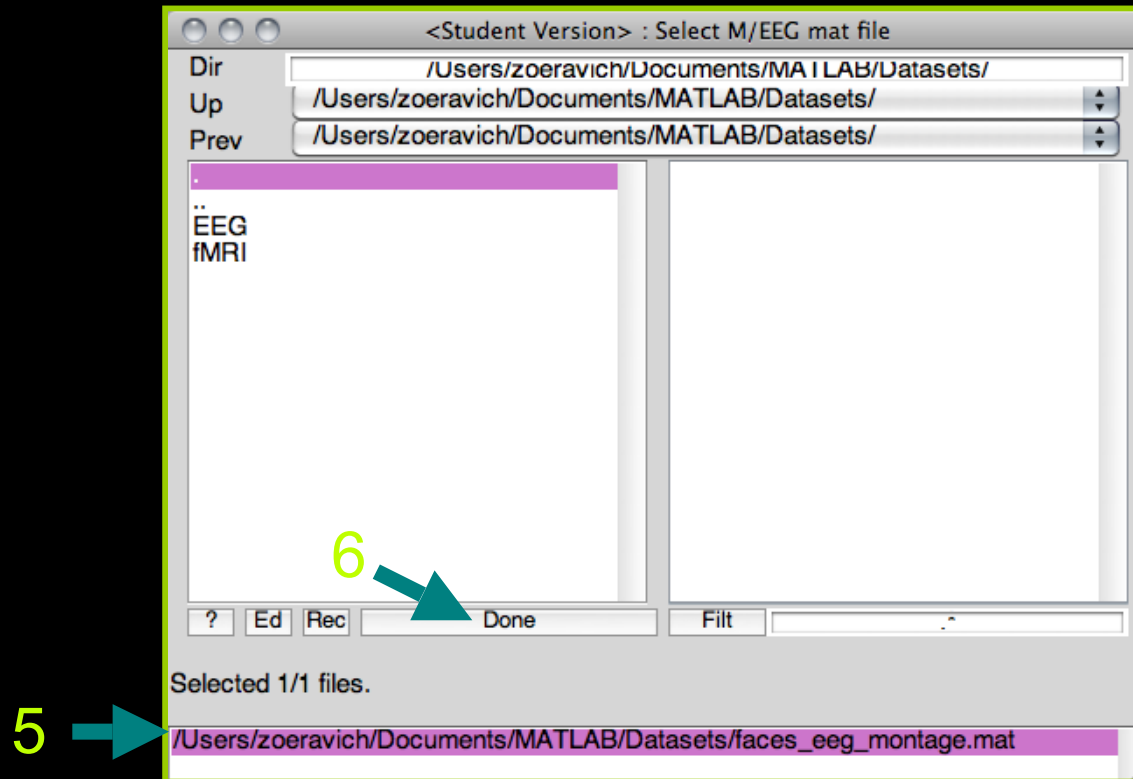
# Montage

---



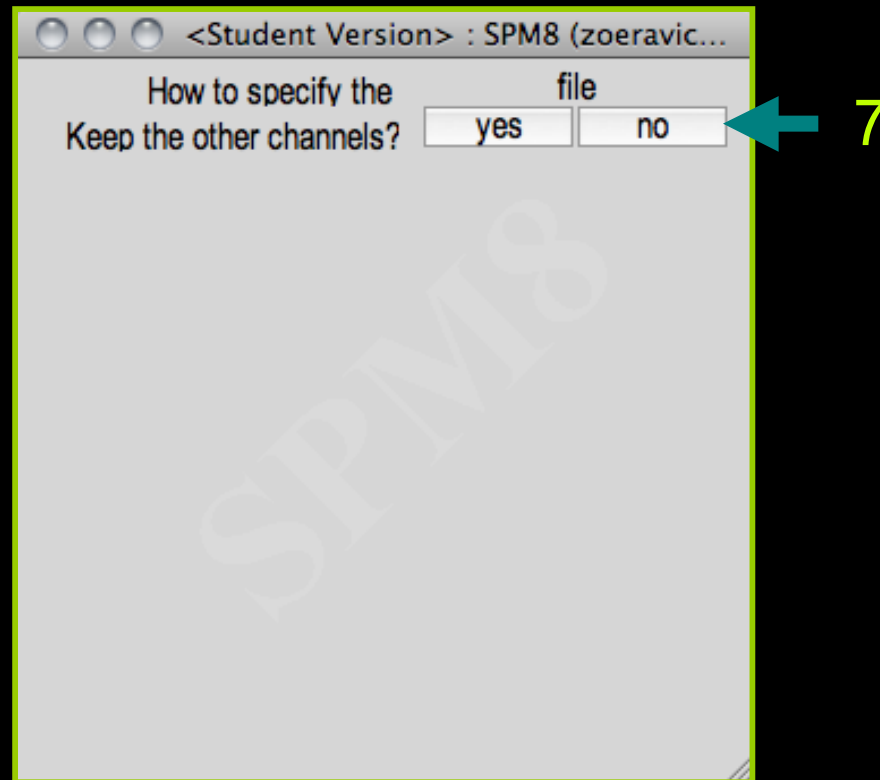
# Step 4 Montage

---

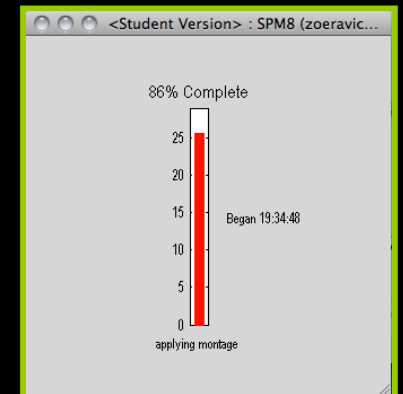


# Step 4 Montage

---



Processing...



# Step 5

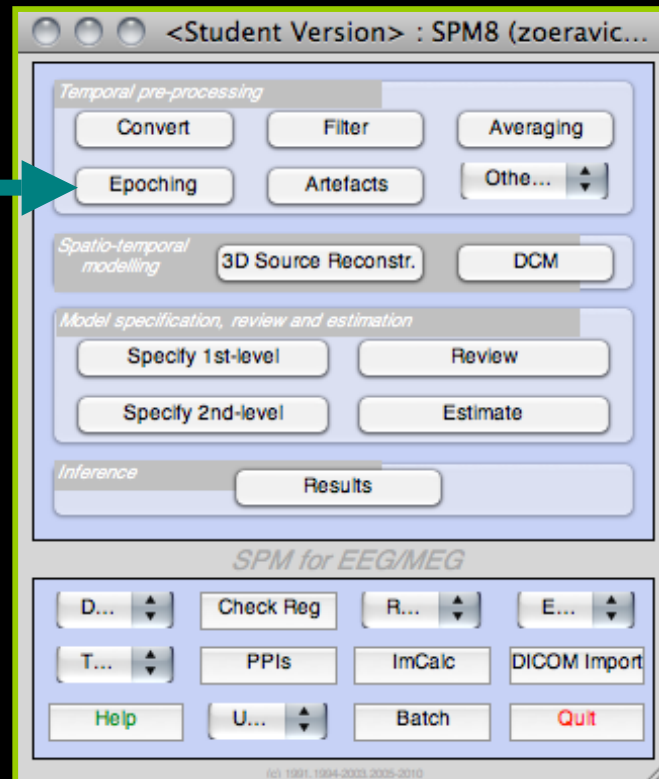
## Epoch

---

- Press the EPOCH button
  - Select the Mdspm8\_faces\_run1.mat file
  - “Start of trial in PST [ms]”; Type “-200”
  - “End of trial in PST [ms]”; Type “600”
- Select the event with type “STATUS” and value 1 appears 172 time in the GUI that pops up and press OK
  - “Review individual trials?”; Click “No”
  - “Save trial definitions?”; Click “No”
- New files: eMdspm8\_faces\_run1.mat and eMdspm8\_faces\_run1.dat

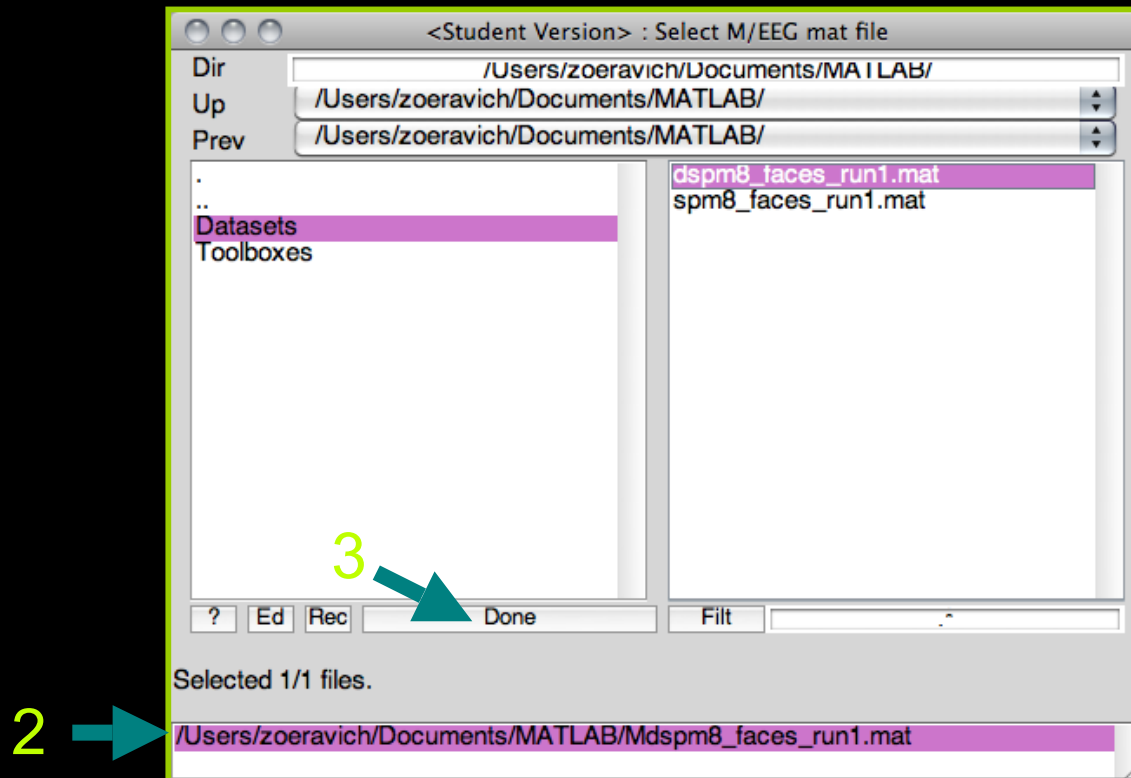
# Step 5 Epoch

1



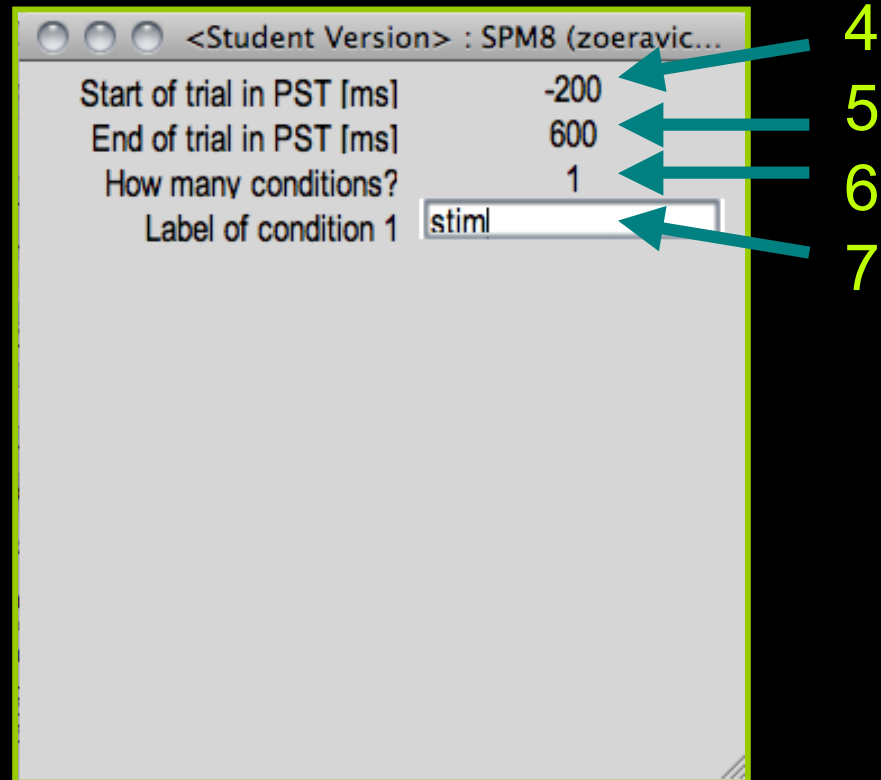
# Step 5

# Epoch



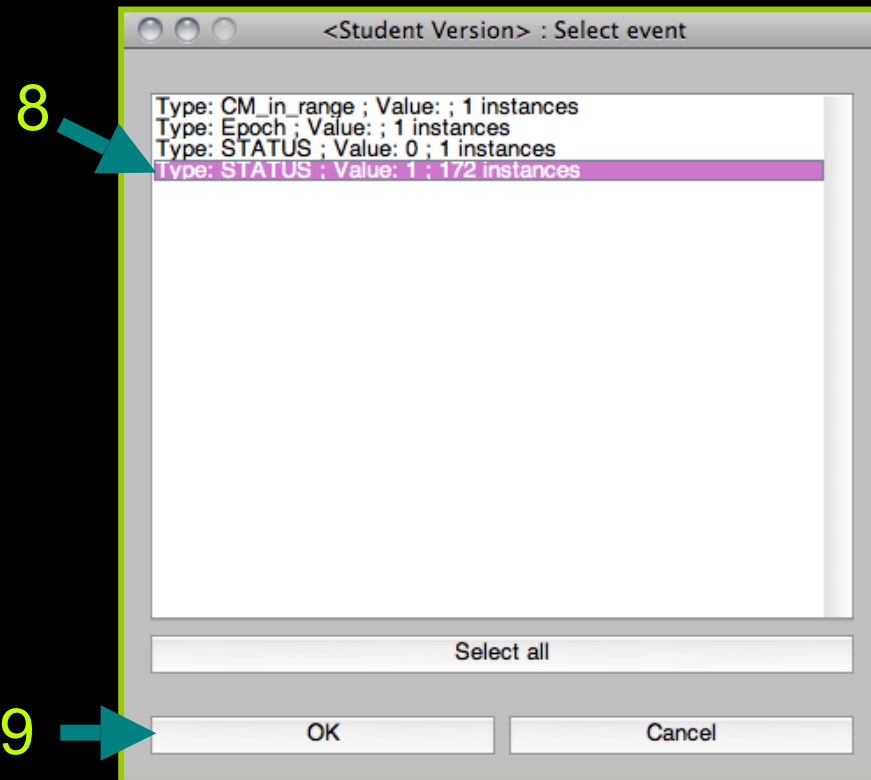
# Step 5 Epoch

---



# Step 5 Epoch

---



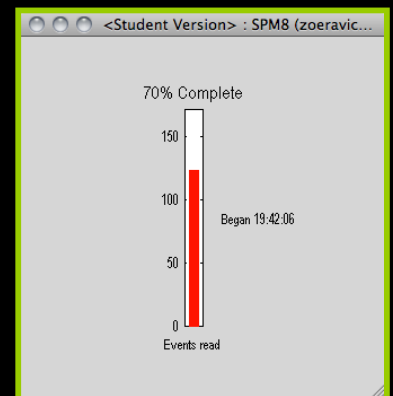
# Step 5 Epoch

<Student Version> : SPM8 (zoeravic...)

Start of trial in PST [ms]	-200
End of trial in PST [ms]	600
How many conditions?	1
Label of condition 1	stim
Review individual trials?	no
Save trial definition?	<input type="button" value="yes"/> <input type="button" value="no"/>

10 & 11

Processing...



# Step 6

## Reassignment of Trial Labels

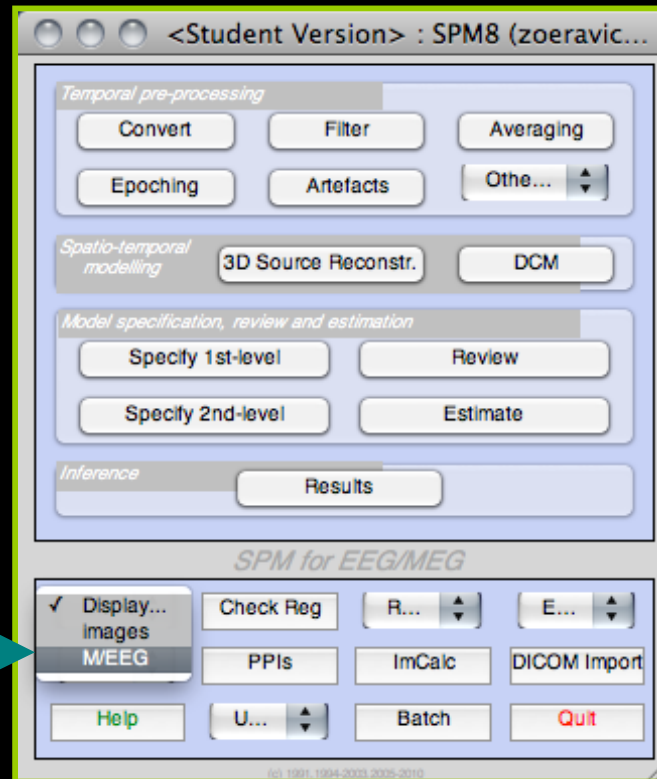
---

- Open the eMdspm8\_faces\_run1.mat file in the reviewing tool
  - Switch to the “Trials” tab, which should present a table with 172 rows
- Open conditions\_labels.txt and select/copy (Ctrl-A/Ctrl-C) all of the rows
  - Place the cursor in the first row and first column under the “Trials” tab and paste the copied labels (Ctrl-V)
  - Press “Update” and then “SAVE”

# Step 6

## Reassignment of Trial Labels

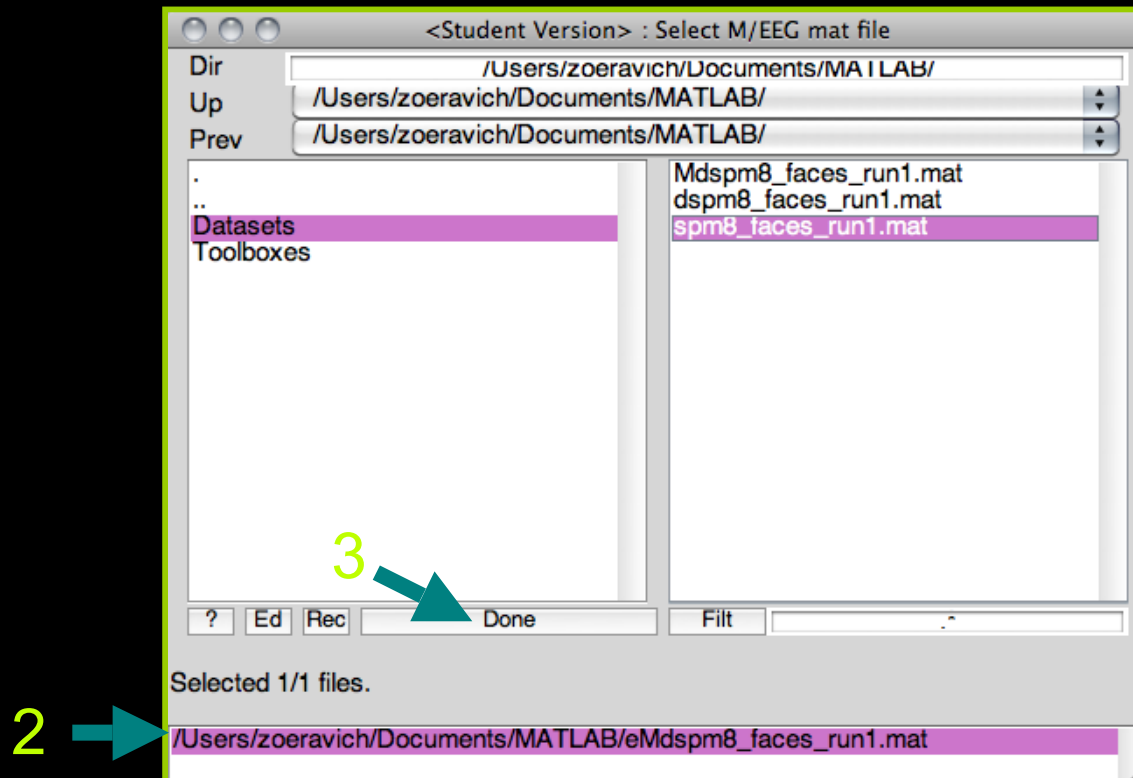
---



# Step 6

## Reassignment of Trial Labels

---



# Step 6

## Reassignment of Trial Labels

<Student Version> : SPM8 (zoeravich): Graphics

File Edit View Insert Tools Desktop Window SPM Figure Help

EEG MEG PLANAR OTHER info source Prepare SPM file SAVE

File name: /Users/zoeravich/Documents/MATLAB/eMdspm8\_faces\_run1.mat  
Type: single  
Number of time samples: 161 (0.805 sec, from -0.195s to 0.605s)  
Time sampling frequency: 200 Hz  
Number of channels: 130 (0 bad channels)  
Number of trials: 172 (0 bad trials)

channels trials inv history

Save as script

Process	function...	input file	output file
1 Convert	spm_eeg_...	/Users/zo...	/Users/zo...
2 Downsam...	spm_eeg_...	/Users/zo...	/Users/zo...
3 Change m...	spm_eeg_...	/Users/zo...	/Users/zo...
4 Epoch	spm_eeg_...	/Users/zo...	[this file]

4

<Student Version> : SPM8 (zoeravich): Graphics

File Edit View Insert Tools Desktop Window SPM Figure Help

EEG MEG PLANAR OTHER info source Prepare SPM file SAVE

File name: /Users/zoeravich/Documents/MATLAB/eMdspm8\_faces\_run1.mat  
Type: single  
Number of time samples: 161 (0.805 sec, from -0.195s to 0.605s)  
Time sampling frequency: 200 Hz  
Number of channels: 130 (0 bad channels)  
Number of trials: 172 (0 bad trials)

channels trials inv history

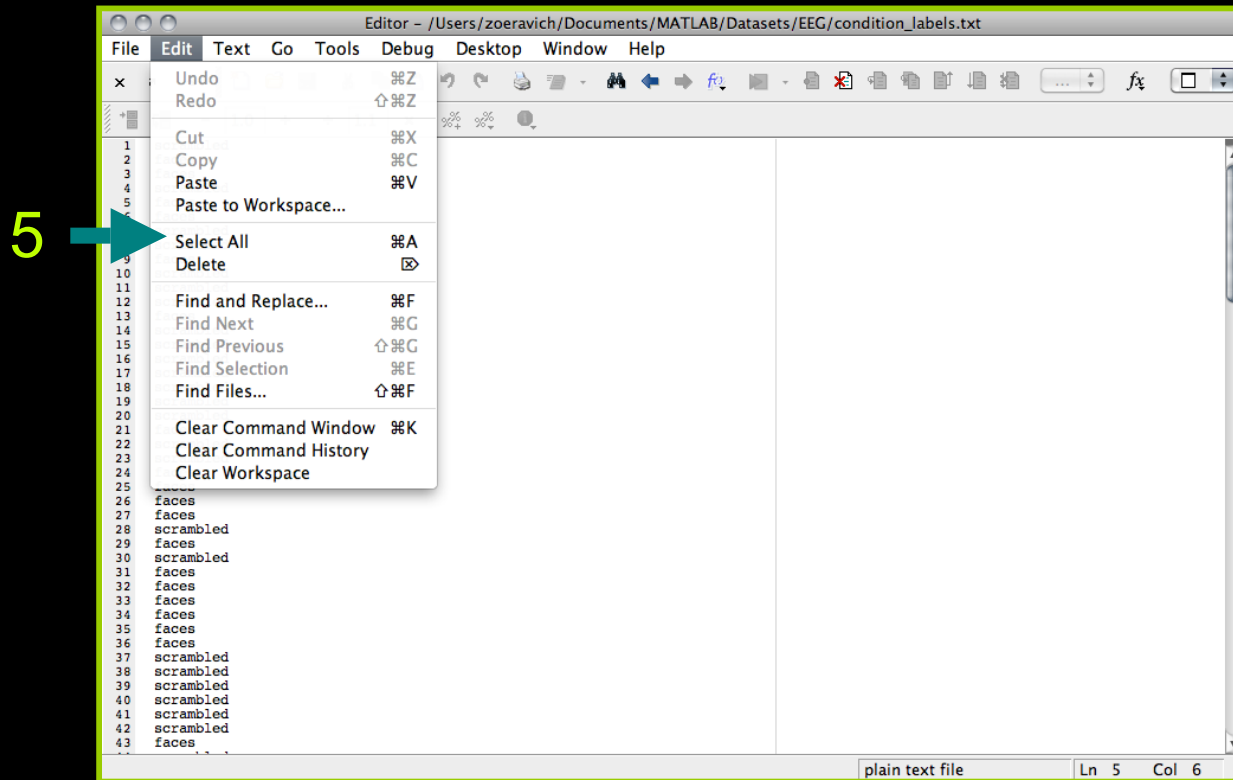
update

	label	type	value	duration	
1	stim	STATUS	1	Undefined	7
2	stim	STATUS	1	Undefined	1
3	stim	STATUS	1	Undefined	1
4	stim	STATUS	1	Undefined	1
5	stim	STATUS	1	Undefined	2
6	stim	STATUS	1	Undefined	2
7	stim	STATUS	1	Undefined	2
8	stim	STATUS	1	Undefined	3
9	stim	STATUS	1	Undefined	3
10	stim	STATUS	1	Undefined	4
11	stim	STATUS	1	Undefined	4
12	stim	STATUS	1	Undefined	4
13	stim	STATUS	1	Undefined	5
14	stim	STATUS	1	Undefined	5
15	stim	STATUS	1	Undefined	5
16	stim	STATUS	1	Undefined	6
17	stim	STATUS	1	Undefined	6
18	stim	STATUS	1	Undefined	7
19	stim	STATUS	1	Undefined	7
20	stim	STATUS	1	Undefined	7
21	stim	STATUS	1	Undefined	8
22	stim	STATUS	1	Undefined	8
23	stim	STATUS	1	Undefined	8
24	stim	STATUS	1	Undefined	9
25	stim	STATUS	1	Undefined	9
26	stim	STATUS	1	Undefined	9
27	stim	STATUS	1	Undefined	1

# Step 6

## Reassignment of Trial Labels

---



# Step 6

## Reassignment of Trial Labels

File name: /Users/zoeravich/Documents/MATLAB/eMdspm8\_faces\_run1.mat  
Type: single  
Number of time samples: 161 (0.805 sec, from -0.195s to 0.605s)  
Time sampling frequency: 200 Hz  
Number of channels: 130 (0 bad channels)  
Number of trials: 172 (0 bad trials)

channels trials inv history

update

	label	type	value	duration	
1	scrambled	STATUS	1	Undefined	7
2	faces	STATUS	1	Undefined	1
3	faces	STATUS	1	Undefined	1
4	scrambled	STATUS	1	Undefined	1
5	faces	STATUS	1	Undefined	2
6	faces	STATUS	1	Undefined	2
7	scrambled	STATUS	1	Undefined	2
8	scrambled	STATUS	1	Undefined	3
9	faces	STATUS	1	Undefined	3
10	scrambled	STATUS	1	Undefined	4
11	scrambled	STATUS	1	Undefined	4
12	scrambled	STATUS	1	Undefined	4
13	faces	STATUS	1	Undefined	5
14	scrambled	STATUS	1	Undefined	5
15	scrambled	STATUS	1	Undefined	5
16	scrambled	STATUS	1	Undefined	6
17	scrambled	STATUS	1	Undefined	6
18	scrambled	STATUS	1	Undefined	7
19	scrambled	STATUS	1	Undefined	7
20	scrambled	STATUS	1	Undefined	7
21	faces	STATUS	1	Undefined	8
22	scrambled	STATUS	1	Undefined	8
23	scrambled	STATUS	1	Undefined	8
24	faces	STATUS	1	Undefined	9
25	faces	STATUS	1	Undefined	9
26	faces	STATUS	1	Undefined	9
27	faces	STATUS	1	Undefined	1

# Step 7

## Scripting the Second File

---

- Open the eMdspm8\_faces\_run1.mat file in the reviewing tool
  - Go to the “History” tab and press the “Save as script” button
  - Name the script eeg\_preprocess.m in the dialogue box that appears
  - Select OK in the next dialogue box to save all the steps
- Open eeg\_preprocess.m
  - Use the “Find & Replace” function to replace all occurrences of “run1” with “run2”
  - Then, delete the line starting with S.timewindow
  - Press the “Run” button to save the changes and run the script
- Type `D = conditions(D, [], importdata('condition_labels.txt'));`  
`D.save;`
  - This updates the trial labels using information imported from the condition\_labels.txt
- New files: eMdspm8\_faces\_run2.mat and eMdspm8\_faces\_run2.dat

# Step 7

## Scripting the Second File

---

1



<Student Version> : SPM8 (zoeravich): Graphics

File Edit View Insert Tools Desktop Window SPM Figure Help

EEG MEG PLANAR OTHER info source Prepare SPM file SAVE

File name: /Users/zoeravich/Documents/MATLAB/eMdspm8\_faces\_run1.mat  
Type: single  
Number of time samples: 161 (0.805 sec, from -0.195s to 0.605s)  
Time sampling frequency: 200 Hz  
Number of channels: 130 (0 bad channels)  
Number of trials: 172 (0 bad trials)

channels trials inv history

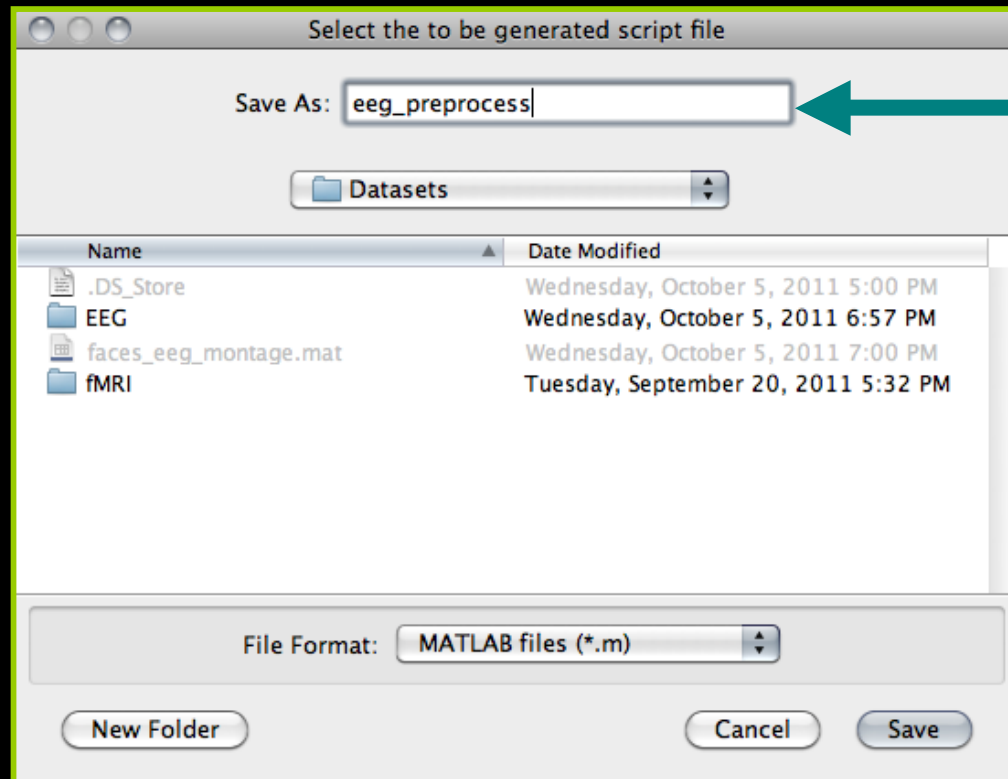
Save as script

	Process	function...	input file	output file
1	Convert	spm_eeg_...	/Users/zo...	/Users/zo...
2	Downsam...	spm_eeg_...	/Users/zo...	/Users/zo...
3	Change m...	spm_eeg_...	/Users/zo...	/Users/zo...
4	Epoch	spm_eeg_...	/Users/zo...	[this file]

# Step 7

## Scripting the Second File

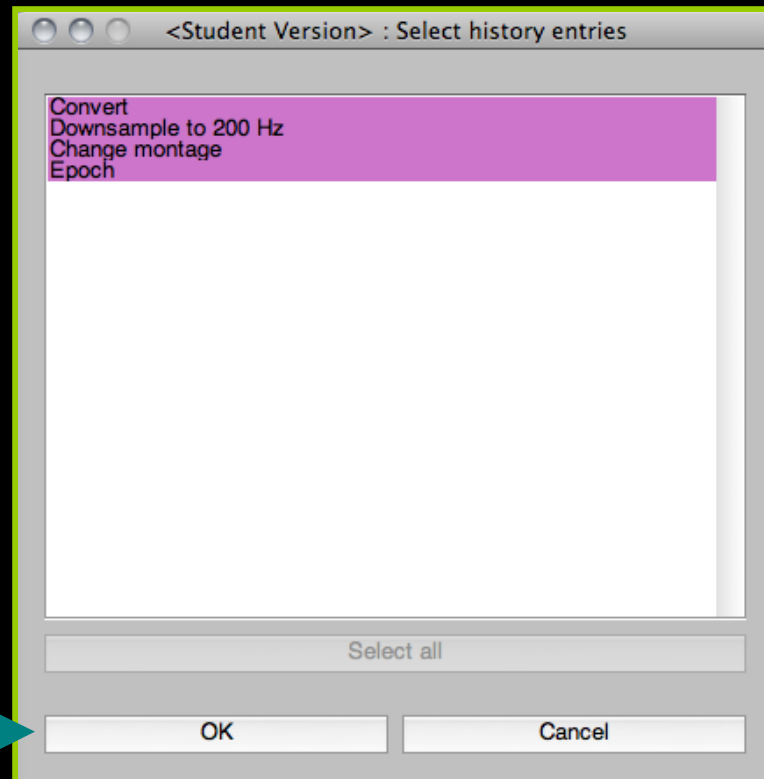
---



# Step 7

## Scripting the Second File

---



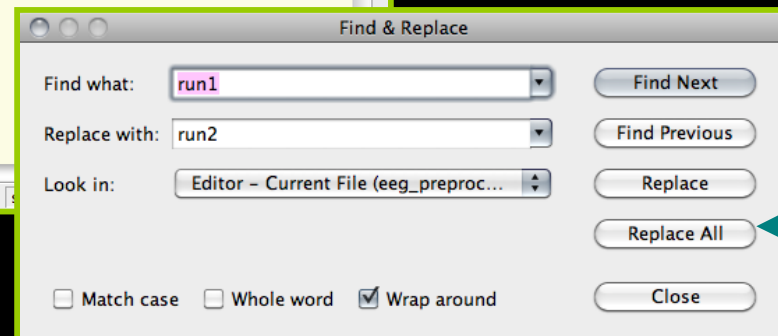
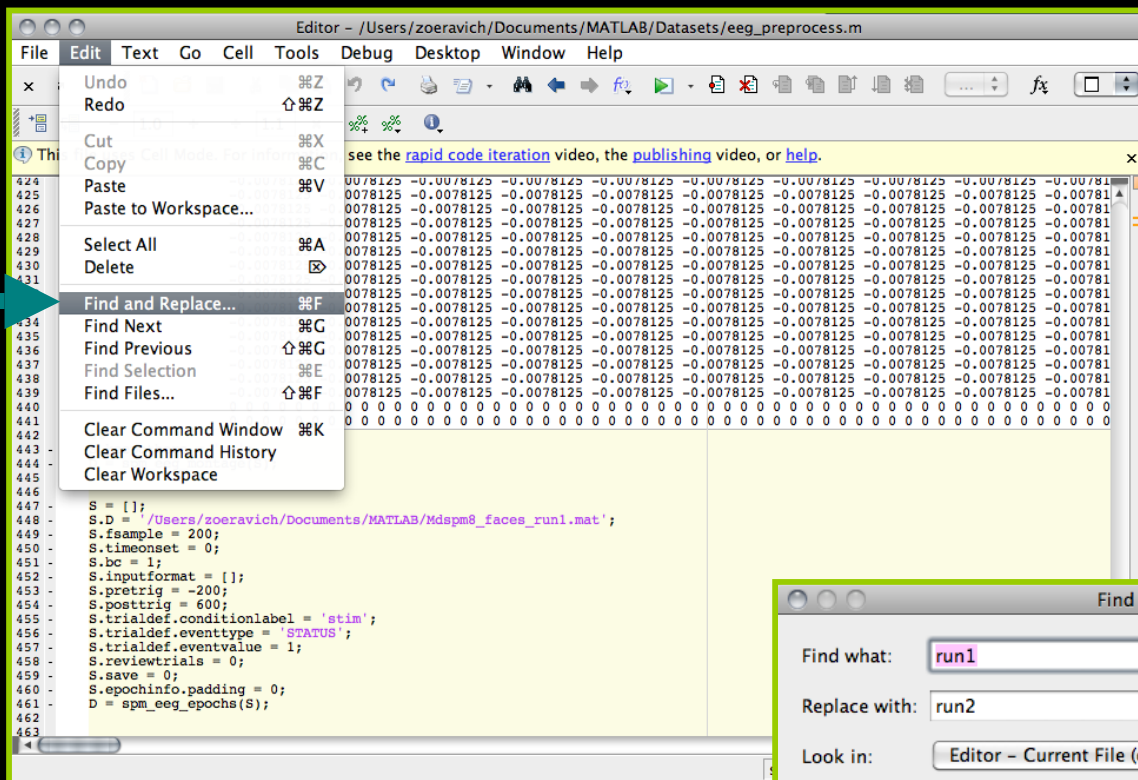
3



# Step 7

## Scripting the Second File

4



5

# Step 7

## Scripting the Second File

```
1 - spm('defaults', 'eeg');
2 -
3 - S = [];
4 - S.dataset = '/Users/zoeravich/Documents/MATLAB/Datasets/EEG/faces_run2.bdf';
5 - S.outfile = 'spm8_faces_run2';
6 - S.channels = 'all';
7 - S.timewindow = [0.00048828125 655];
8 - S.blocksize = 3276800;
9 - S.checkboundary = 1;
10 - S.usetrials = 1;
11 - S.datatype = 'float32-le';
12 - S.eventpadding = 0;
13 - S.saveorigheader = 0;
14 - S.conditionlabel = {'Undefined'};
15 - S.inputformat = 1;
16 - S.continuous = true;
17 - D = spm_eeg_convert(S);
18 -
19 -
20 - S = [];
21 - S.D = '/Users/zoeravich/Documents/MATLAB/spm8_faces_run2.mat';
22 - S.fsamples_new = 200;
23 - D = spm_eeg_downsample(S);
24 -
25 -
26 - S = [];
27 - S.D = '/Users/zoeravich/Documents/MATLAB/dspm8_faces_run2.mat';
28 - S.blocksize = 655360;
29 - %%%
30 - S.montage.labelorg = {
31 -     'A1'
32 -     'A2'
33 -     'A3'
34 -     'A4'
35 -     'A5'
36 -     'A6'
37 -     'A7'
38 -     'A8'
39 -     'A9'
40 -     'A10'
41 - }
```

script Ln 7 Col 36



# Step 8

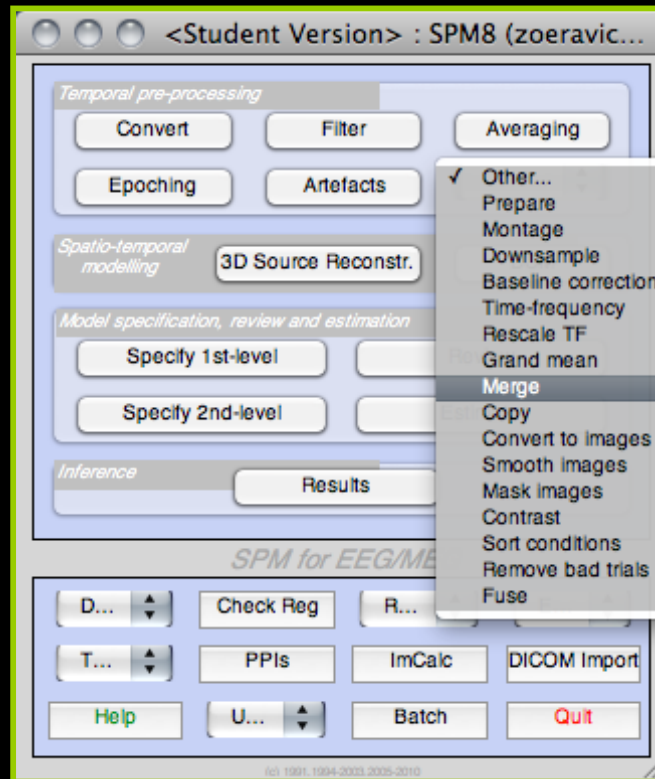
## Merge

---

- Select MERGE from the “Other” drop-down menu
  - Select the eMspm8\_faces\_run1.mat and eMdspm8\_faces\_run2.mat files
  - Press “Done”
  - “What to do with condition labels?”; Click “Leave as they are”
- New files: ceMdspm8\_races\_run1.mat and ceMdspm8\_races\_run1.dat

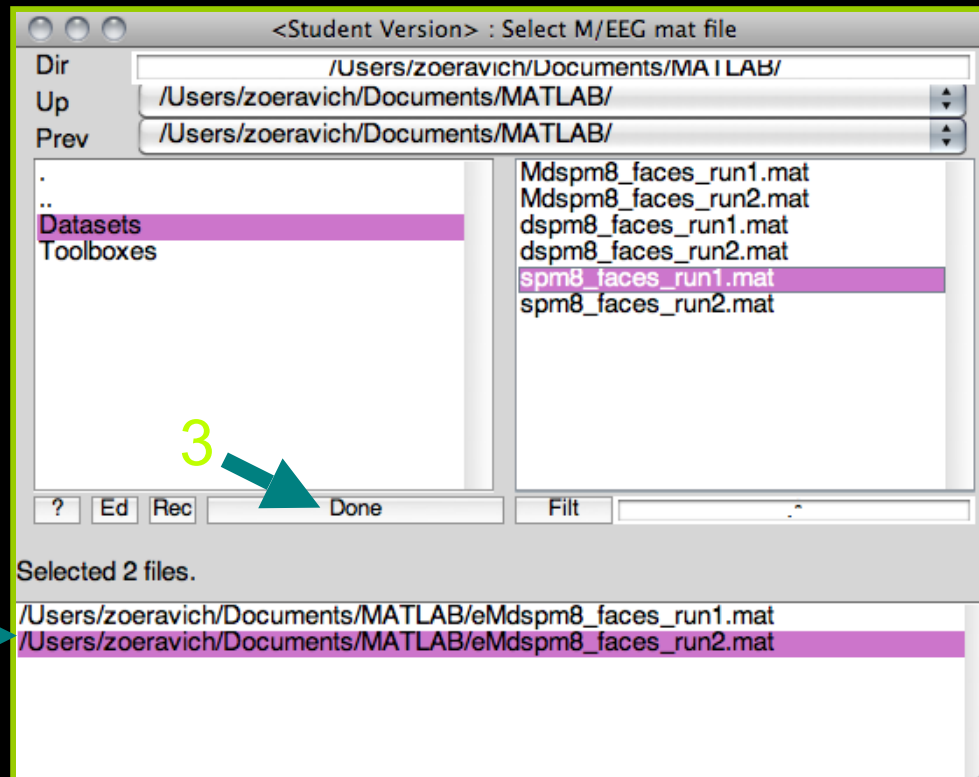
# Step 8

# Merge



# Step 8

# Merge

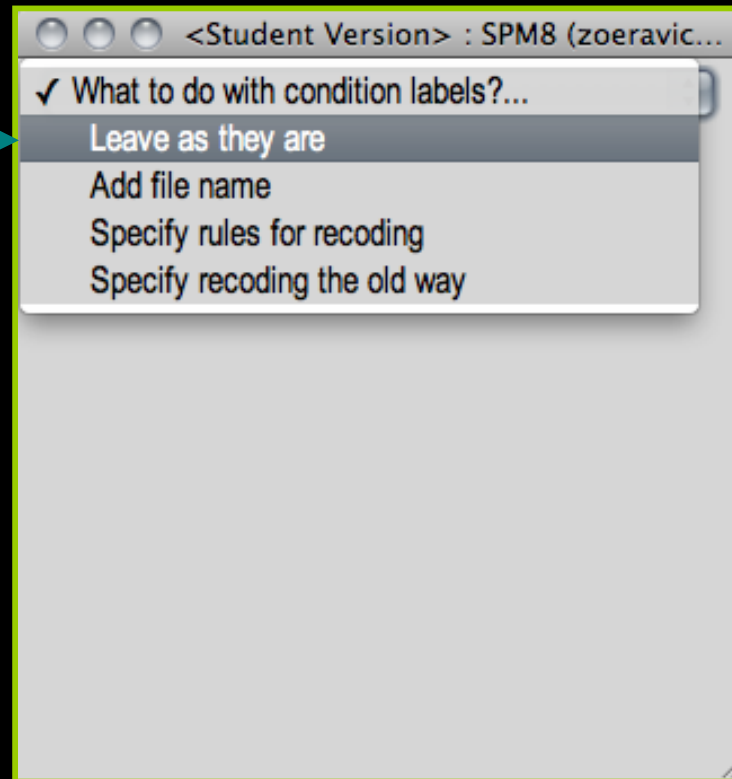


# Step 8

## Merge

---

4 →



# Step 9

## Prepare

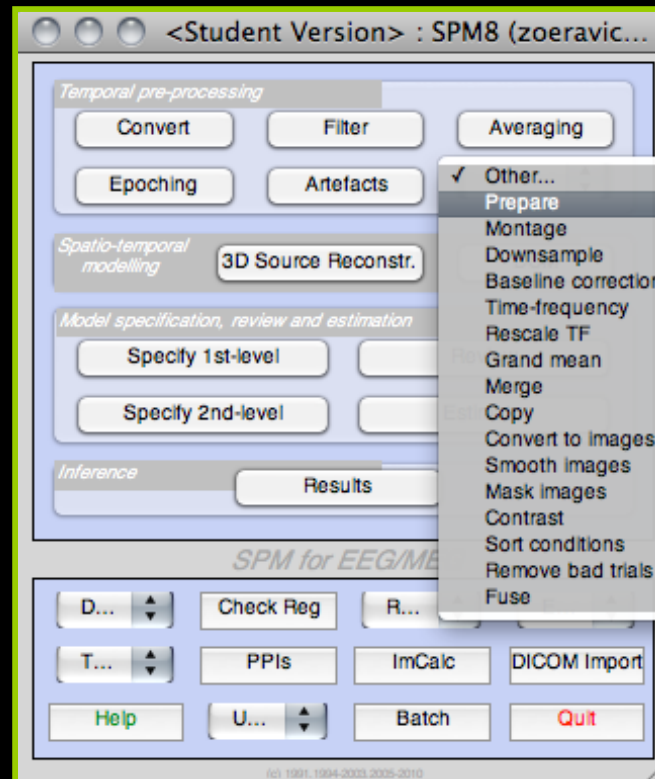
---

- Select PREPARE from the “Other” drop-down menu button
  - Select the ceMdspm8\_faces\_run1.mat file
  - In the “Sensors” submenu, choose “Load EEG sensors”/”Convert locations file”; Choose the electrode\_locations\_and\_headshape.sfp file
  - In the “2D Projection” submenu, select “Project 3D (EEG)”
  - After a 2D channel layout appears, select “Apply” from the “2D Projection” submenu and “Save” from the “File” submenu

# Step 9

# Prepare

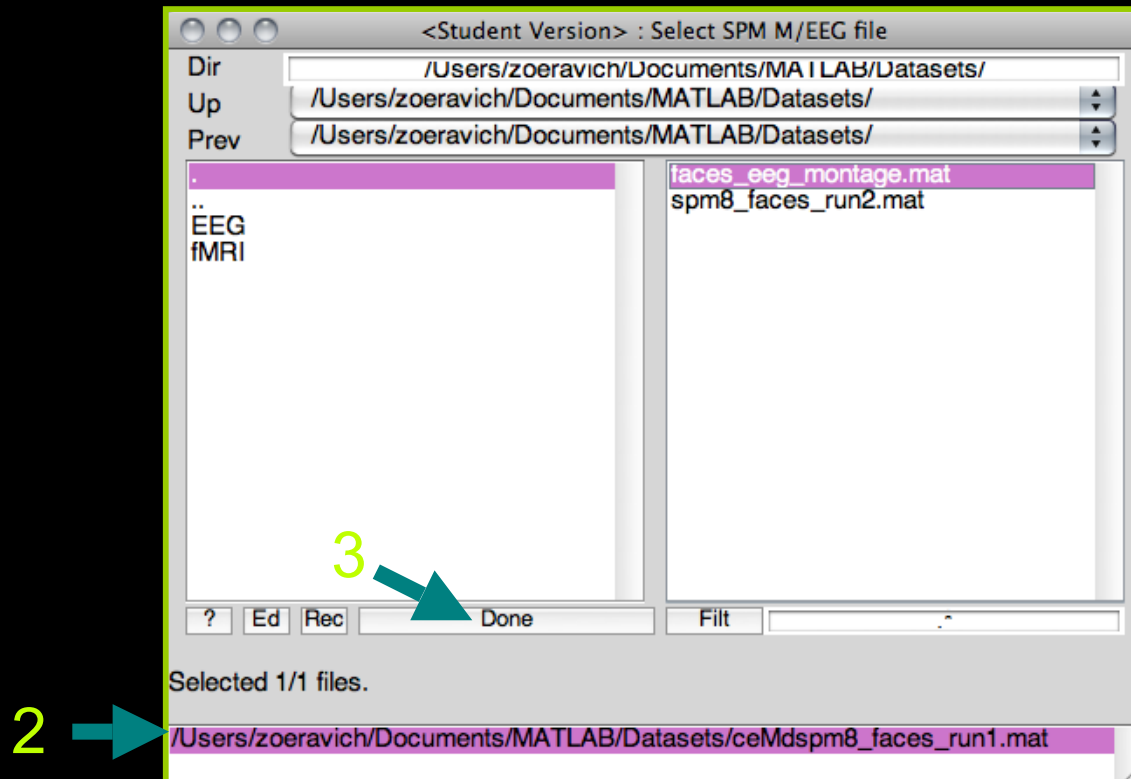
---



# Step 9

## Prepare

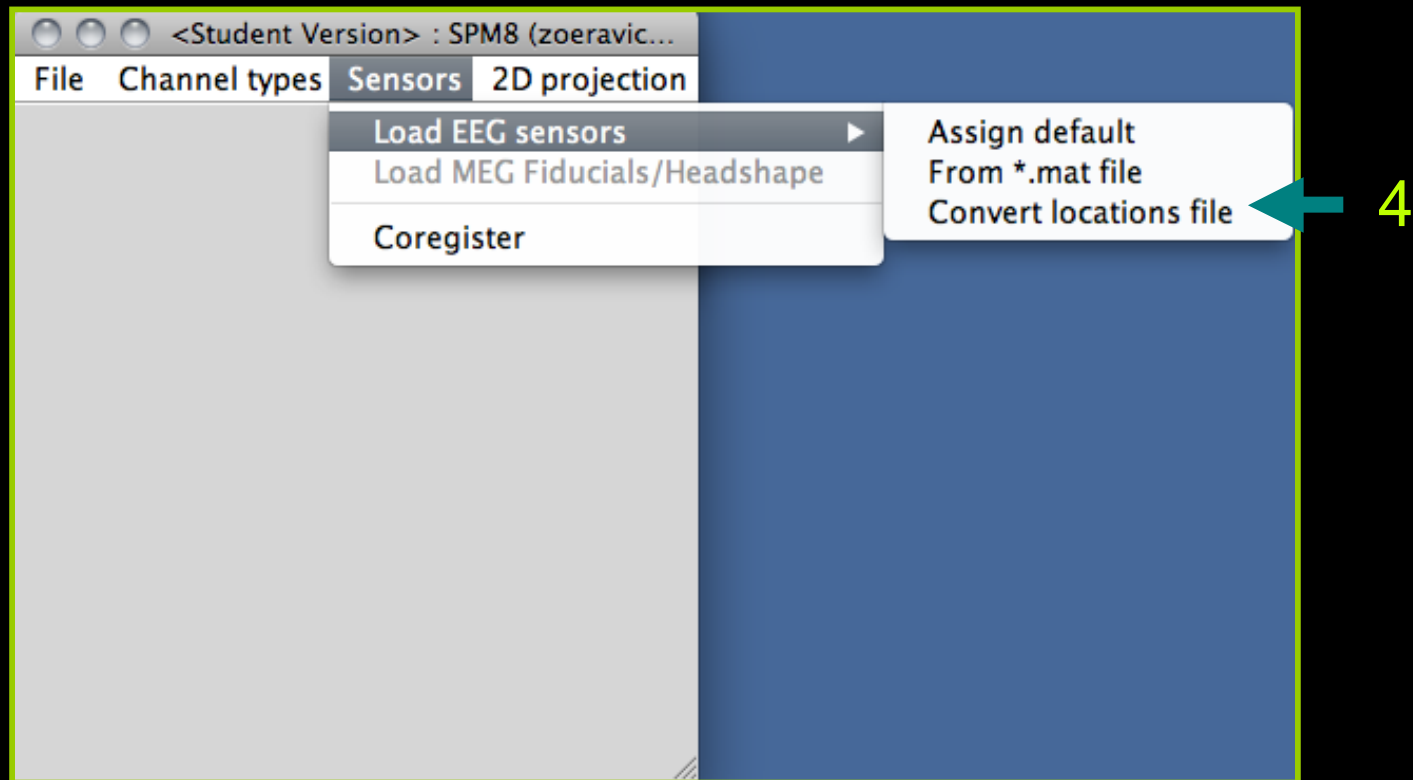
---



# Step 9

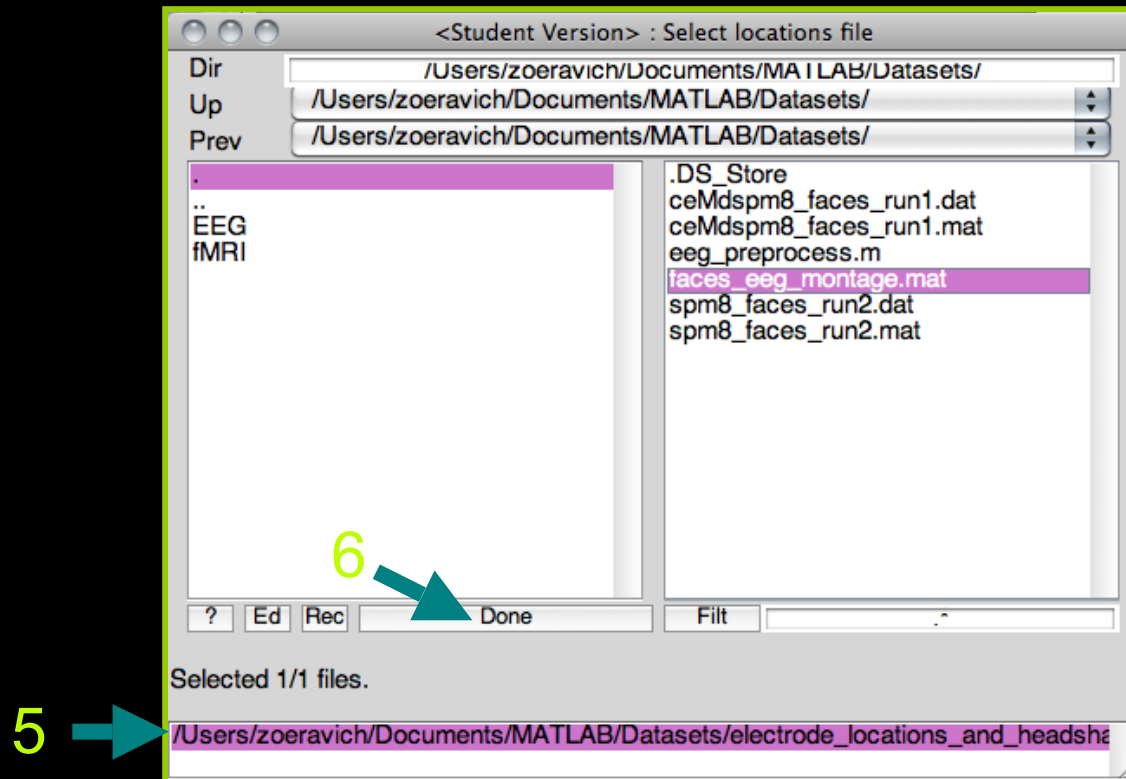
## Prepare

---



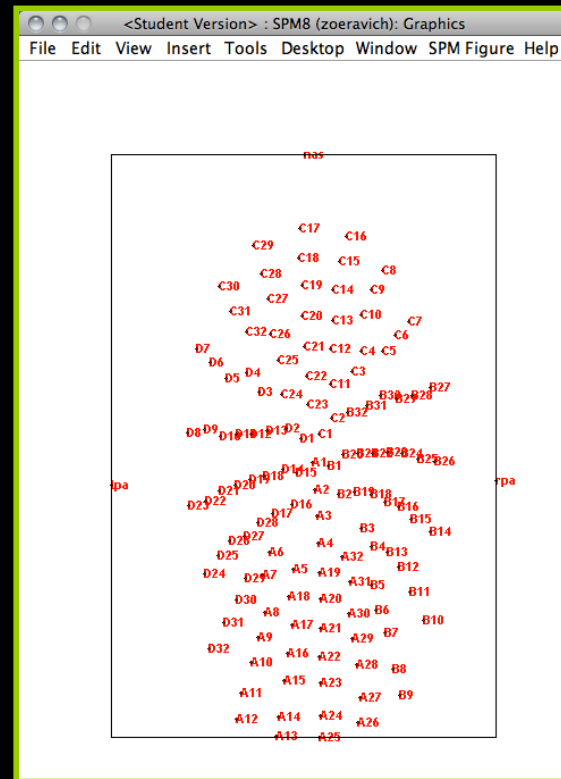
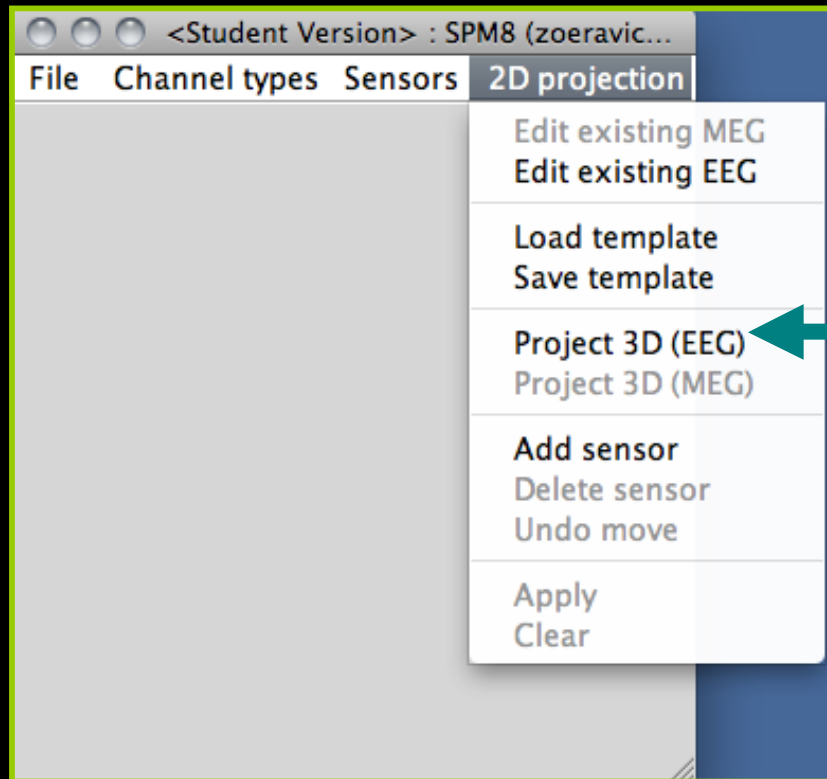
# Step 9

## Prepare



# Step 9

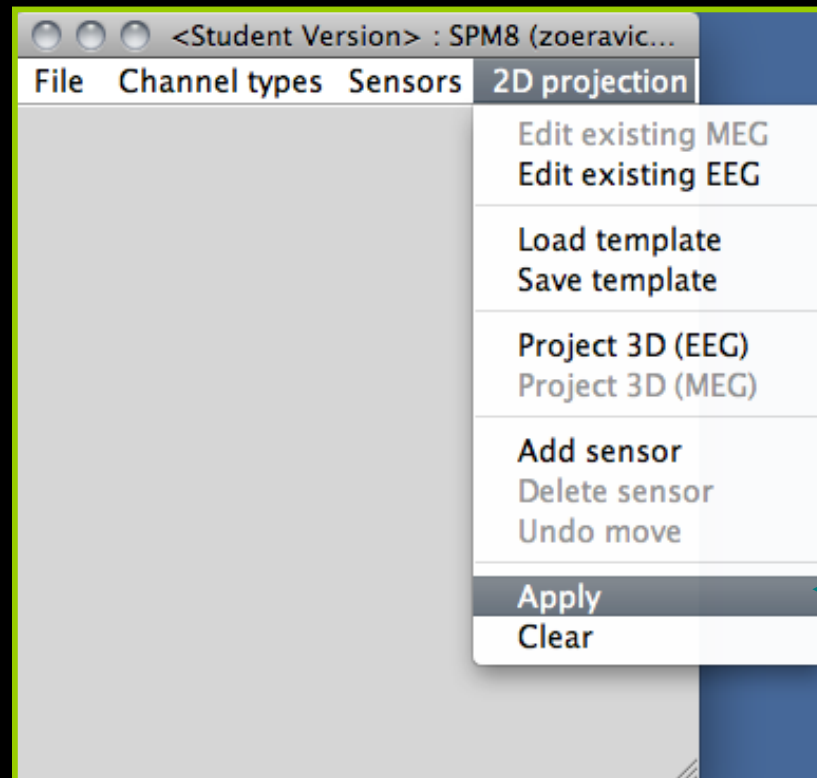
## Prepare



# Step 9

## Prepare

---

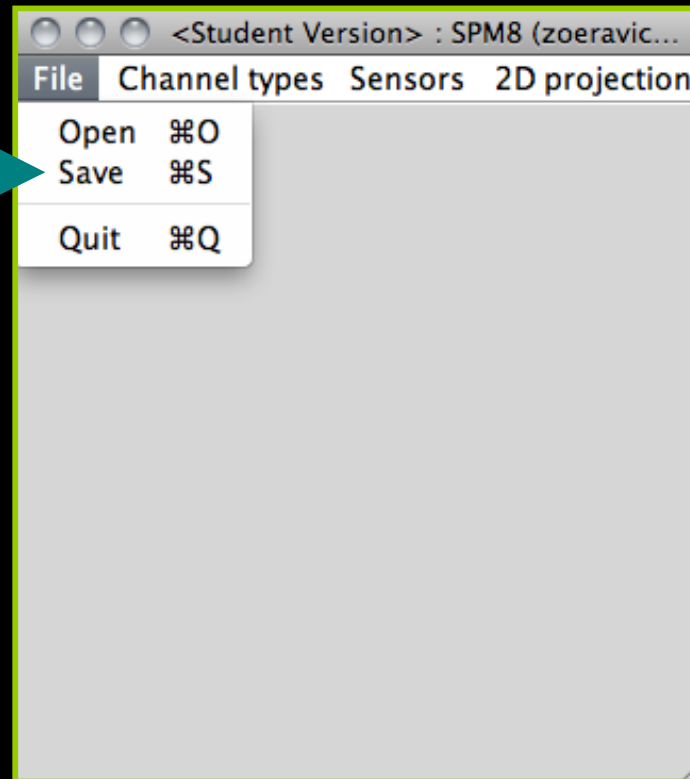


# Step 9

## Prepare

---

9



# Step 10

## Artefact Rejection

---

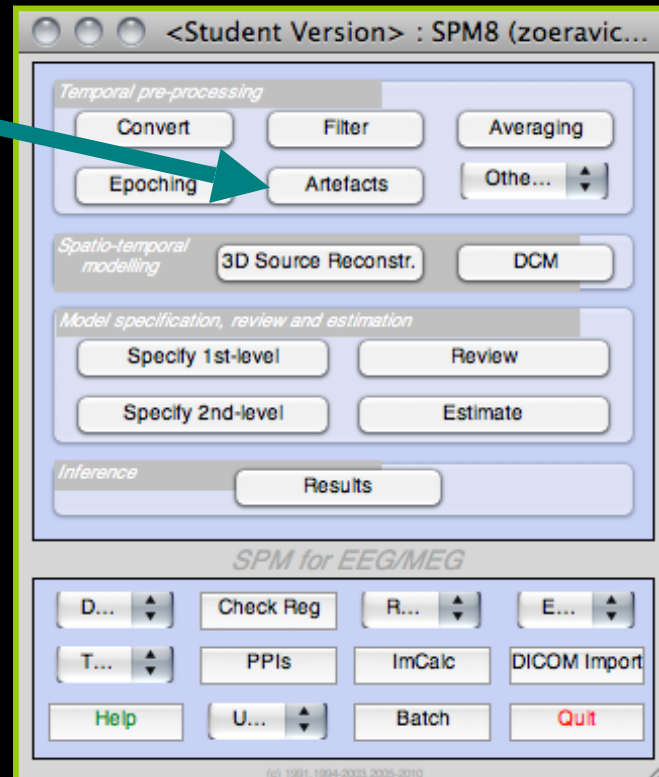
- Press the ARTEFACTS button
  - Select the ceMdspm8\_faces\_run1.mat file as the “File name”
  - “How to look for artefacts”; Click on “Detection algorithm” and select “Threshold channels”
  - “Threshold”; Type 200 ( $\mu\text{V}$ )
  - Run the batch by pressing the green button at the top of the window
- New files: aceMdspm8\_races\_run1.mat and aceMdspm8\_races\_run1.dat

# Step 10

## Artefact Rejection

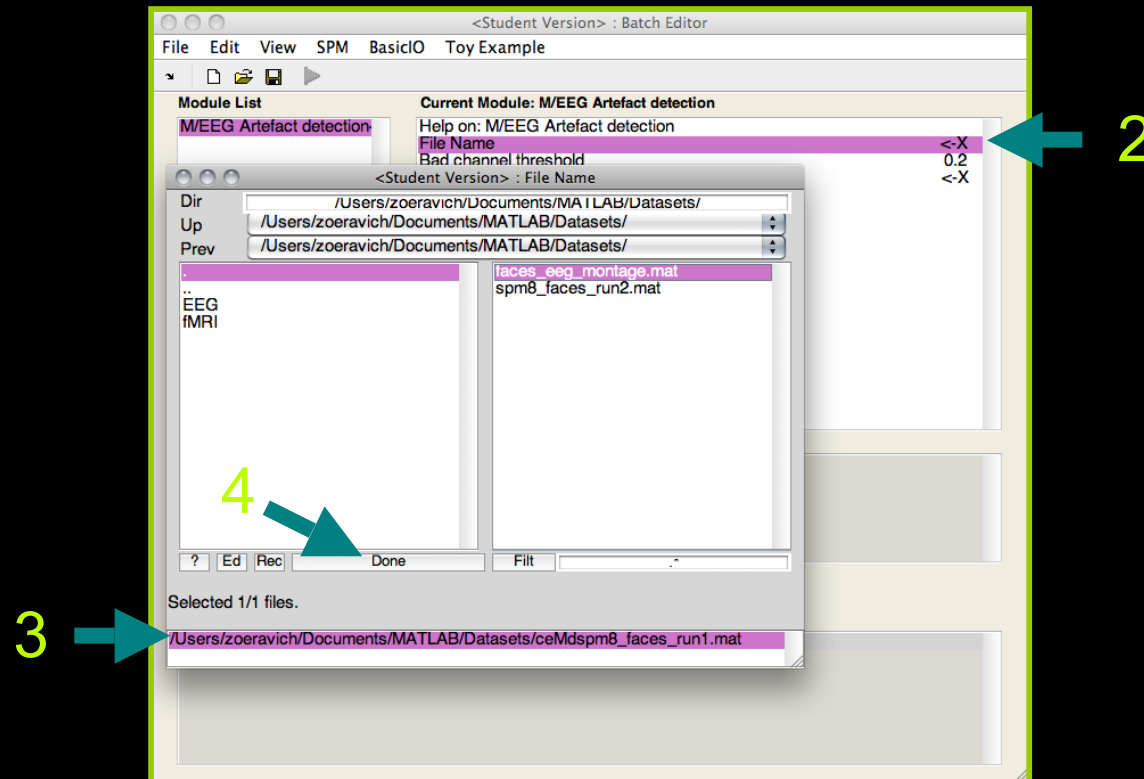
---

1



# Step 10

## Artefact Rejection



# Step 10

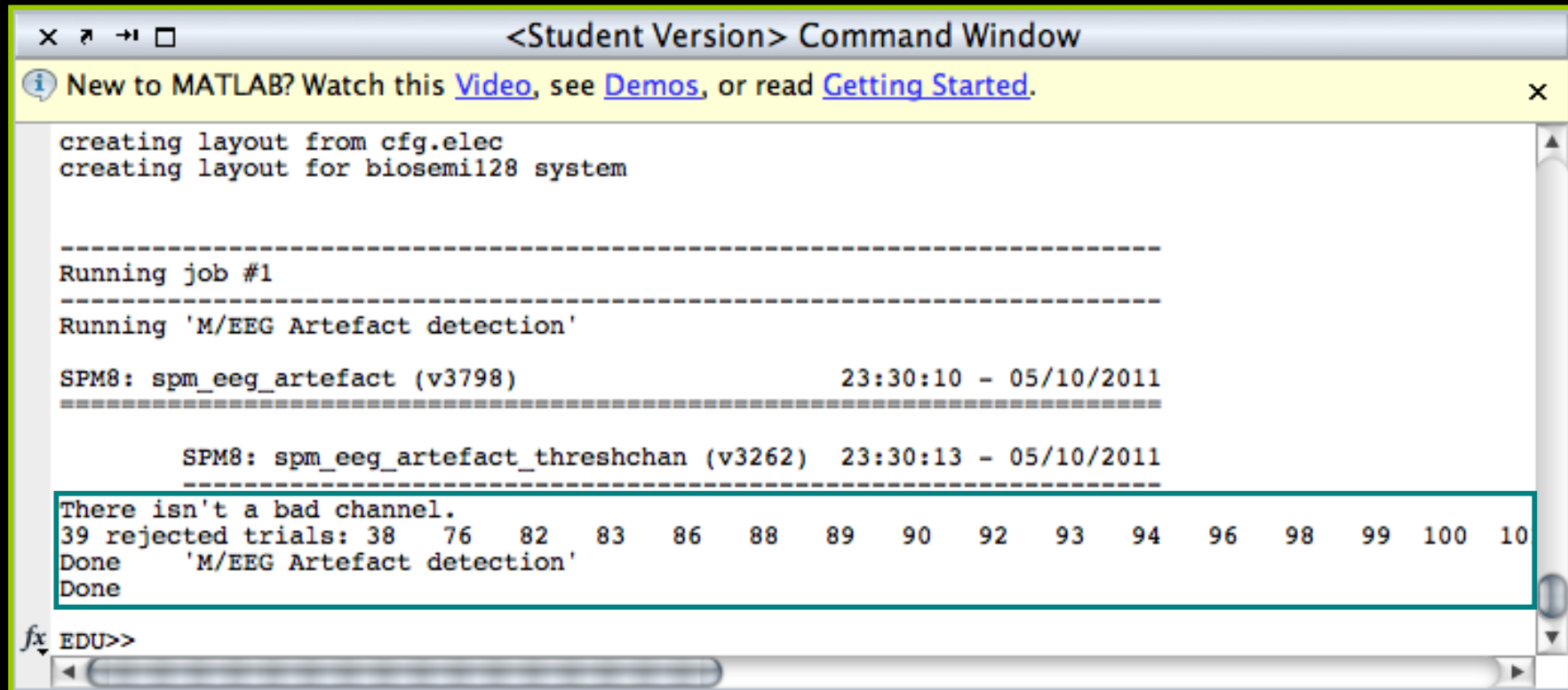
## Artefact Rejection

The image shows a screenshot of the SPM software interface, specifically the Batch Editor window titled "<Student Version> : Batch Editor". The interface is divided into several sections:

- Module List:** A list of modules on the left, with "M/EEG Artefact detection:" selected. A yellow arrow labeled "9" points to this list.
- Current Module: M/EEG Artefact detection:** A central panel showing configuration options for the selected module. A yellow arrow labeled "5" points to the "Bad channel threshold" field, which contains the value "0.2". A yellow arrow labeled "6" points to the "Detection algorithm" field, which is currently set to "All".
- Current Item: Detection algorithm:** A sub-panel showing options for the detection algorithm. A yellow arrow labeled "7" points to the "Threshold channels" option, which is currently selected.
- Detection algorithm:** A summary panel at the bottom left showing the selected options: "Flat segments", "Difference between adjacent samples", "Peak to peak amplitude", and "Threshold channels". The "Currently selected option:" is "Threshold channels".
- Threshold Dialog Box:** A separate dialog box titled "<Student Version> : Threshold" is open in the foreground. It prompts the user to "Enter a value." and provides instructions: "To clear a value, clear the input field and accept." and "Accept input with CTRL-RETURN, cancel with ESC." The input field contains the value "200". A yellow arrow labeled "8" points to this input field. The dialog box has "OK" and "Cancel" buttons.

# Step 10

## Artefact Rejection



```
<Student Version> Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.
creating layout from cfg.elec
creating layout for biosemi128 system

-----
Running job #1
-----
Running 'M/EEG Artefact detection'

SPM8: spm_eeg_artefact (v3798)                23:30:10 - 05/10/2011
=====
                SPM8: spm_eeg_artefact_threshchan (v3262) 23:30:13 - 05/10/2011
=====
There isn't a bad channel.
39 rejected trials: 38  76  82  83  86  88  89  90  92  93  94  96  98  99  100  10
Done 'M/EEG Artefact detection'
Done

fx EDU>>
```

# Step 11

## Exploring the M/EEG Object

---

- Review the preprocessed dataset by typing `D = spm_eeg_load` and then selecting the `aceMdspm8_races_run1.mat` file
  - This reveals the data values, the list of condition labels, a vector of rejected and retained trials, the order and the names of the channels, as well as the size of the data matrix
- Review the full list of methods performing operations with the object by typing `methods('meeg')`

# Step 11

## Exploring the M/EEG Object

```
<Student Version> Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.

creating layout from cfg.elec
creating layout for biosemi128 system

-----
Running job #1
-----
Running 'M/EEG Artefact detection'

SPM8: spm_eeg_artefact (v3798)                23:30:10 - 05/10/2011
=====

          SPM8: spm_eeg_artefact_threshchan (v3262)  23:30:13 - 05/10/2011
          -----

There isn't a bad channel.
39 rejected trials: 38  76  82  83  86  88  89  90  92  93  94  96  98  99  100  101
Done 'M/EEG Artefact detection'
Done

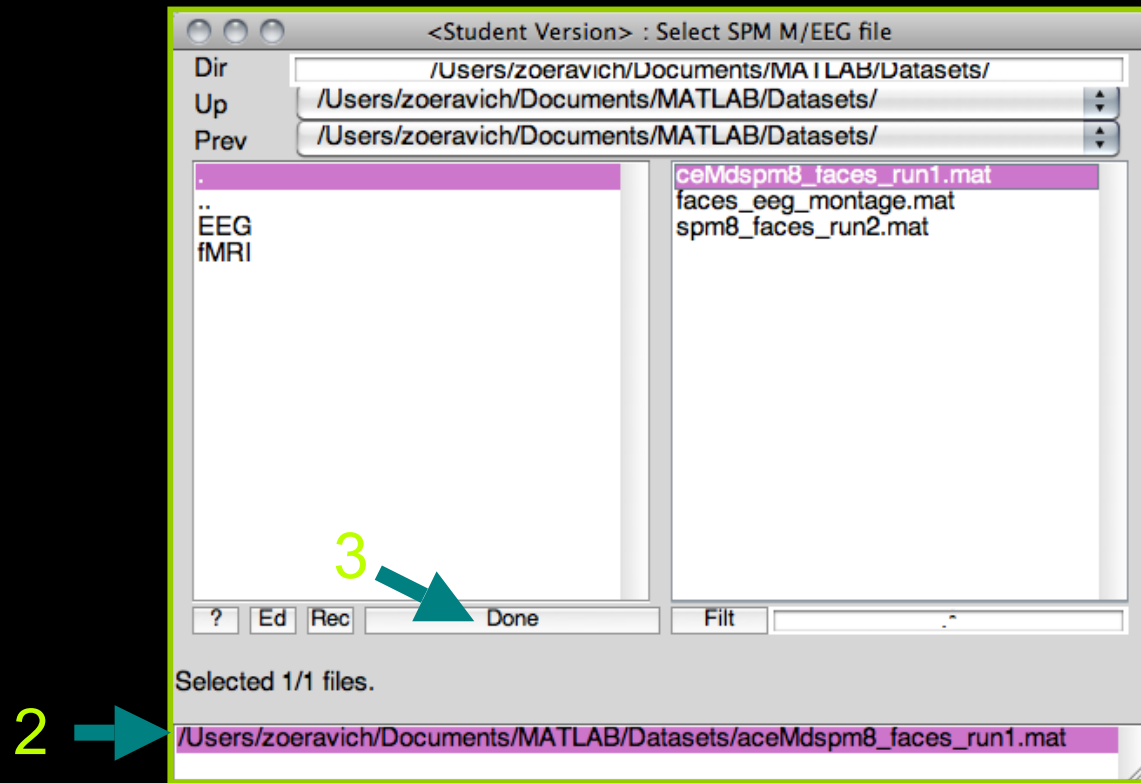
fx EDU>> D = spm_eeg_load|
```



# Step 11

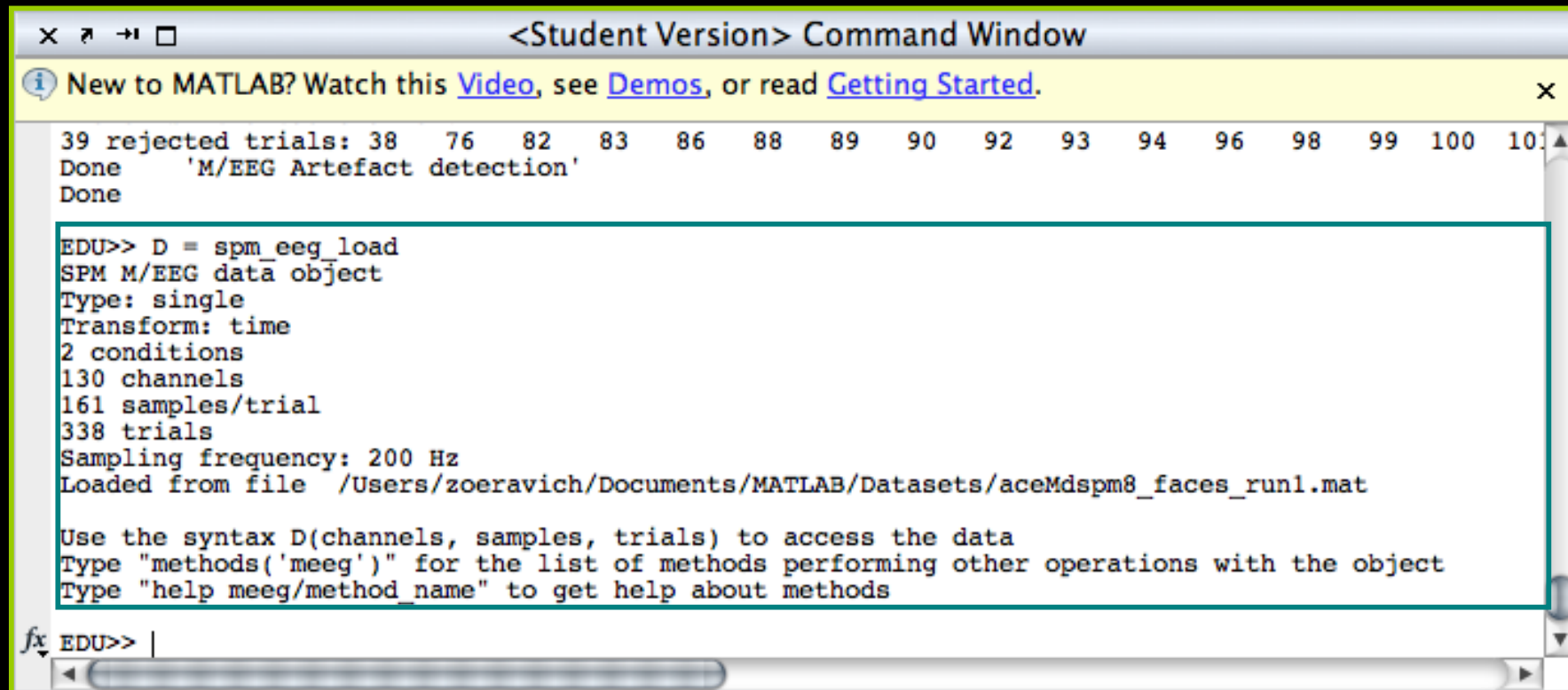
## Exploring the M/EEG Object

---



# Step 11

## Exploring the M/EEG Object



```
<Student Version> Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.
39 rejected trials: 38 76 82 83 86 88 89 90 92 93 94 96 98 99 100 101
Done 'M/EEG Artefact detection'
Done
EDU>> D = spm_eeg_load
SPM M/EEG data object
Type: single
Transform: time
2 conditions
130 channels
161 samples/trial
338 trials
Sampling frequency: 200 Hz
Loaded from file /Users/zoeravich/Documents/MATLAB/Datasets/aceMdspm8_faces_run1.mat

Use the syntax D(channels, samples, trials) to access the data
Type "methods('meeg')" for the list of methods performing other operations with the object
Type "help meeg/method_name" to get help about methods
fx EDU>> |
```

# Step 12

## Basic ERPs

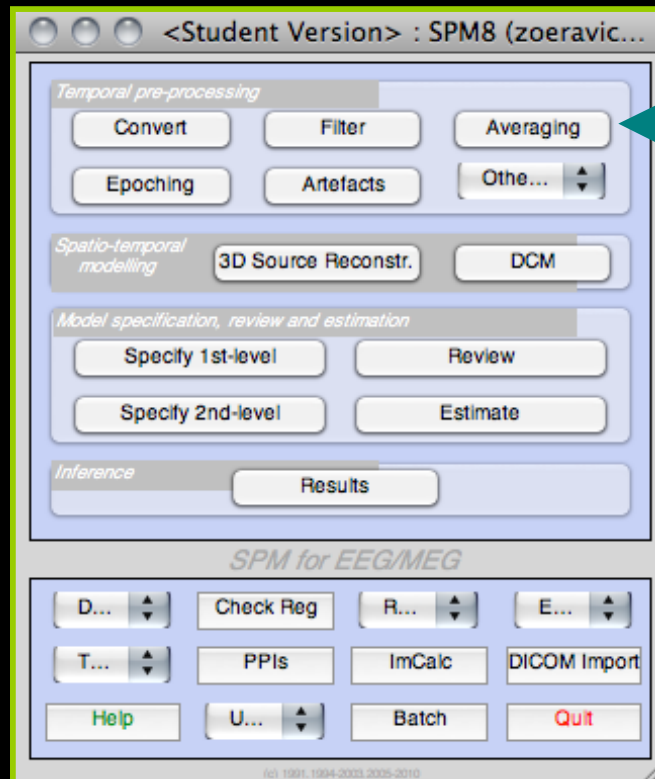
---

- Press the AVERAGING button
  - Select the aceMdspm8\_faces\_run1.mat file
  - “Use robust averaging?”; Click “Yes”
  - “Save weights”; Click “Yes”
  - “Compute weights by condition”; Click “No”
  - “Offset of the weighting function”; Hit “Enter”
- New datasets: maceMdspm8\_faces\_run1.{mat,dat} and WaceMdspm8\_faces\_run1.{mat, dat}
- Select CONTRAST from the “Other” drop-down menu button
  - Select the maceMdspm8\_faces\_run1.mat file
  - “Difference”; Type [1 -1]
  - “Add another”; Click “Yes”
  - “Mean”; Type [1/2 1/2]
  - “Add another”; Click “No”
  - “Weight by num replications”; Click “No”
- New datasets: wmaceMdspm8\_faces\_run1.{mat,dat}

# Step 12

## Basic ERPs

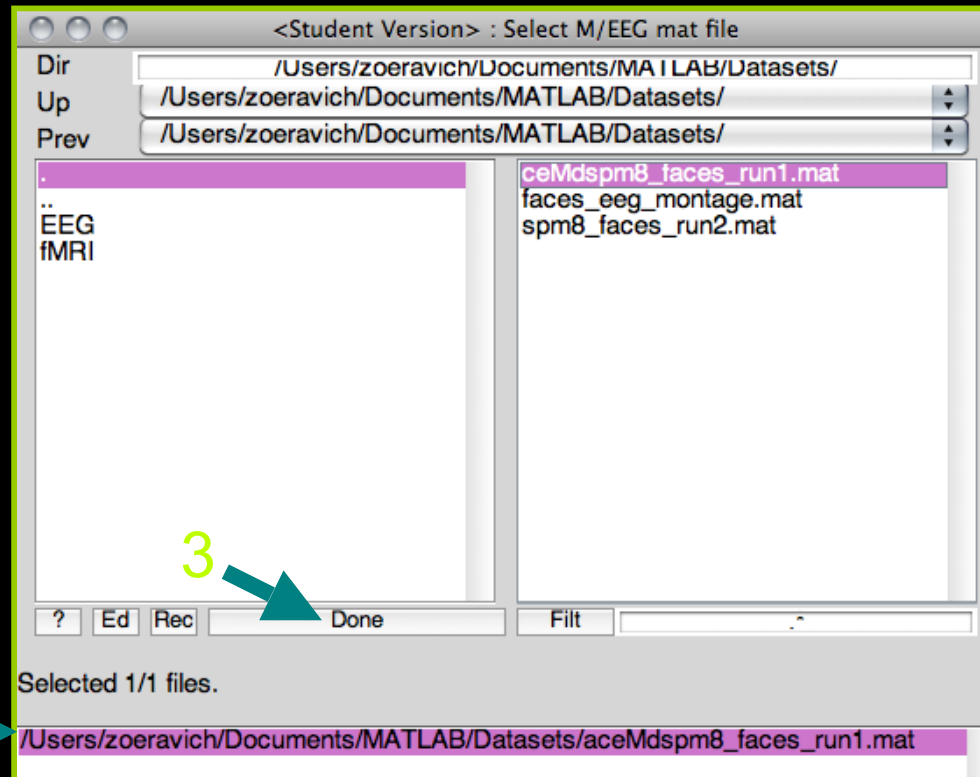
---



# Step 12

## Basic ERPs

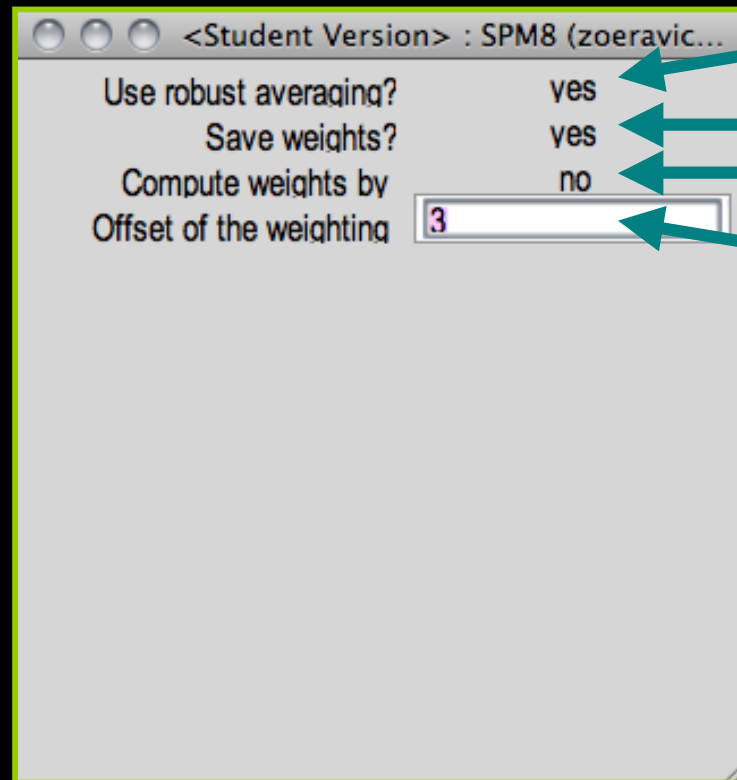
---



# Step 12

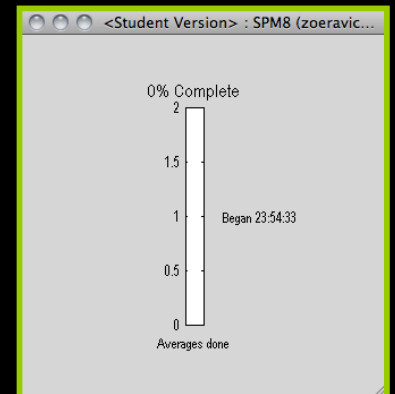
## Basic ERPs

---



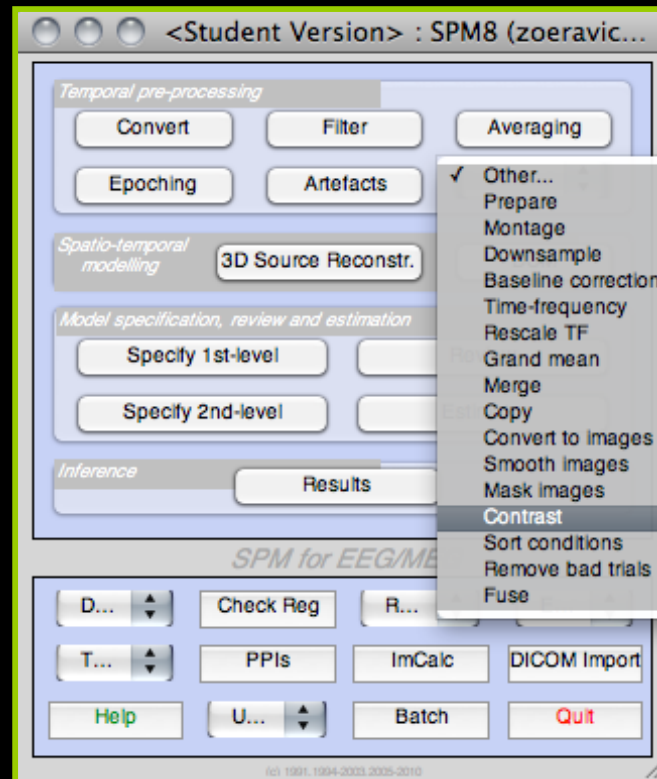
4  
5  
6  
7

Processing...



# Step 12

## Basic ERPs

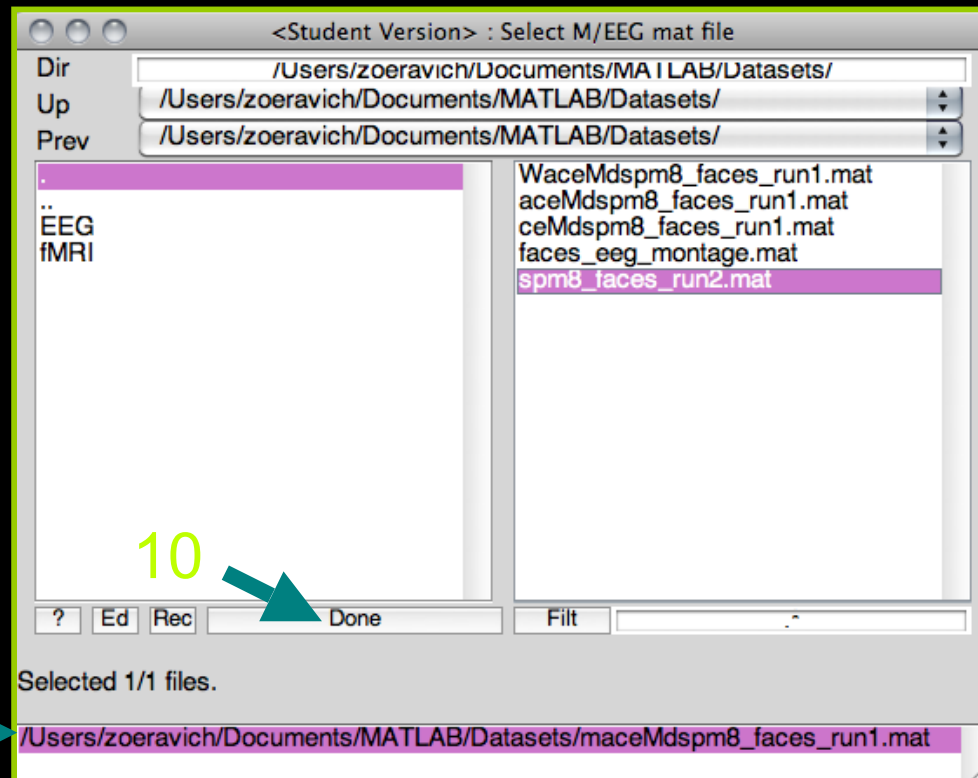


8

# Step 12

## Basic ERPs

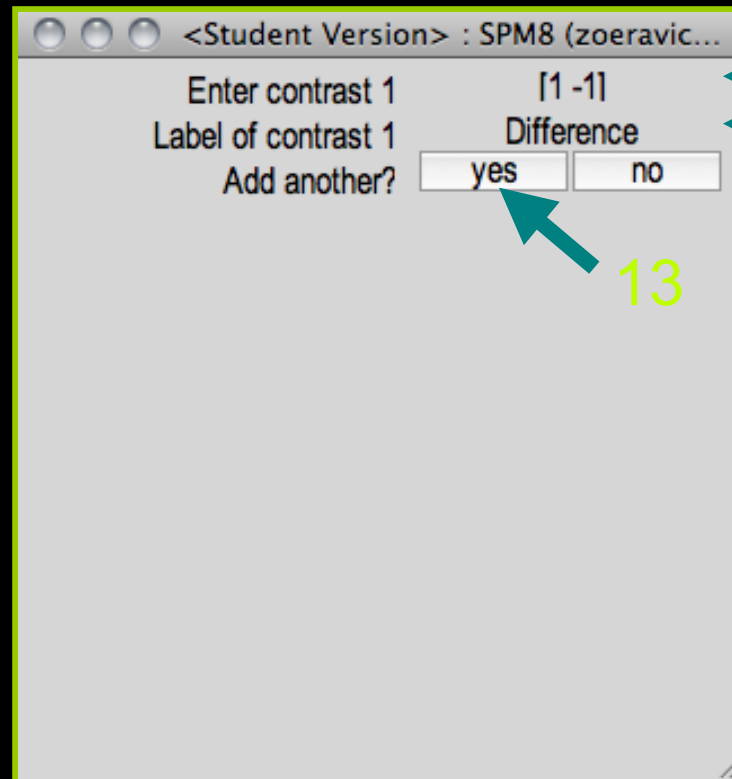
---



# Step 12

## Basic ERPs

---



The screenshot shows a dialog box titled "<Student Version> : SPM8 (zoeravic...)". It contains the following text and controls:

- Enter contrast 1: [1 -1]
- Label of contrast 1: Difference
- Add another?:  yes  no

Three blue arrows point to the dialog box with the numbers 11, 12, and 13 next to them. Arrow 11 points to the contrast value "[1 -1]". Arrow 12 points to the label "Difference". Arrow 13 points to the "yes" button.

11  
12

13

# Step 12

## Basic ERPs

---

<Student Version> : SPM8 (zoeravic...)

Enter contrast 2 [1/2 1/2]

Label of contrast 2 Mean

Add another? no

Weight by num  yes  no

14

15

16

17

# Step 13

## 3D SPMs

---

- Select CONVERT TO IMAGES from the “Other” drop-down menu button
  - Select the aceMdspm8\_faces\_run1.mat file
  - “Output image dimensions”; Type “32”
  - “Interpolate bad channels or”; Click “Interpolate”
- New directory: aceMdspm8\_faces\_run1
- Select SMOOTH IMAGES from the “Other” drop-down menu button
  - Select the files within the aceMdspm8\_faces\_run1 directory
  - “FWHM”; Type “9 9 20”
  - “Implicit masking”; Click “Yes”
  - Run the batch by pressing the green button at the top of the window

# Step 13

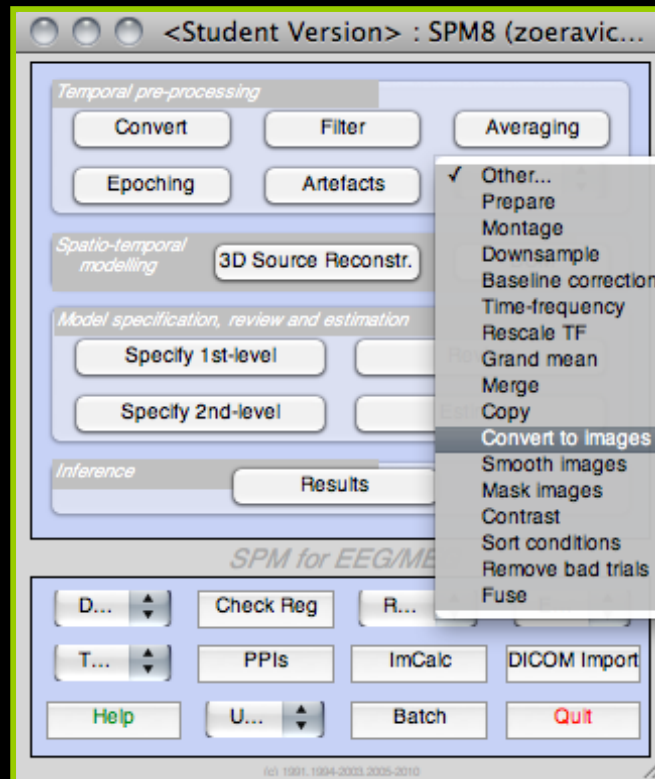
## 3D SPMs Continued

---

- Create the new directory mkdir\_XYTstats
- Press the SPECIFY 2ND LEVEL button
  - “Directory”; Select the mkdir\_XYTstats directory
  - “Design”; Click “Two-sample t-test”
  - “Group 1 scans”; Select all images in the subdirectory type\_faces
  - “Group 2 scans”; Select all images in the subdirectory type\_scrambled
  - Run the batch by pressing the green button at the top of the window
- Press the ESTIMATE button
  - Select the aceMdspm8\_faces\_run1.mat file
- Press the RESULTS button
  - Define a new F-contrast as [1 -1]
  - Keep the default contrast options the same
  - “Data Type”; Click “Scalp-Time”
  - Press “Whole brain”

# Step 13

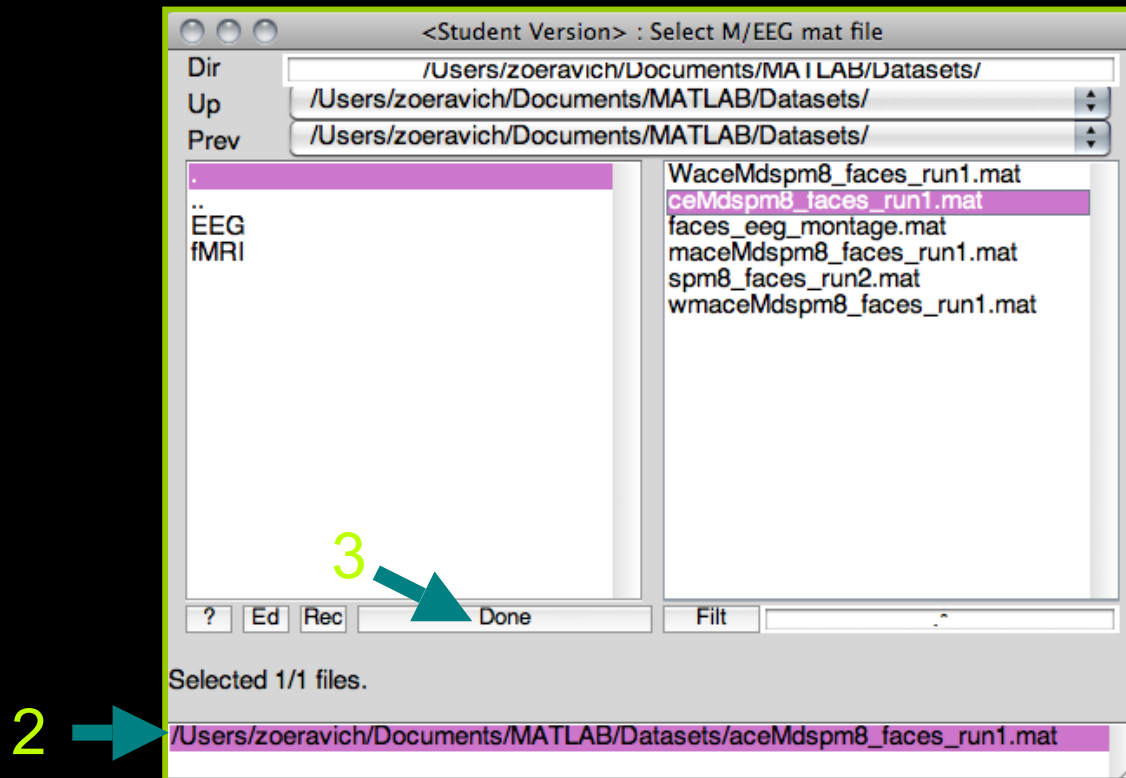
## 3D SPMs



1

# Step 13

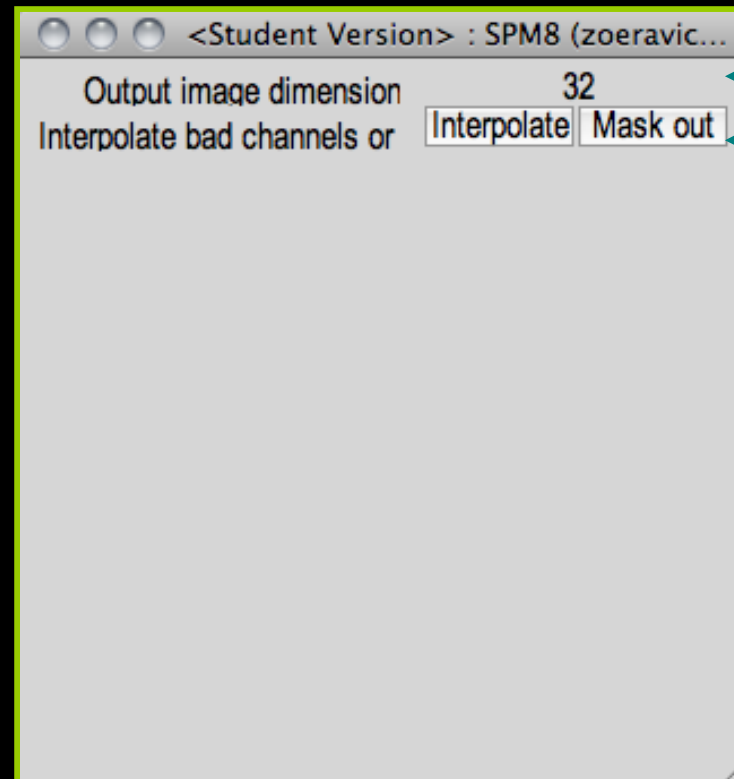
## 3D SPMs



# Step 13

## 3D SPMs

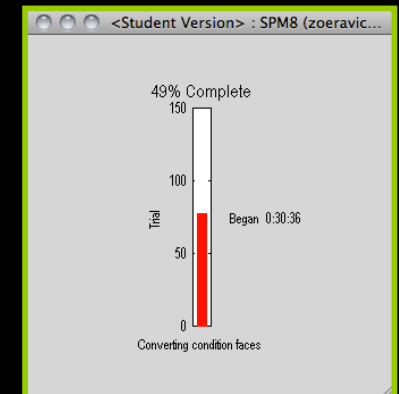
---



4

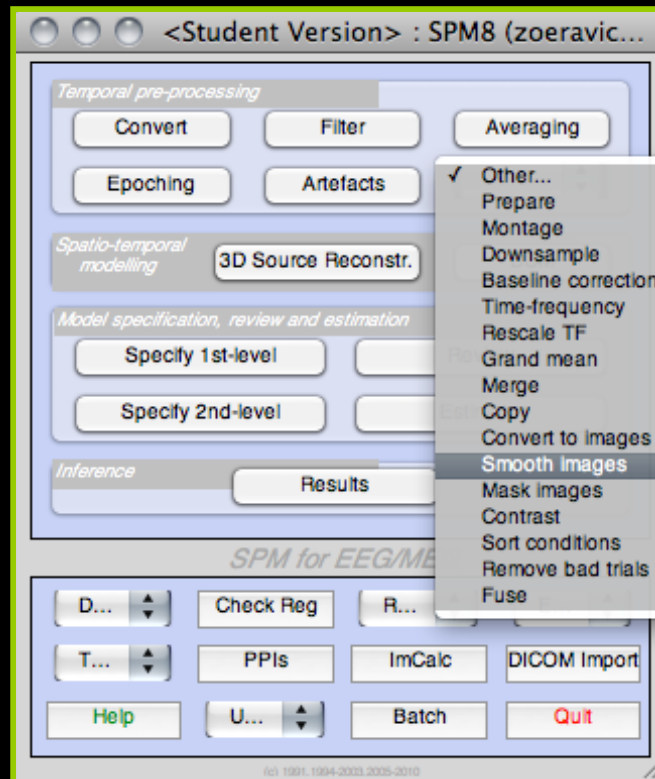
5

Processing...



# Step 13

## 3D SPMs



6

# Step 13

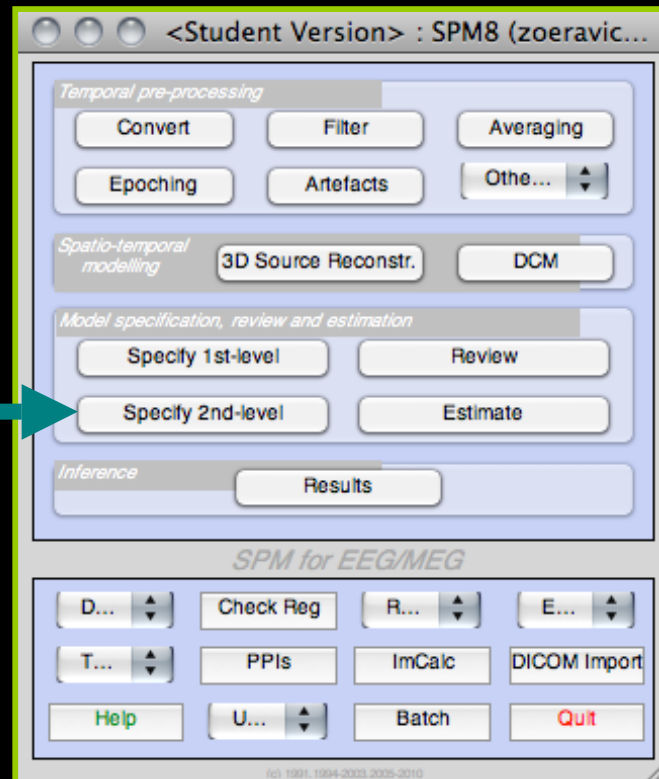
## 3D SPMs

The image shows two overlapping windows from the SPM software. The left window, titled '<Student Version> : Images to Smooth', displays a file browser with a directory path of '/Users/zoeravich/Documents/MATLAB/Datasets'. A file list is visible, and a 'Done' button is highlighted with a yellow arrow labeled '9'. Below the file list, the text 'Selected 299 files.' is shown, with a yellow arrow labeled '8' pointing to the first line of the file list. The right window, titled '<Student Version> : Batch Editor', shows the 'Smooth' module configuration. The 'Module List' on the left contains 'Smooth'. The 'Current Module: Smooth' section on the right shows parameters: 'Help on: Smooth', 'Images to Smooth', 'FWHM', 'Data Type', 'Implicit masking' (set to 'Yes'), and 'Filename Prefix'. A yellow arrow labeled '7' points to the 'Smooth' module in the list, '10' points to the 'Implicit masking' parameter, and '11' points to the 'Yes' value. Below the configuration, the 'Current Item: Implicit masking' section shows a radio button for 'Yes' which is selected. At the bottom, a scrollable text area contains the following text: 'Implicit masking' followed by a definition: 'An "implicit mask" is a mask implied by a particular voxel value (0 for images with integer type, NaN for float images). If set to "Yes", the implicit masking of the input image is preserved in the smoothed image. One of the following options must be selected: \* Yes \* No'. A yellow arrow labeled '8' points to the first line of this text area.

# Step 13

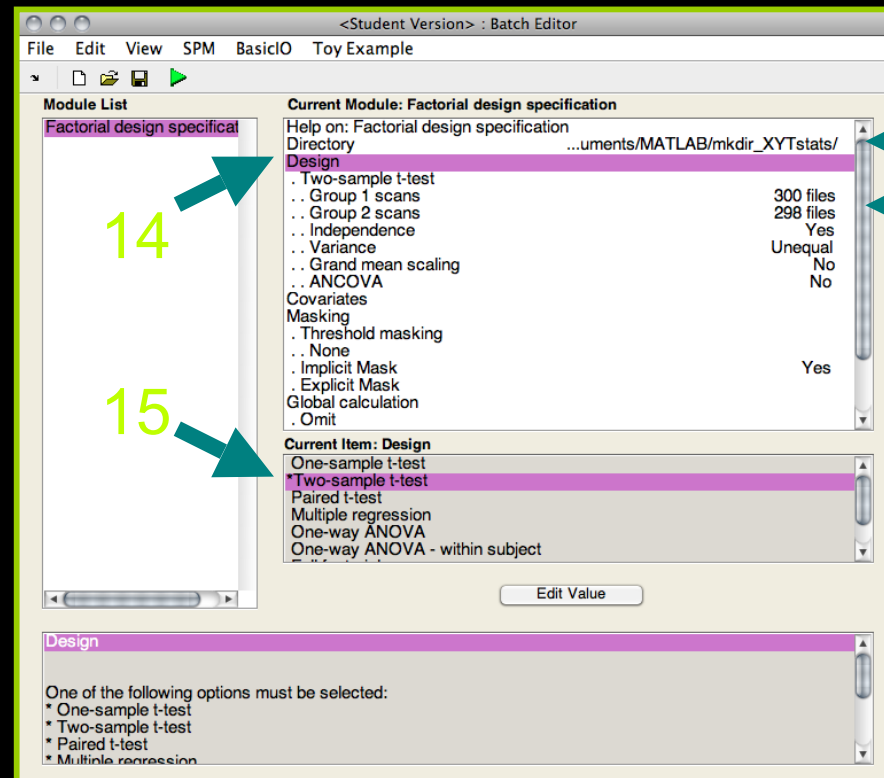
## 3D SPMs

12



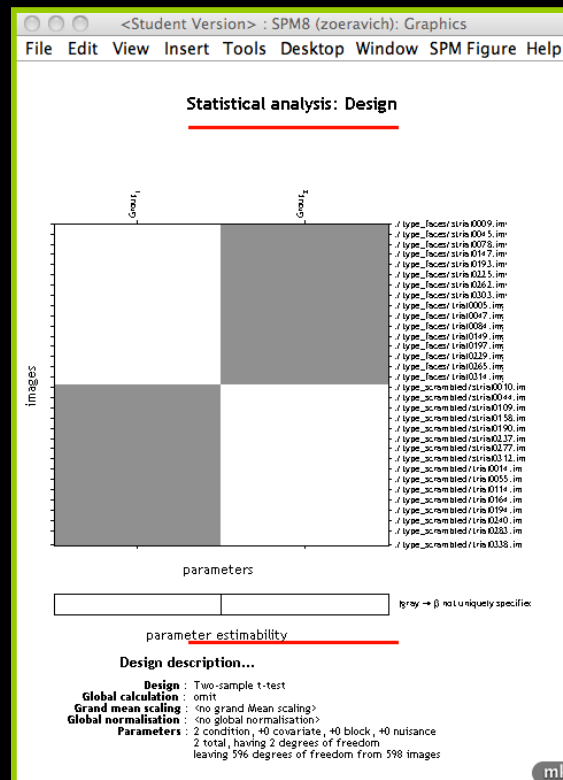
# Step 13

## 3D SPMs



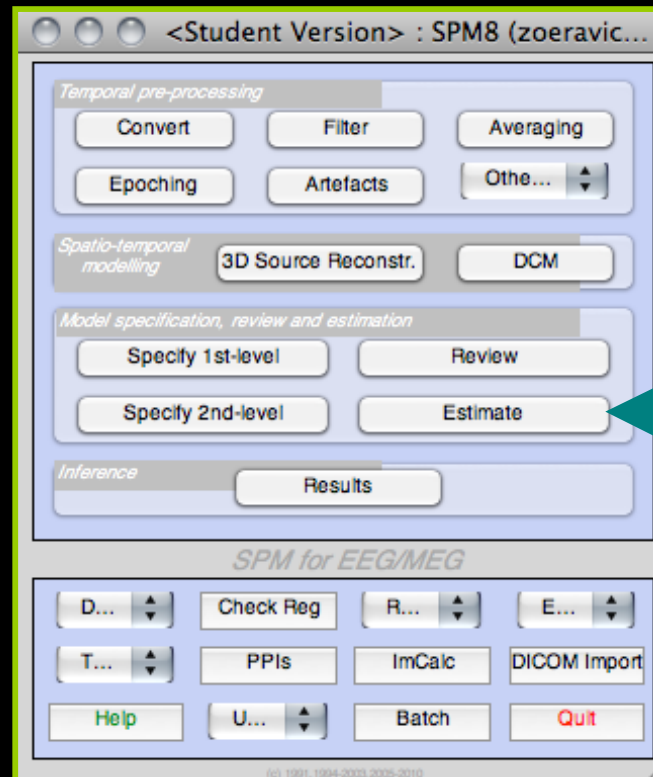
# Step 13

## 3D SPMs



# Step 13

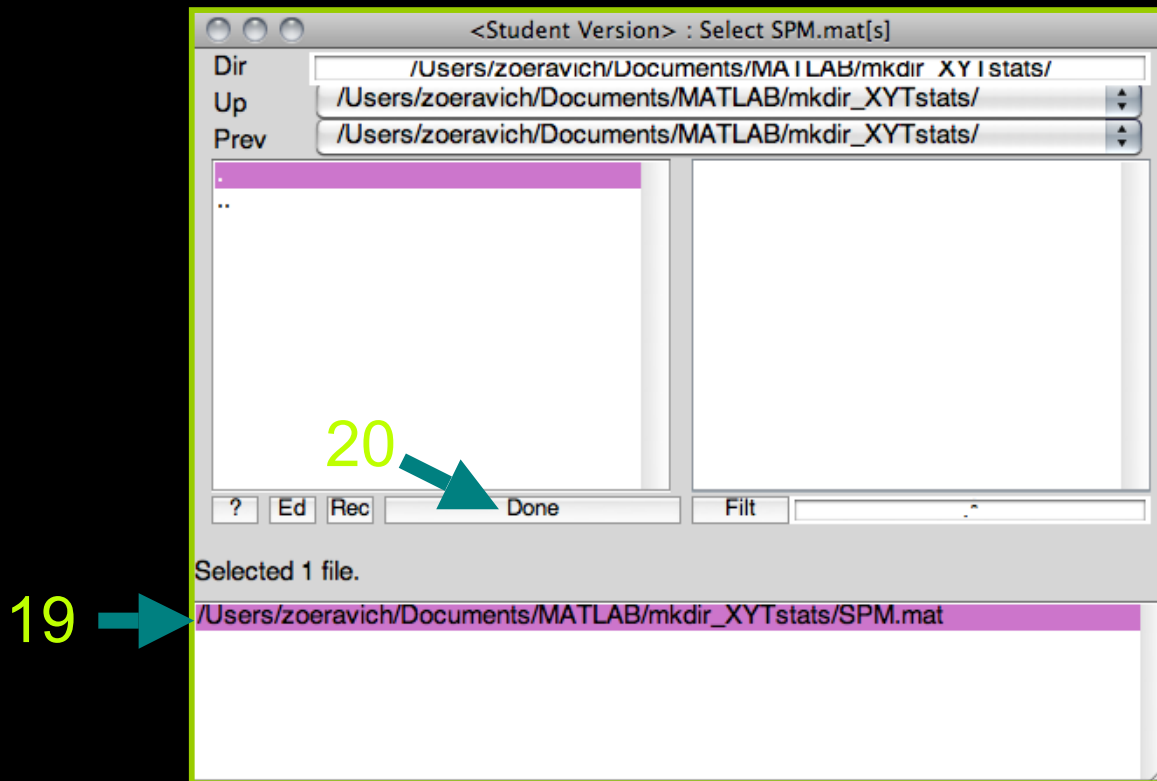
## 3D SPMs



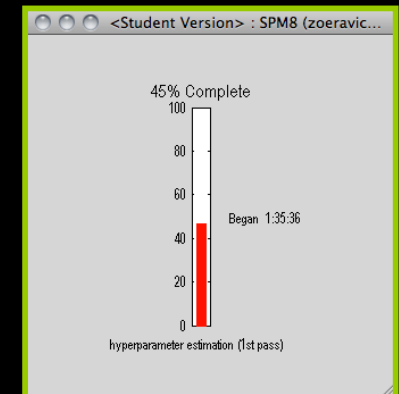
18

# Step 13

## 3D SPMs

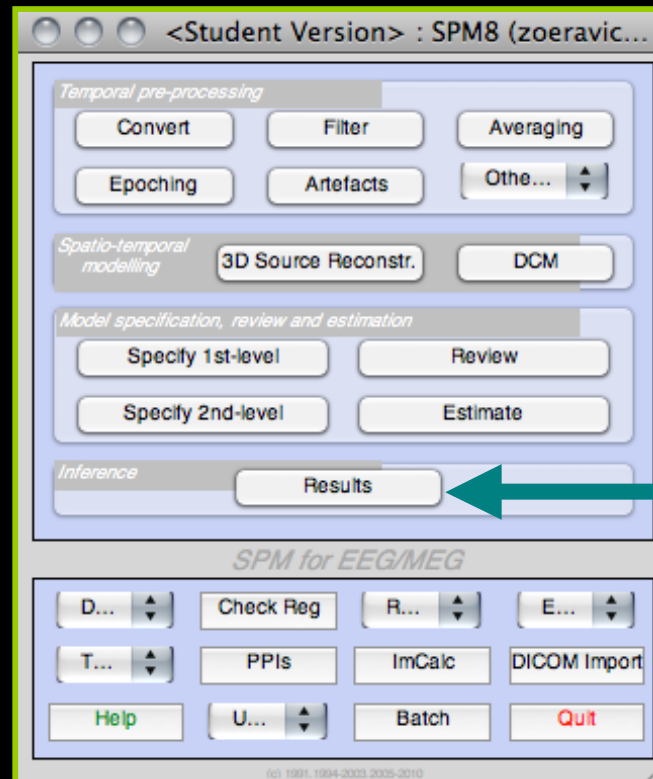


Processing...



# Step 13

## 3D SPMs

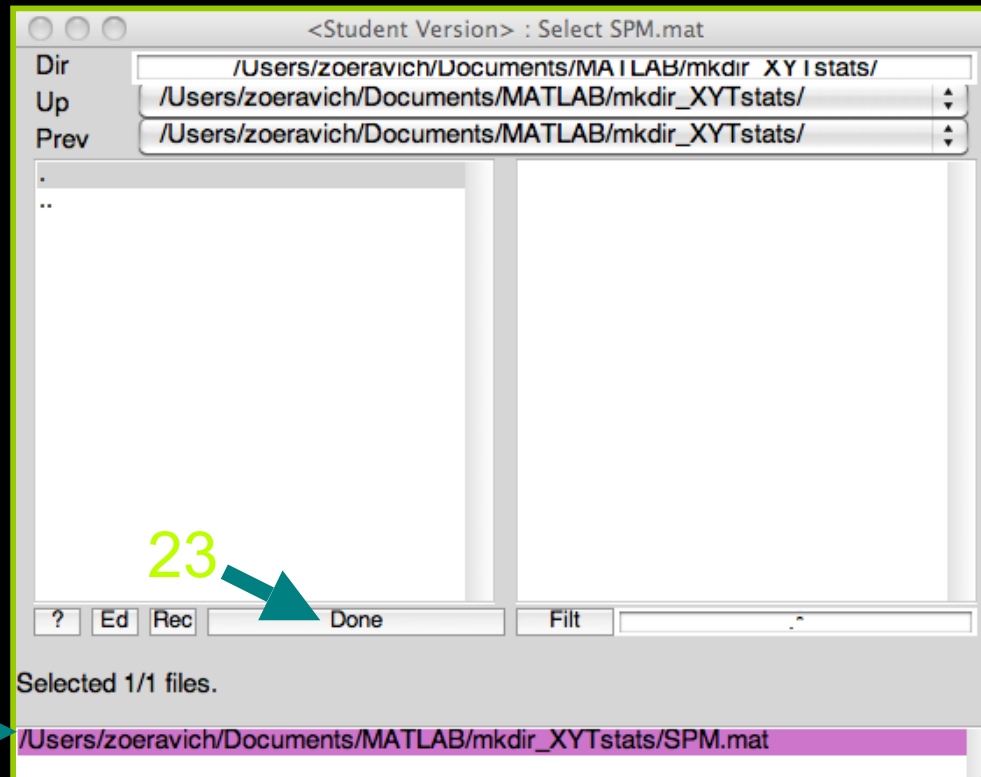


21

# Step 13

## 3D SPMs

---



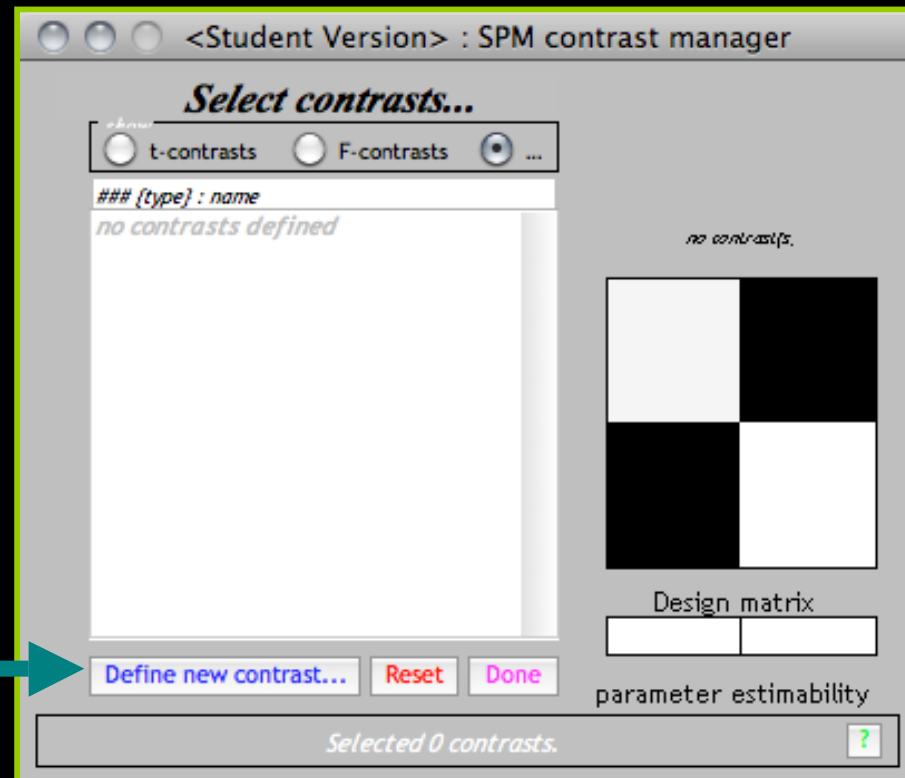
22

23

# Step 13

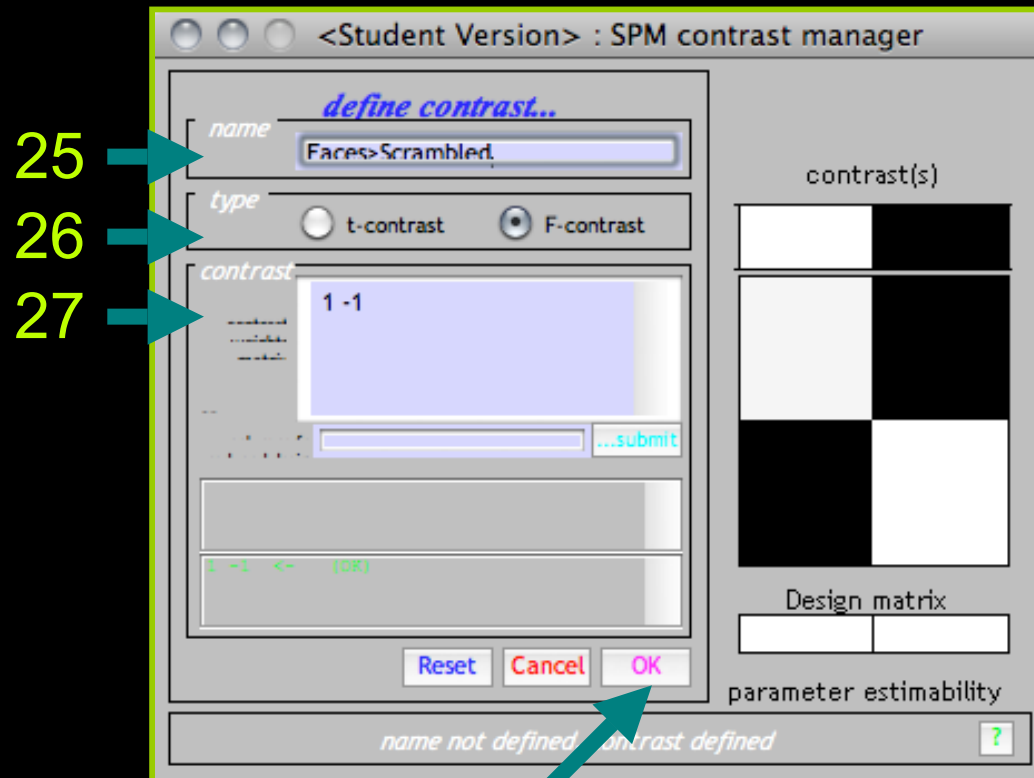
## 3D SPMs

24



# Step 13

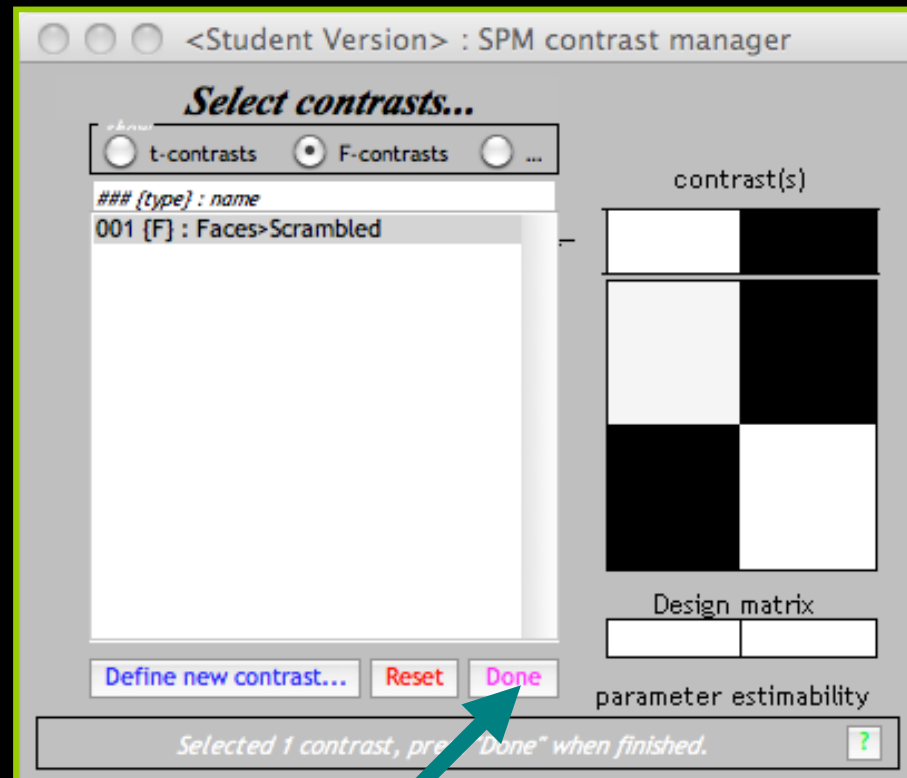
## 3D SPMs



28

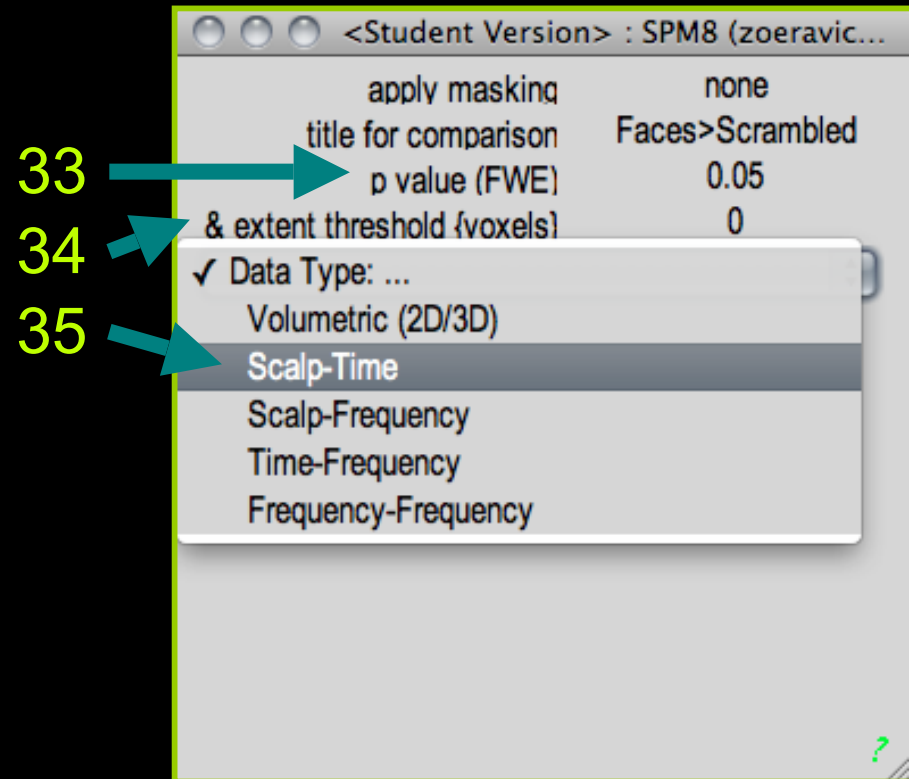
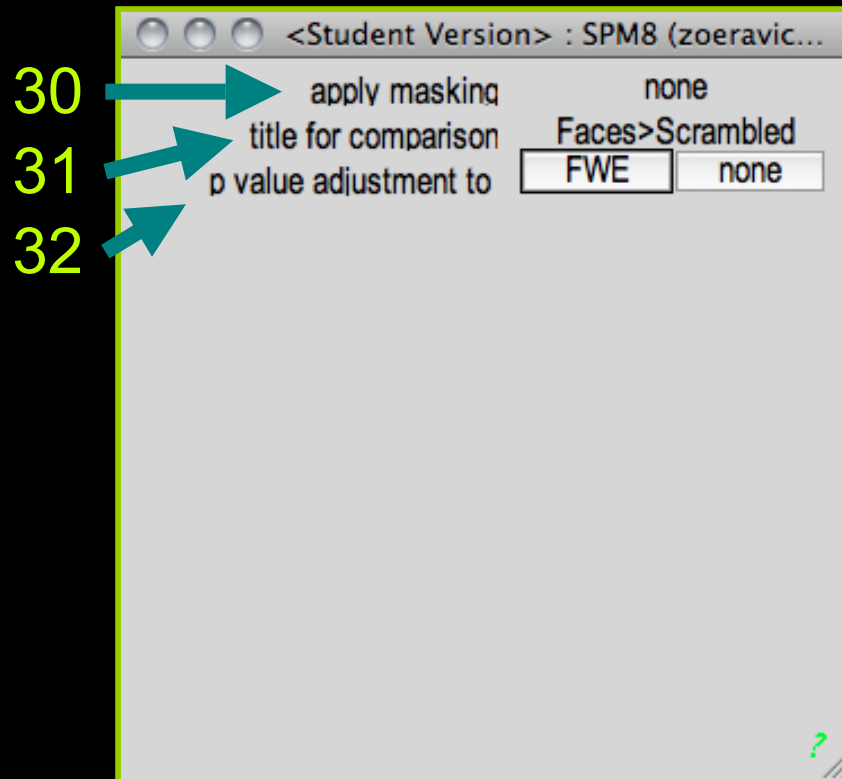
# Step 13

## 3D SPMs

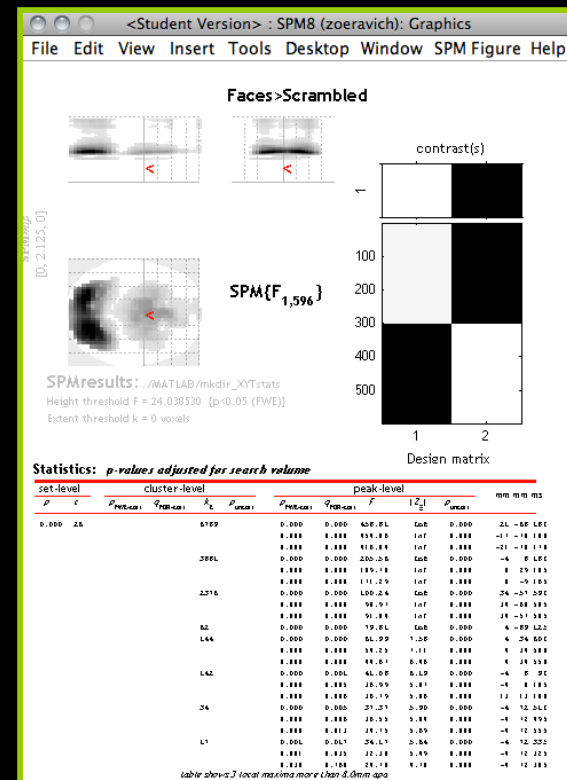
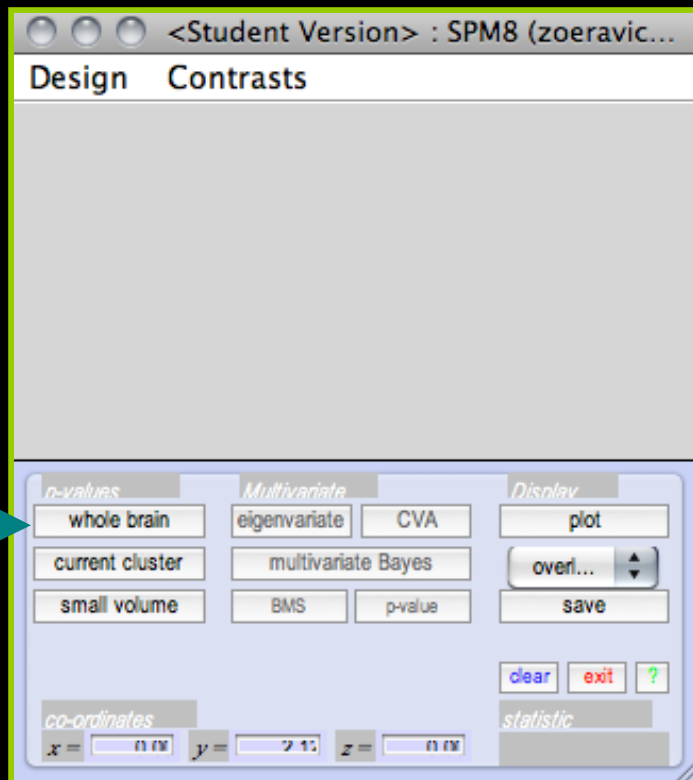


# Step 13

## 3D SPMs

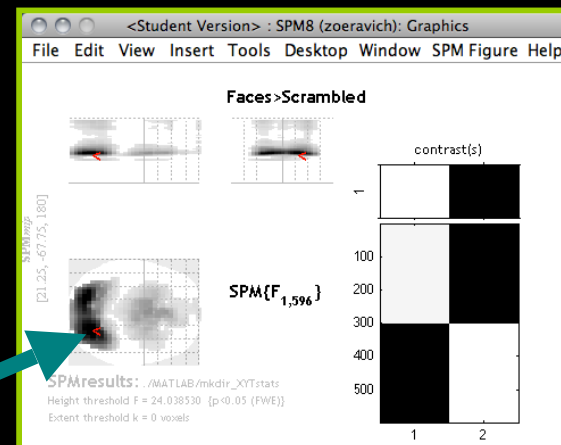
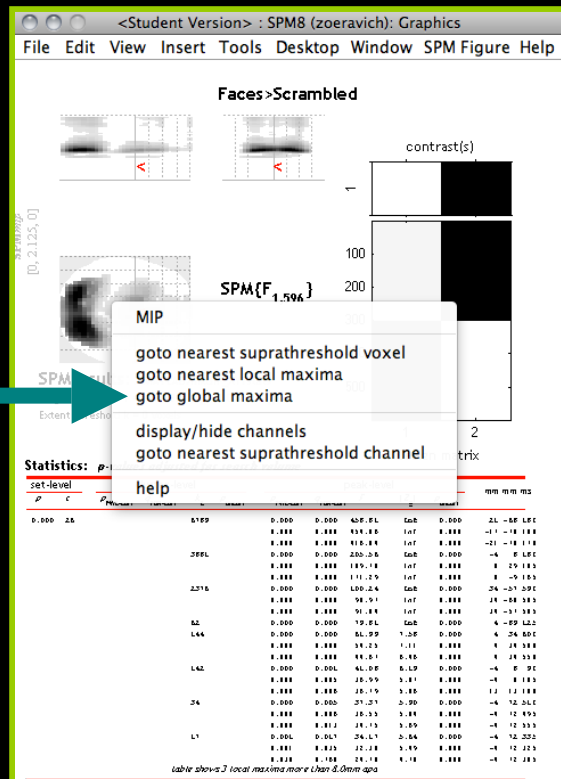


# Step 13 3D SPMs



# Step 13

## 3D SPMs (Exploratory)



```

New to MATLAB? Watch this Video, see Demos, or read Getting Started.

Premature end of file.
Could not parse the file: /Applications/MATLAB_R2010aSV.app/toolbox/simulink/simulink/info.xml

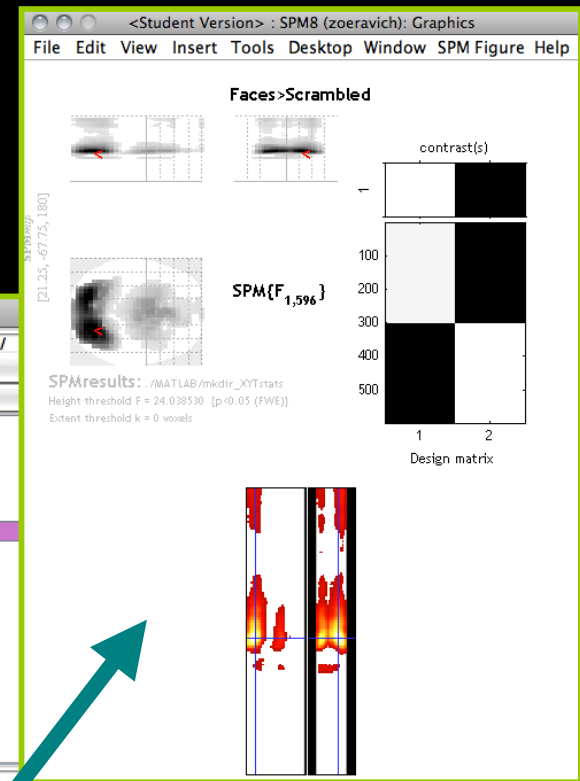
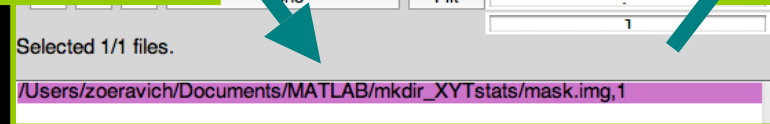
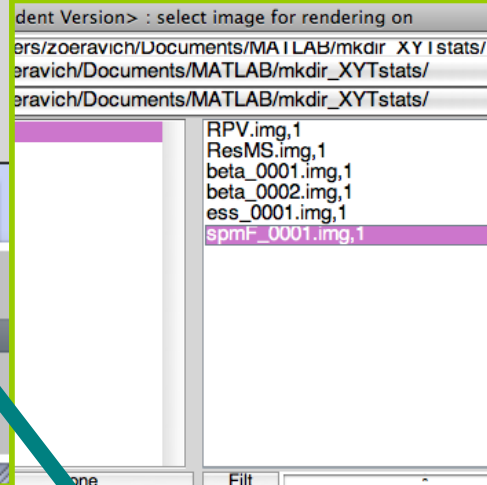
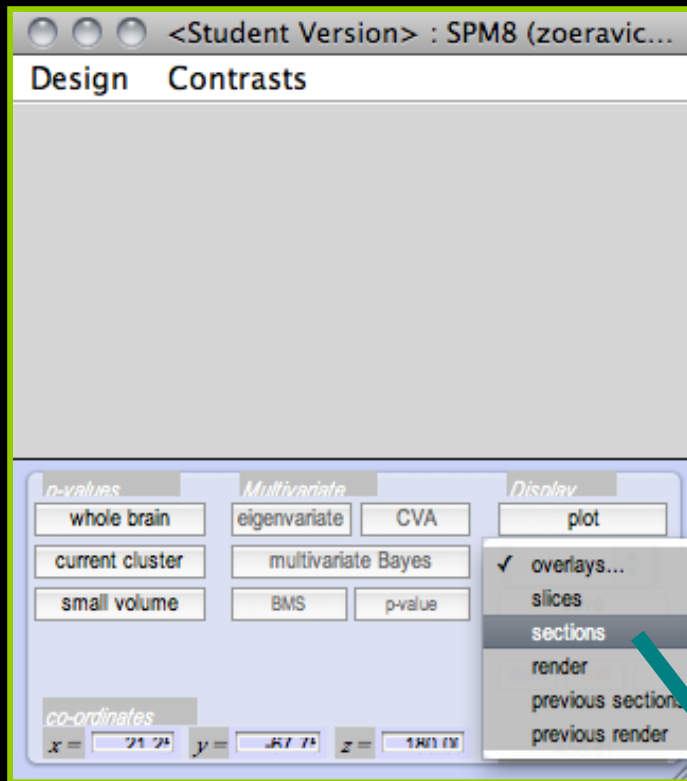
SPM8: spm_spm (v3960) 01:42:17 - 06/10/2011
=====
SPM8: spm_spm (v3960) 01:42:38 - 06/10/2011
=====
SPM8: spm_results_ui (v3928) 01:46:52 - 06/10/2011
=====
ESS image 1 : ..written ess_0001.img
spm(F) image 1 : ..written spmF_0001.img
SPM computation : ..done
Premature end of file.
Could not parse the file: /Applications/MATLAB_R2010aSV.app/toolbox/simulink/simulink/info.xml

spm_mip_ui: Jumped 194.25mm from [ 0, 2, 0],
to global maxima at [ 21, -68, 180]
    
```

1

# Step 13

## 3D SPMs (Exploratory)



# Step 14

## 3D “Imaging” Reconstruction

---

- Press the 3D SOURCE RECONSTRUCTION button
  - Press the “Load” button
    - Select the `wmaceMdspm8_faces_run1.mat` file
    - “Label”; Type “N170 MSP”
  - Press “Save”
  - Press the “MRI” button
    - Select the `smri.img` file
    - “Cortical mesh”; Click “Normal”
  - Press “Save”
  - Press the “Co-register” button
    - Click “OK”
    - “How to specify nas”; Click “Type”
    - “[3] Input MNI coordinates”; Type `[0 91 -28]`

# Step 14

## 3D “Imaging” Reconstruction Continued

---

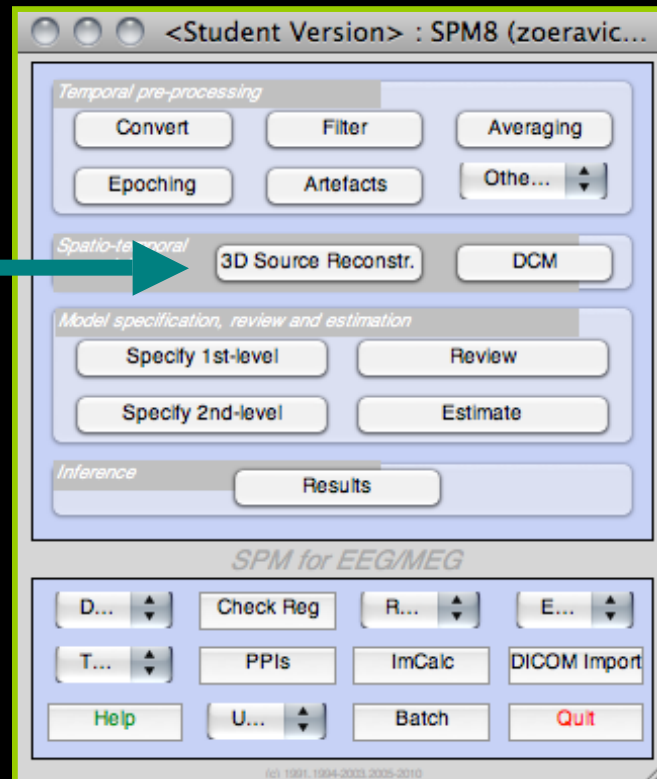
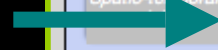
- “How to specify lpa”; Click “Type”
- “[3] Input MNI coordinates”; Type [-72 4 -59]
- “How to specify rpa”; Click “Type”
- “[3] Input MNI coordinates”; Type [71 -6 -62]
- Press “Save”
- Press the “Forward Model” button
  - Select “EEG BEM”
- Press “Save”
- Press the “Invert” button
  - “Reconstruction”; Click “Imaging”
  - “All conditions or trials”; Click “Yes”
  - “Model”; Click “Standard”
- Press “Save”

# Step 14

## 3D “Imaging” Reconstruction

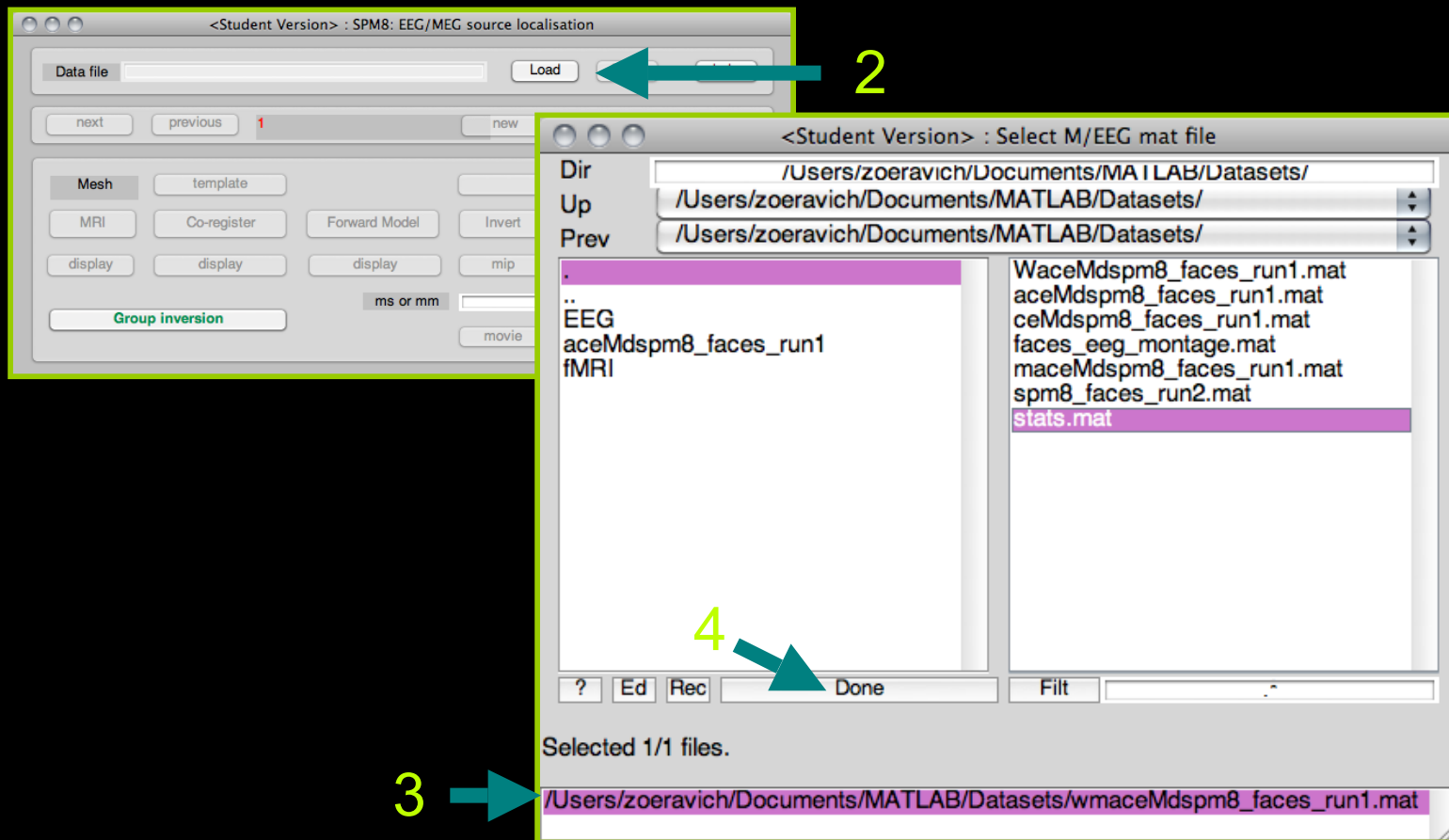
---

1



# Step 14

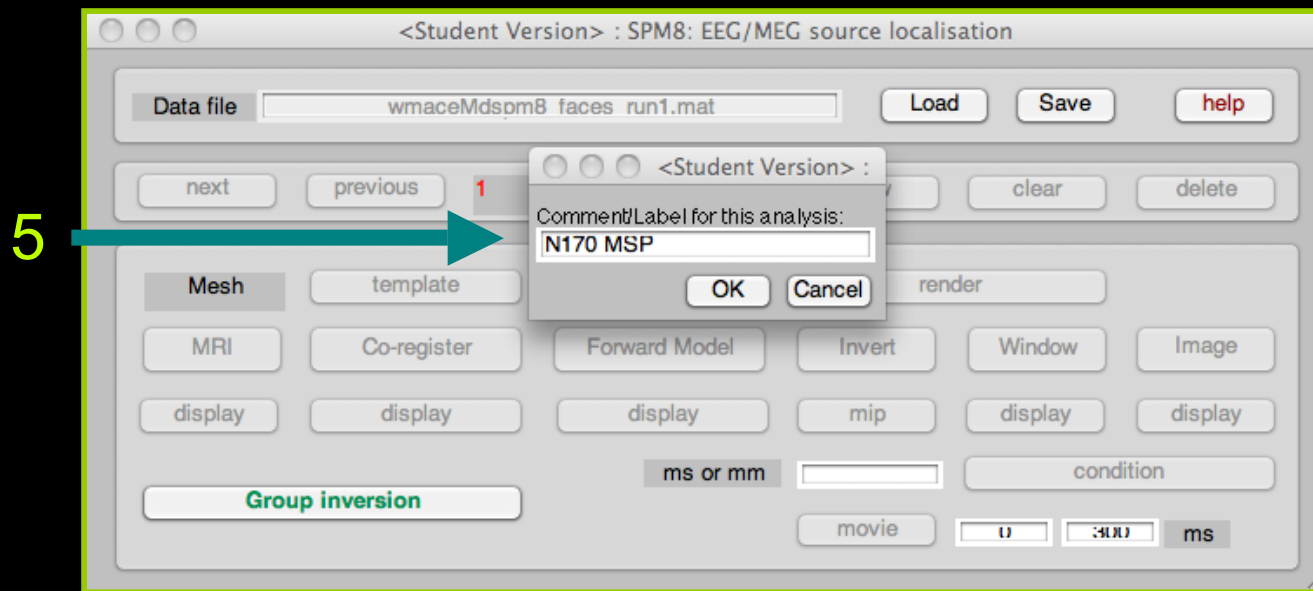
## 3D “Imaging” Reconstruction



# Step 14

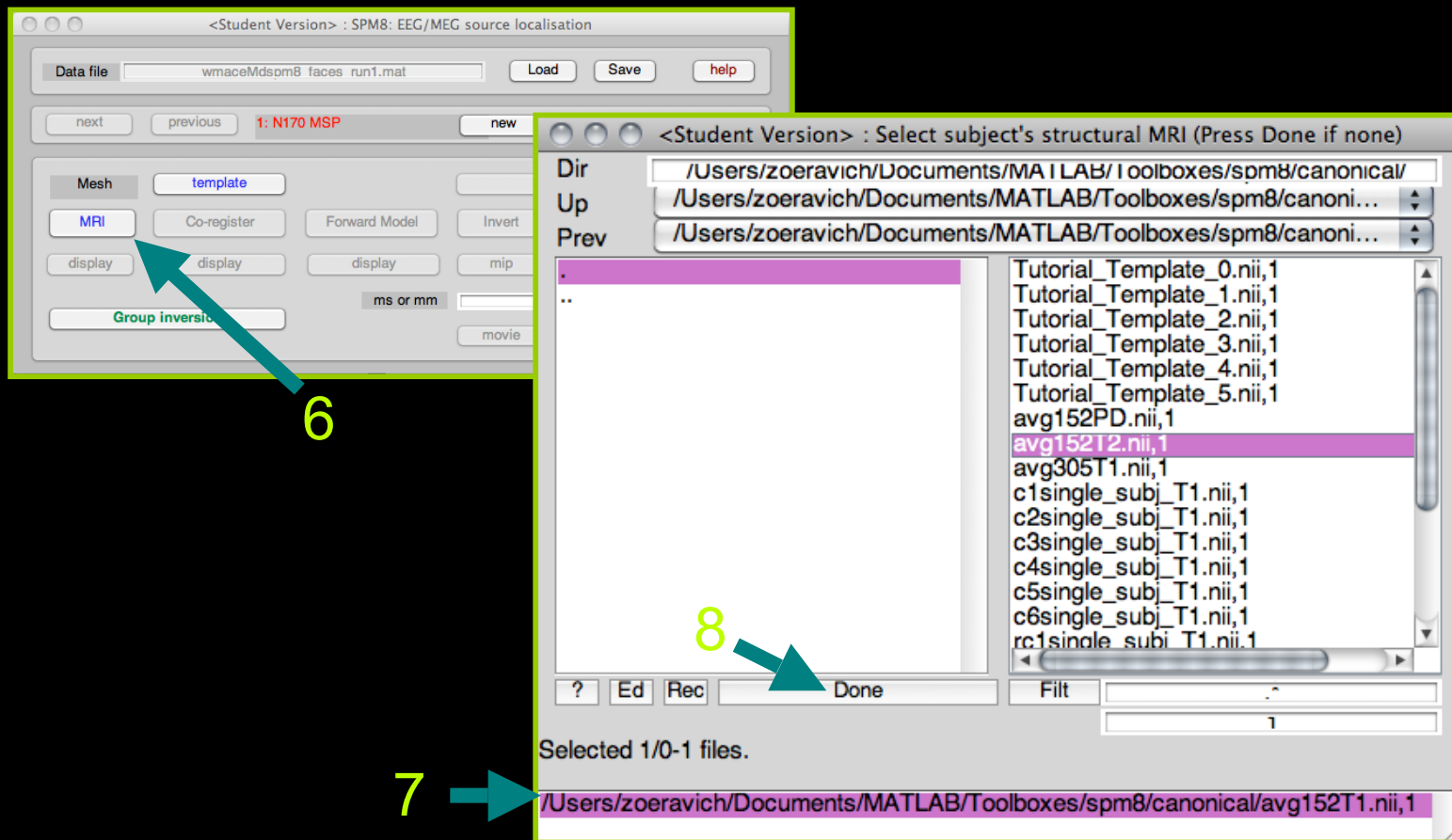
## 3D “Imaging” Reconstruction

---



# Step 14

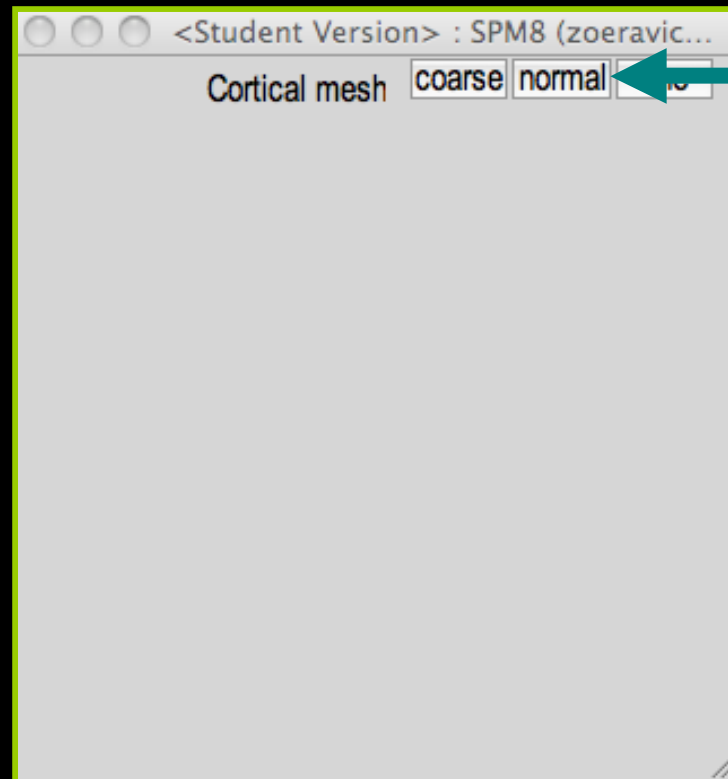
## 3D “Imaging” Reconstruction



# Step 14

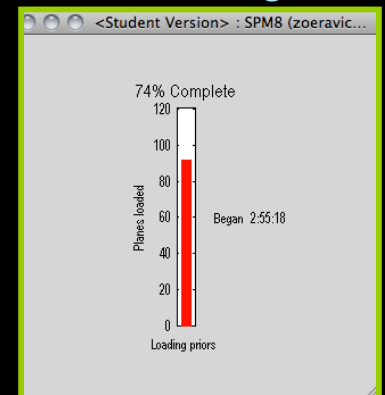
## 3D “Imaging” Reconstruction

---



9

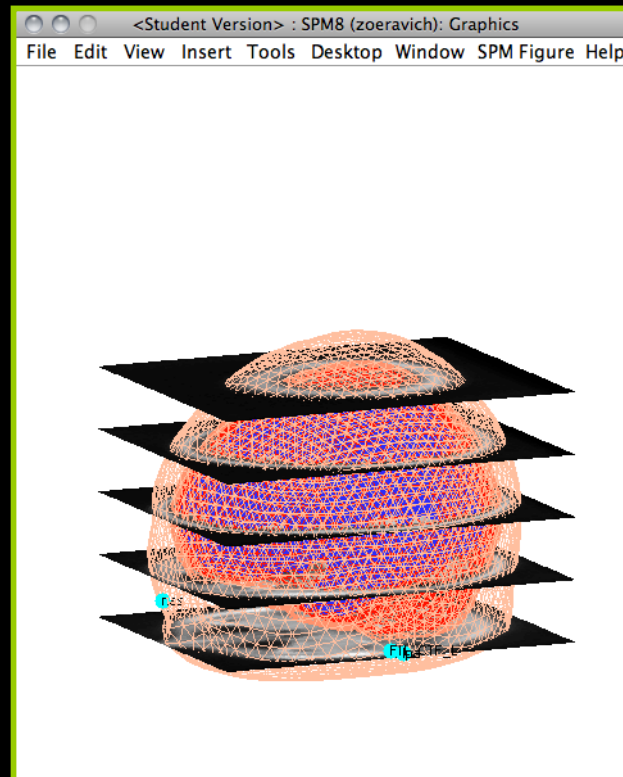
Processing...



# Step 14

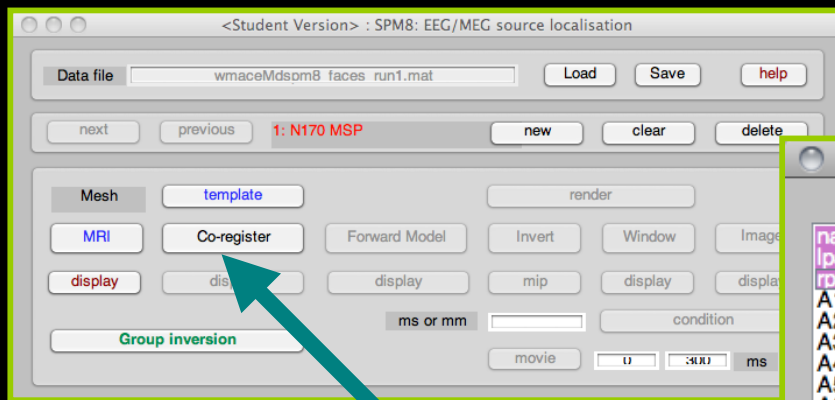
## 3D “Imaging” Reconstruction

---

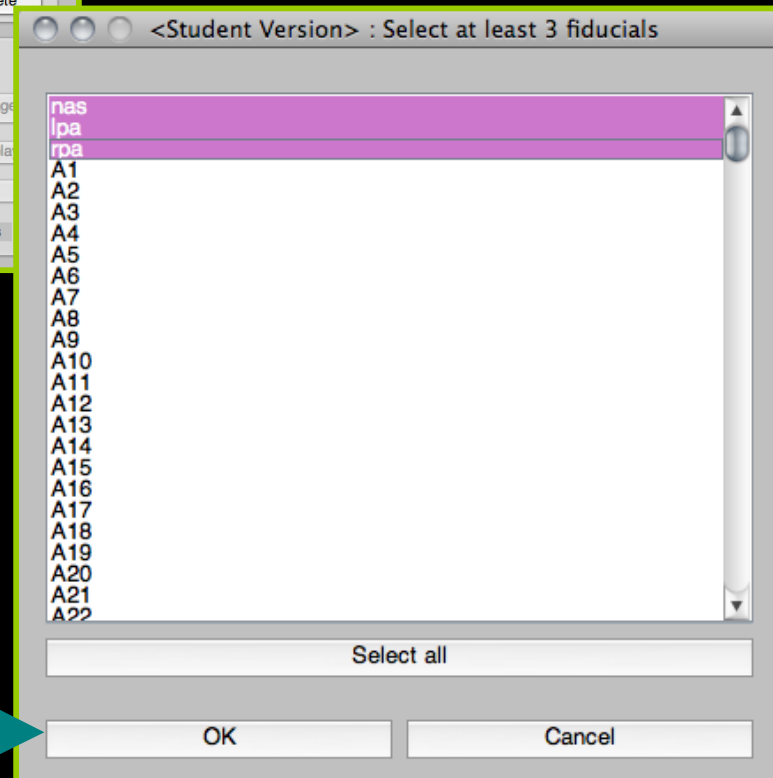


# Step 14

## 3D “Imaging” Reconstruction



10

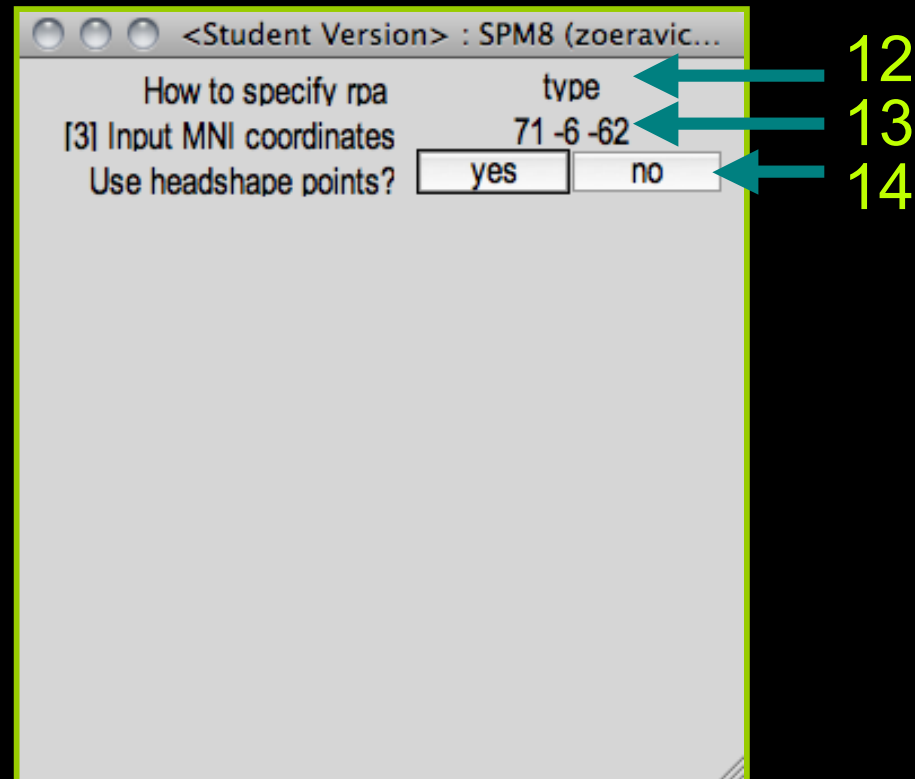


11

# Step 14

## 3D “Imaging” Reconstruction

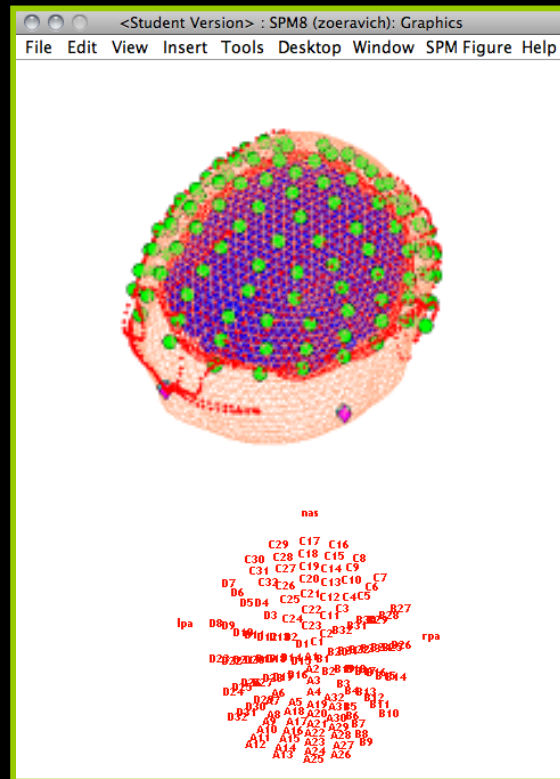
---



# Step 14

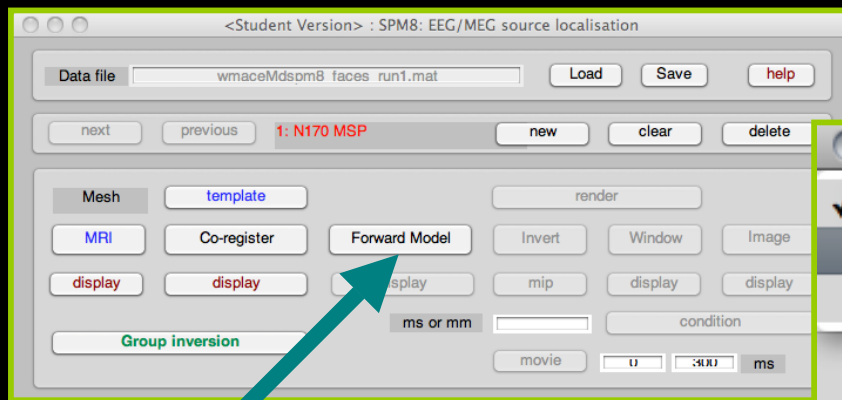
## 3D “Imaging” Reconstruction

---

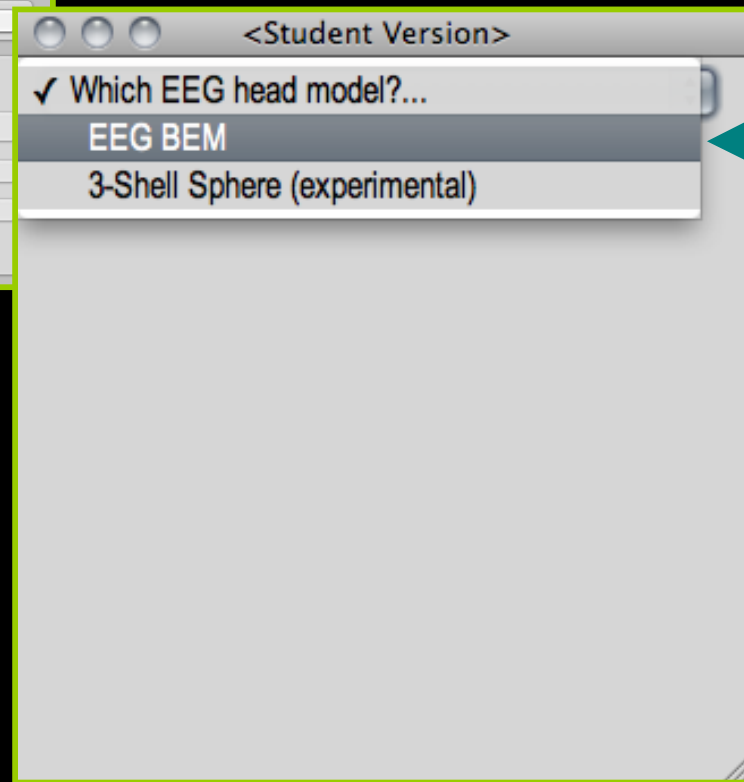


# Step 14

## 3D “Imaging” Reconstruction



15

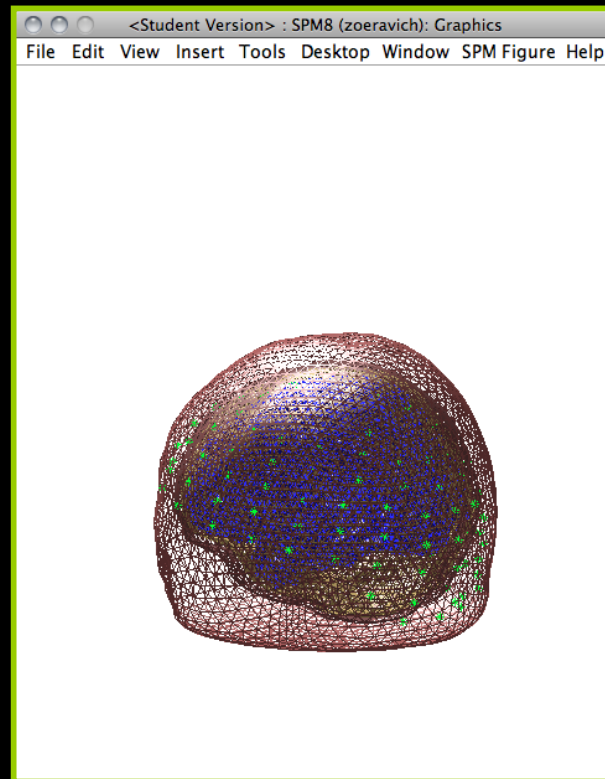


16

# Step 14

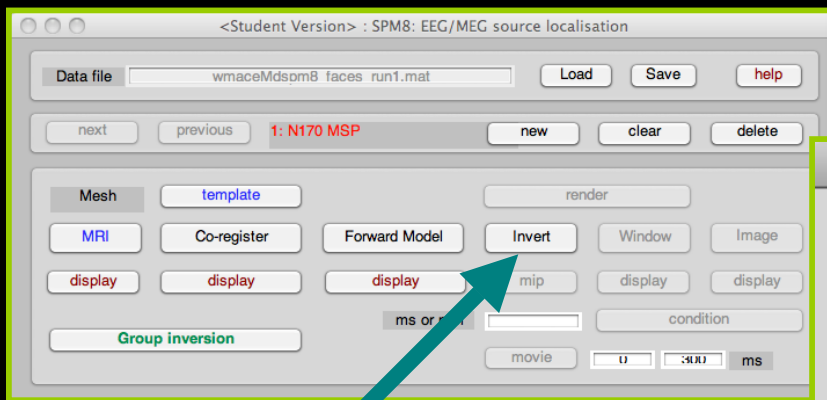
## 3D “Imaging” Reconstruction

---

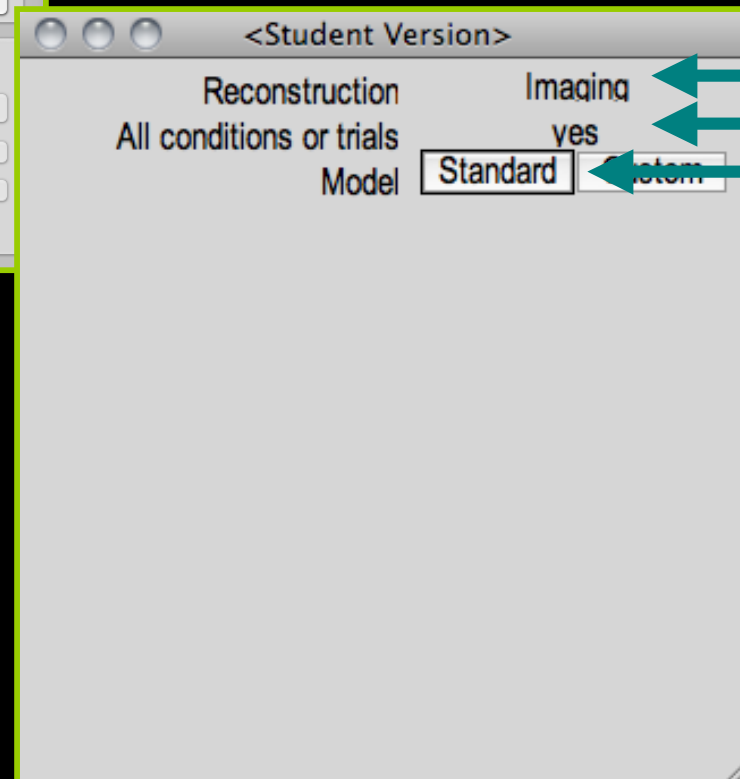


# Step 14

## 3D “Imaging” Reconstruction



17

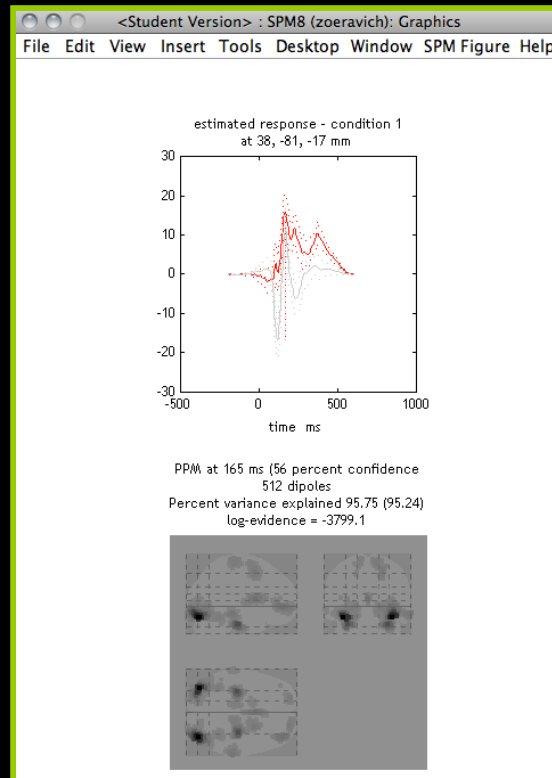


18  
19  
20

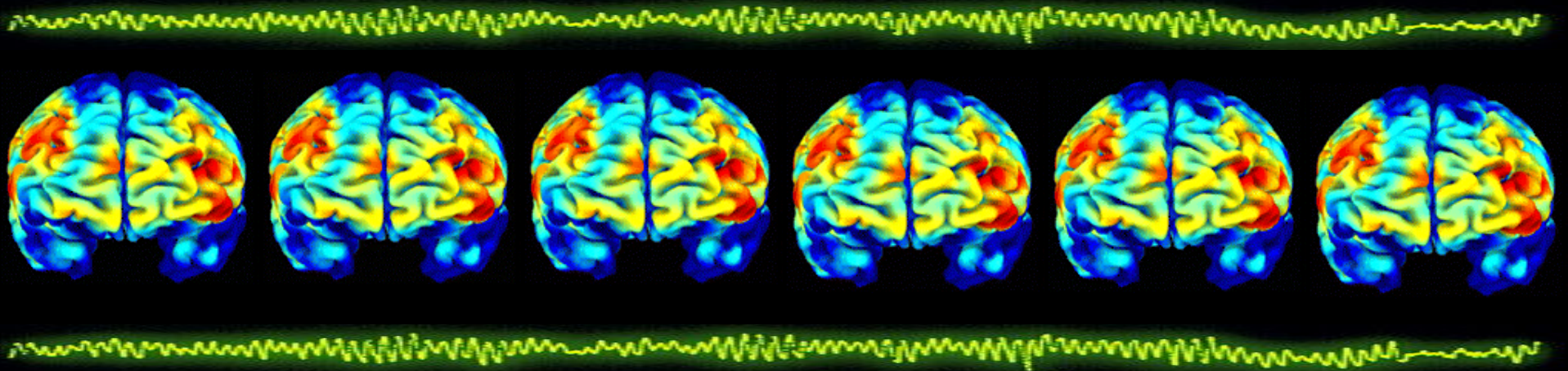
# Step 14

## 3D “Imaging” Reconstruction

---



# Congratulations!



You Successfully Processed  
and Explored SPM's EEG  
Dataset!