STUDY design and plotting overview

STEP 1

Build a STUDY

STEP 2

Build design(s)

STEP 3

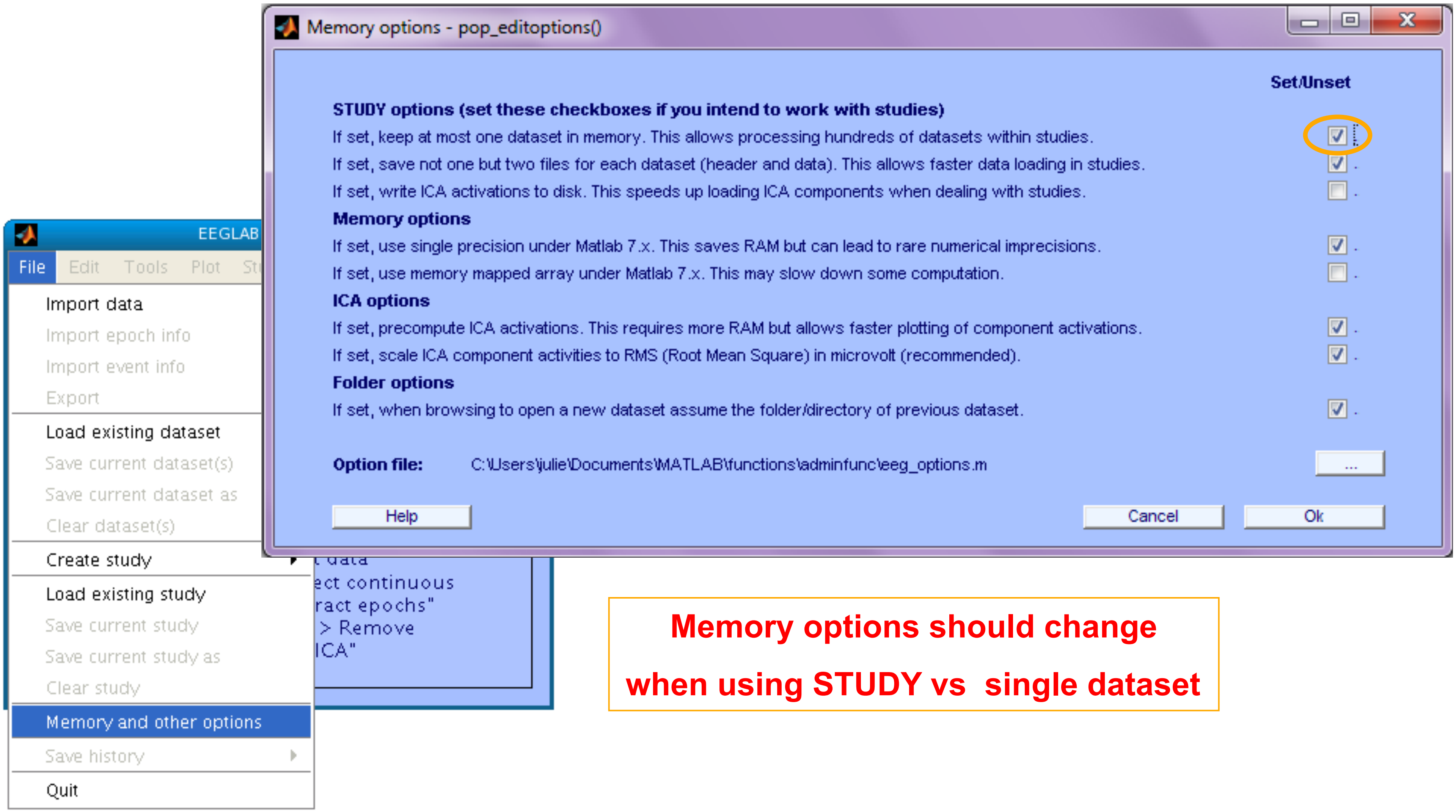
Precompute the data

STEP 4

Plot the data

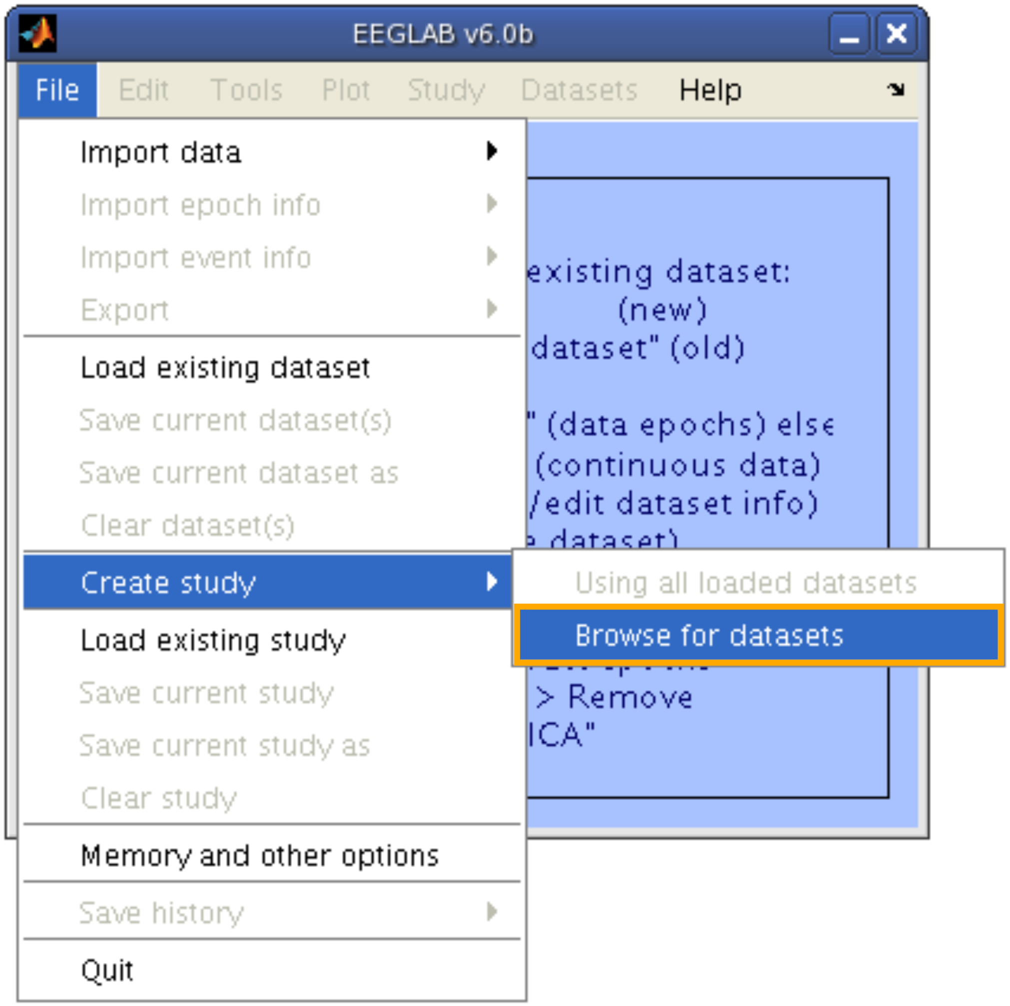
Exercise...

Memory options

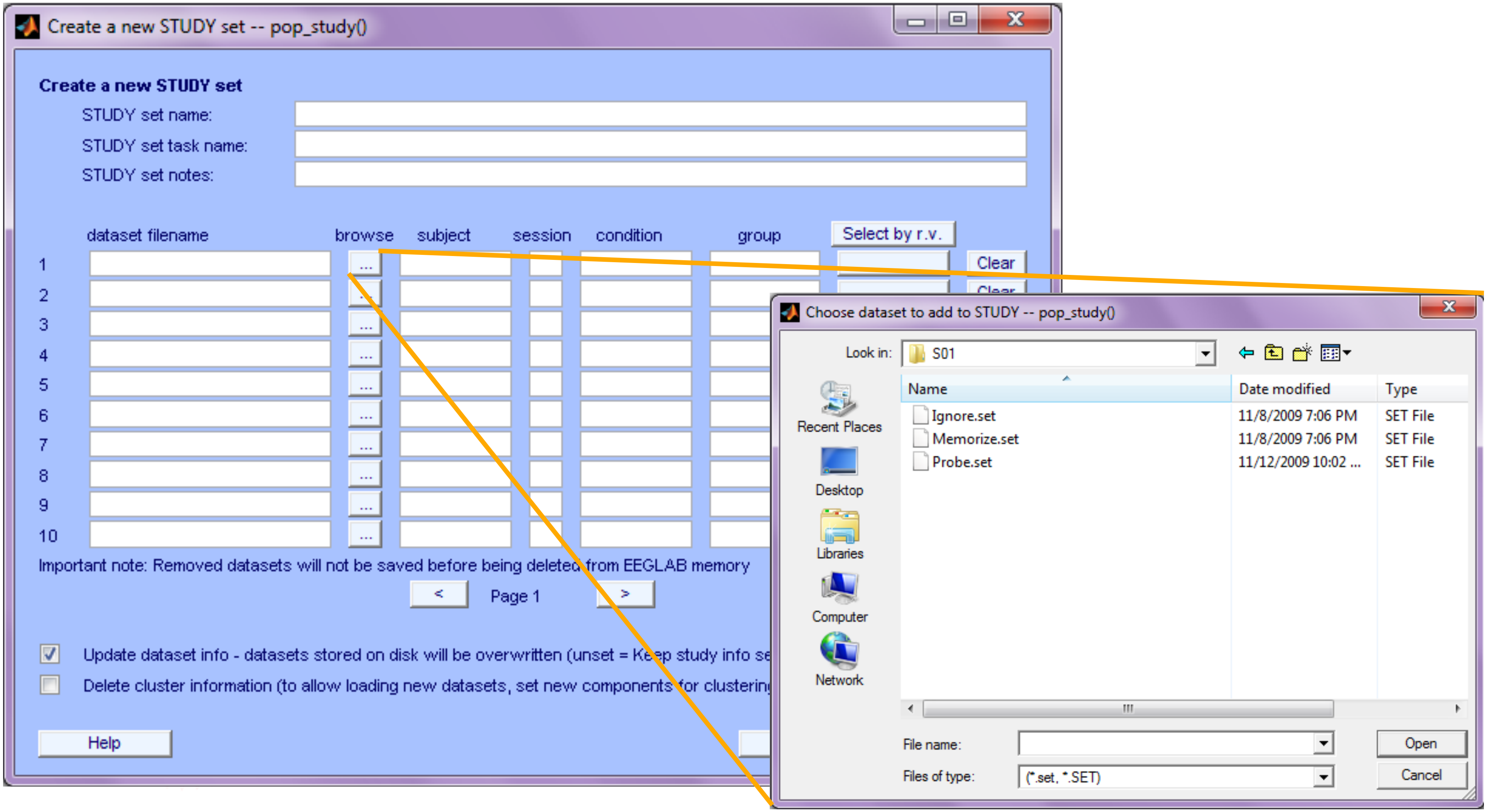


Memory options should change when using STUDY vs single dataset

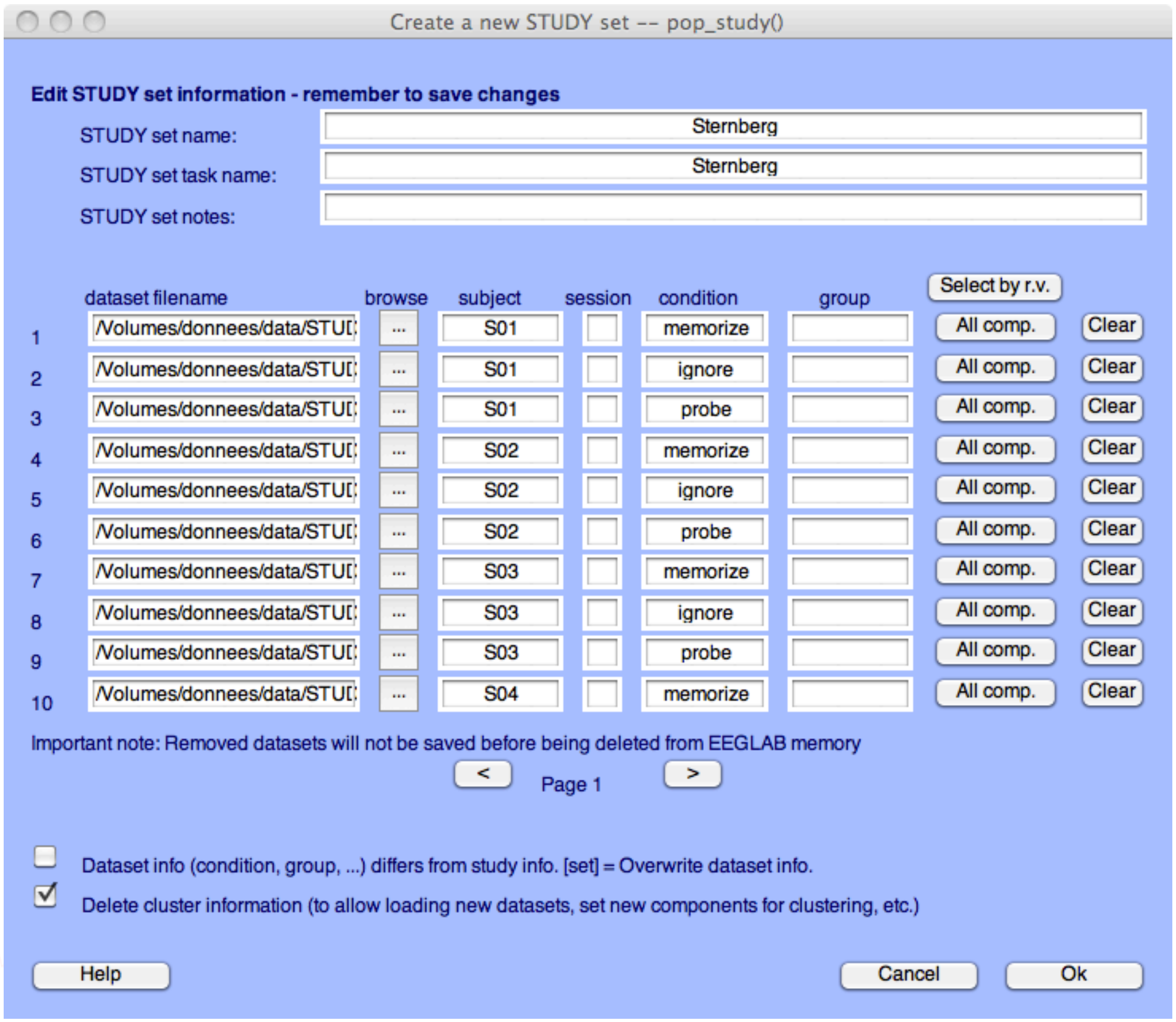
Build a STUDY



Build a STUDY, cont'd



Edit dataset info



Experimental design

1x2 unpaired

Patients	Controls
Group A	Group B

1x2 paired

Stim A	Stim B

2x2 paired

	Stim A	Stim B
Drug A		
Drug B		

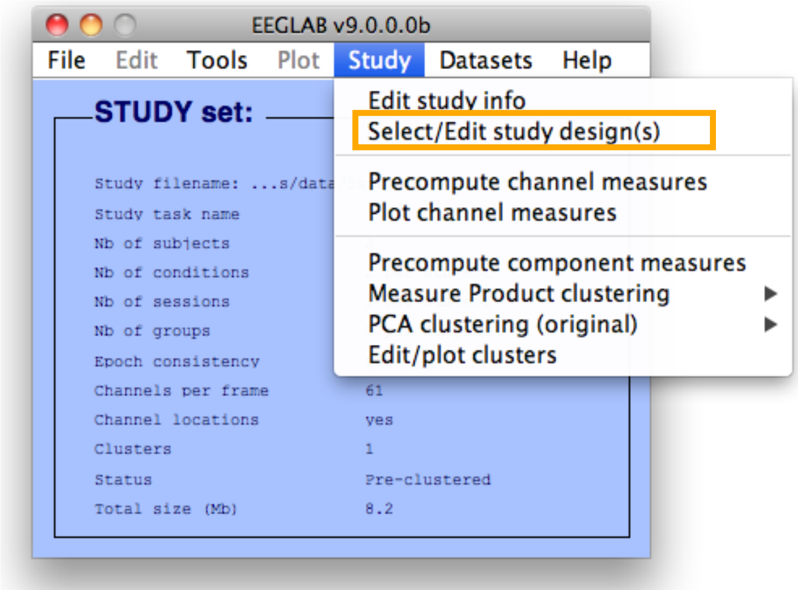
2x2 unpaired

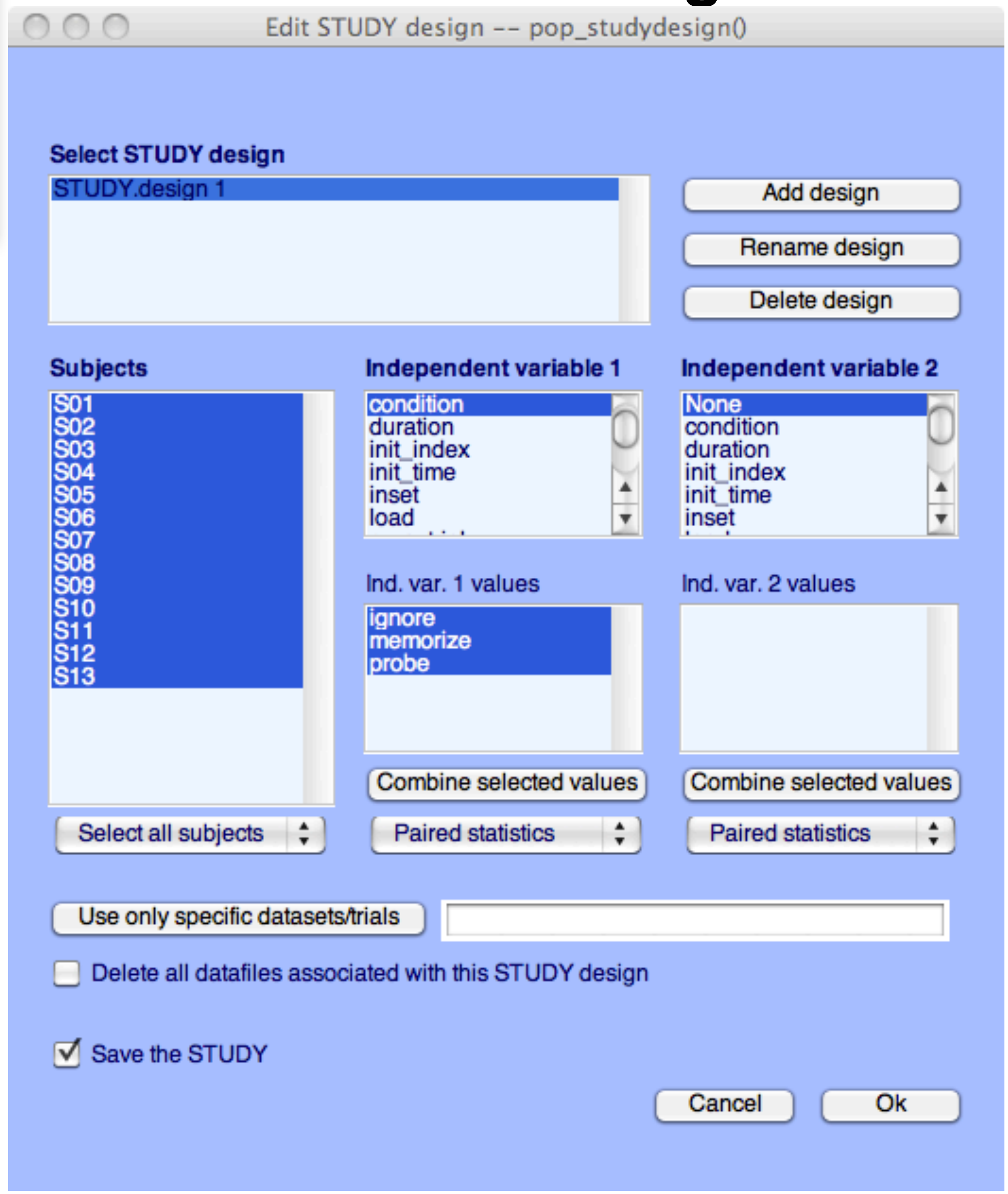
	Patients	Controls
Old	Group A	Group B
Young	Group C	Group D

2x2 paired & unpaired

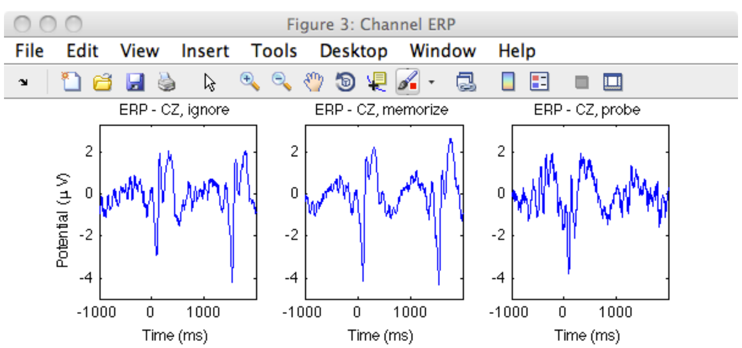
	Patients	Controls
Drug A		
Drug B		

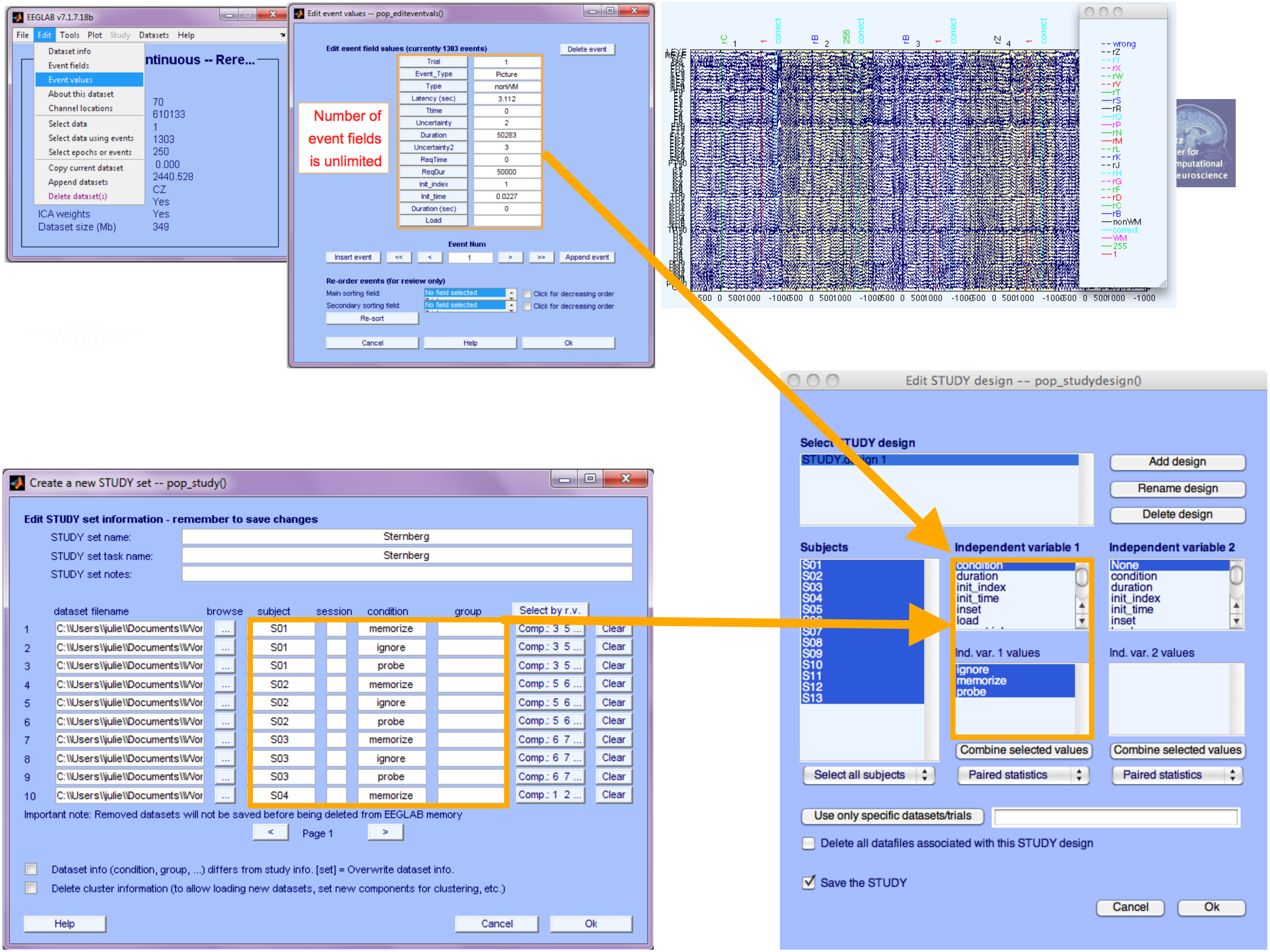
Create design





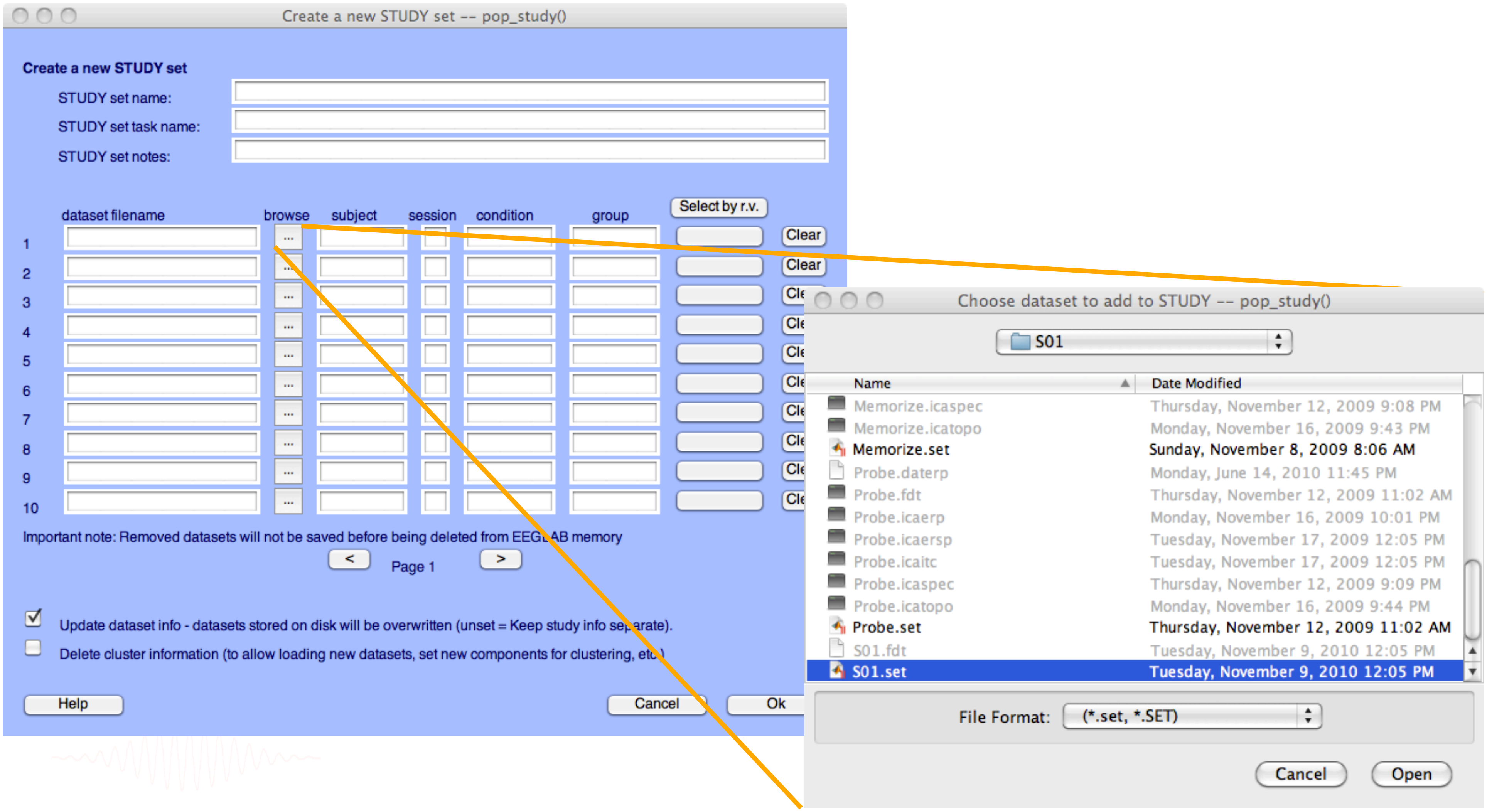
1x3 design



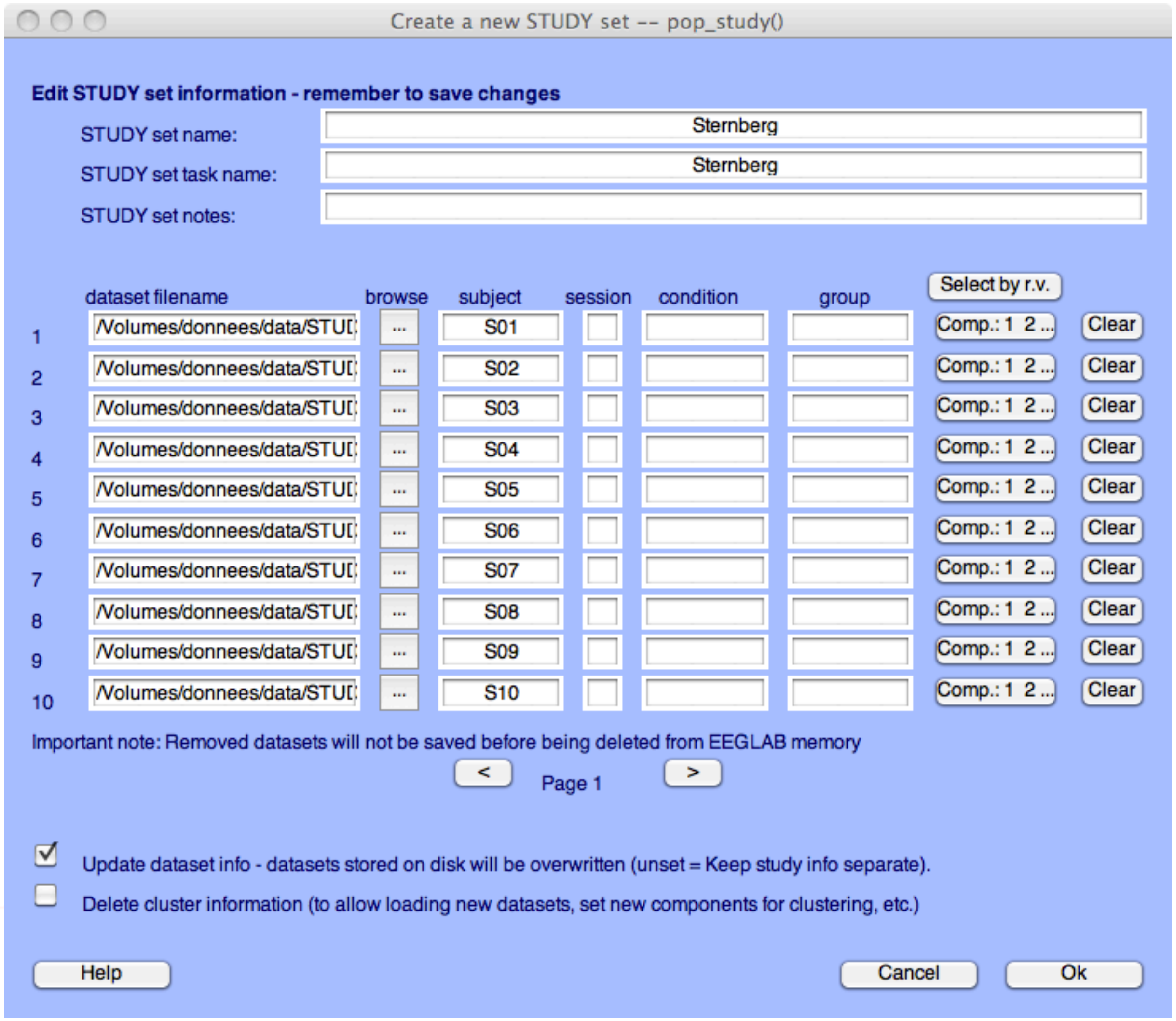


EEGLAB v7.1.7.18b
File Edit Tools Plot Study Datasets Help
Dataset info
Event fields
Event values
About this dataset
Channel locations
Select data
Select data using events
Select epochs or events
Copy current dataset
Append datasets
Delete dataset(s)
ntinuous -- Rere...
ICA weights
Dataset size (Mb)
Edit event values -- pop_editeventvals()
Edit event field values (currently 1303 events)
Delete event
Trial
Event_Type
Type
Latency (sec)
Ttime
Uncertainty
Duration
Uncertainty2
ReqTime
ReqDur
Init_index
Init_time
Duration (sec)
Load
Number of event fields is unlimited
Event Num
Insert event
Append event
Re-order events (for review only)
Main sorting field:
Secondary sorting field:
No field selected
Click for decreasing order
Re-sort
Cancel
Help
Ok
Edit STUDY design -- pop_studydesign()
Select STUDY design
STUDY.design 1
Add design
Rename design
Delete design
Subjects
Independent variable 1
Independent variable 2
Ind. var. 1 values
Ind. var. 2 values
ignore
memorize
probe
Combine selected values
Select all subjects
Paired statistics
Use only specific datasets/trials
Delete all datafiles associated with this STUDY design
Save the STUDY
Create a new STUDY set -- pop_study()
Edit STUDY set information - remember to save changes
STUDY set name:
STUDY set task name:
STUDY set notes:
Sternberg
dataset filename
browse
subject
session
condition
group
Select by r.v.
Clear
Important note: Removed datasets will not be saved before being deleted from EEGLAB memory
Page 1
Dataset info (condition, group, ...) differs from study info. [set] = Overwrite dataset info.
Delete cluster information (to allow loading new datasets, set new components for clustering, etc.)

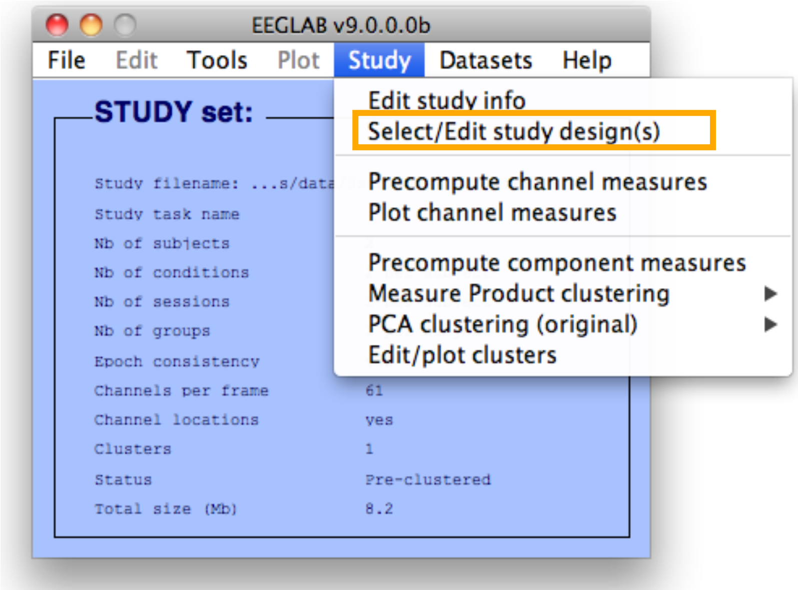
Build a STUDY, alternative method

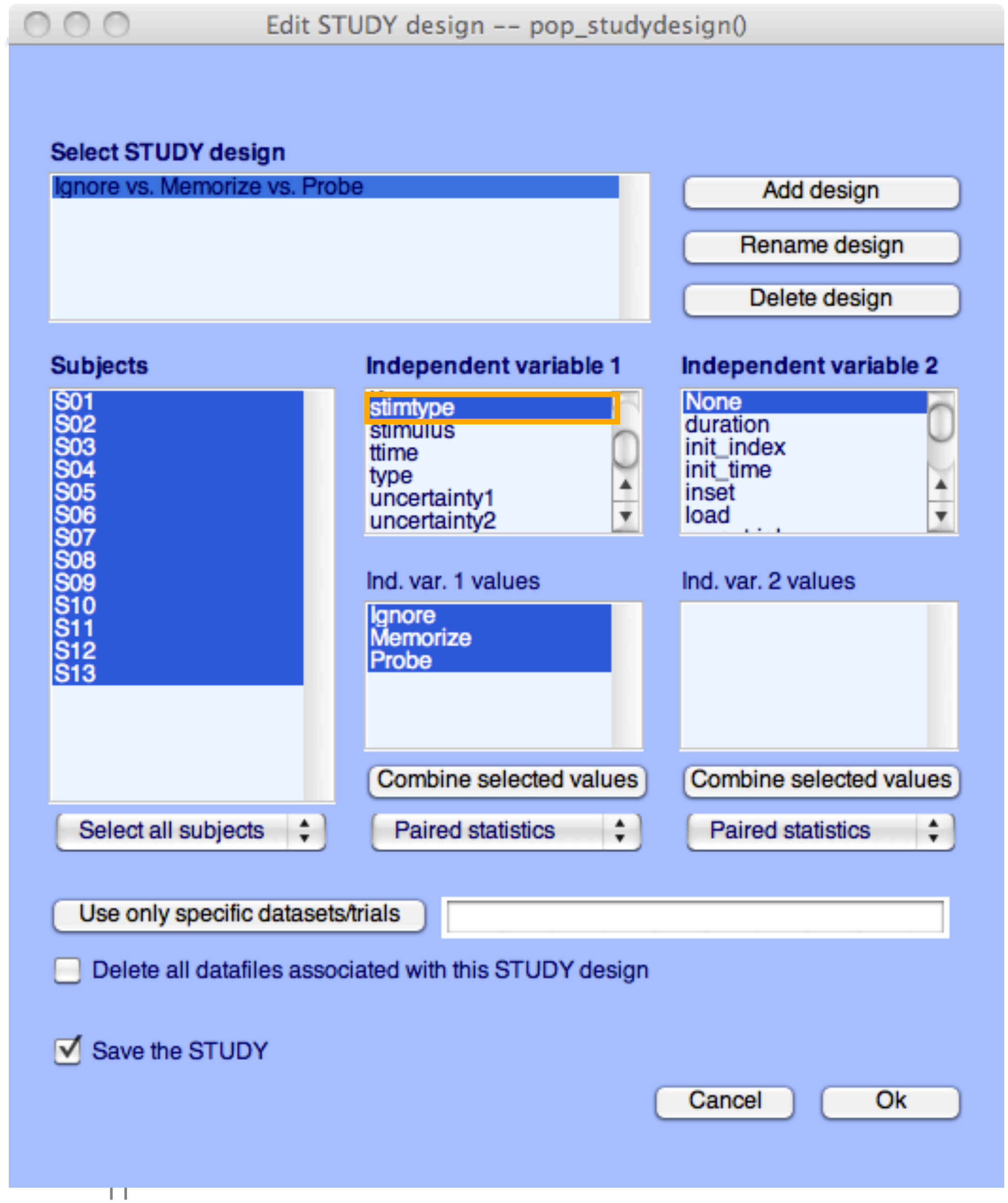


Edit dataset info

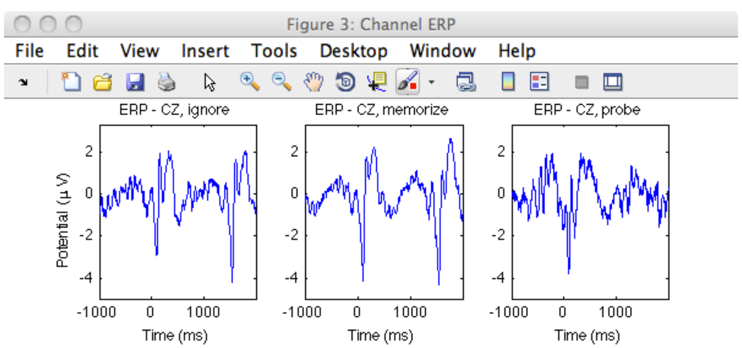


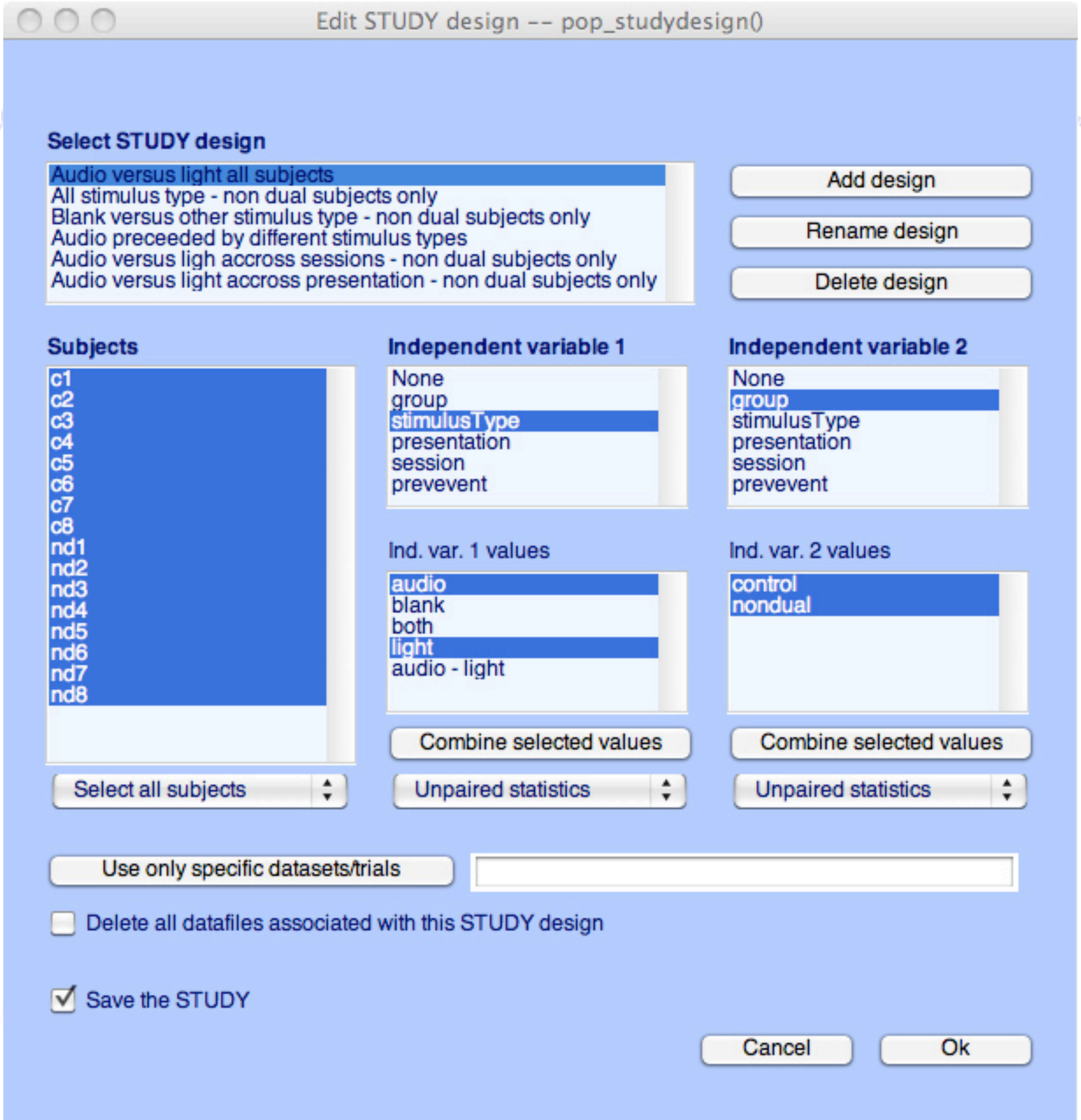
Create design



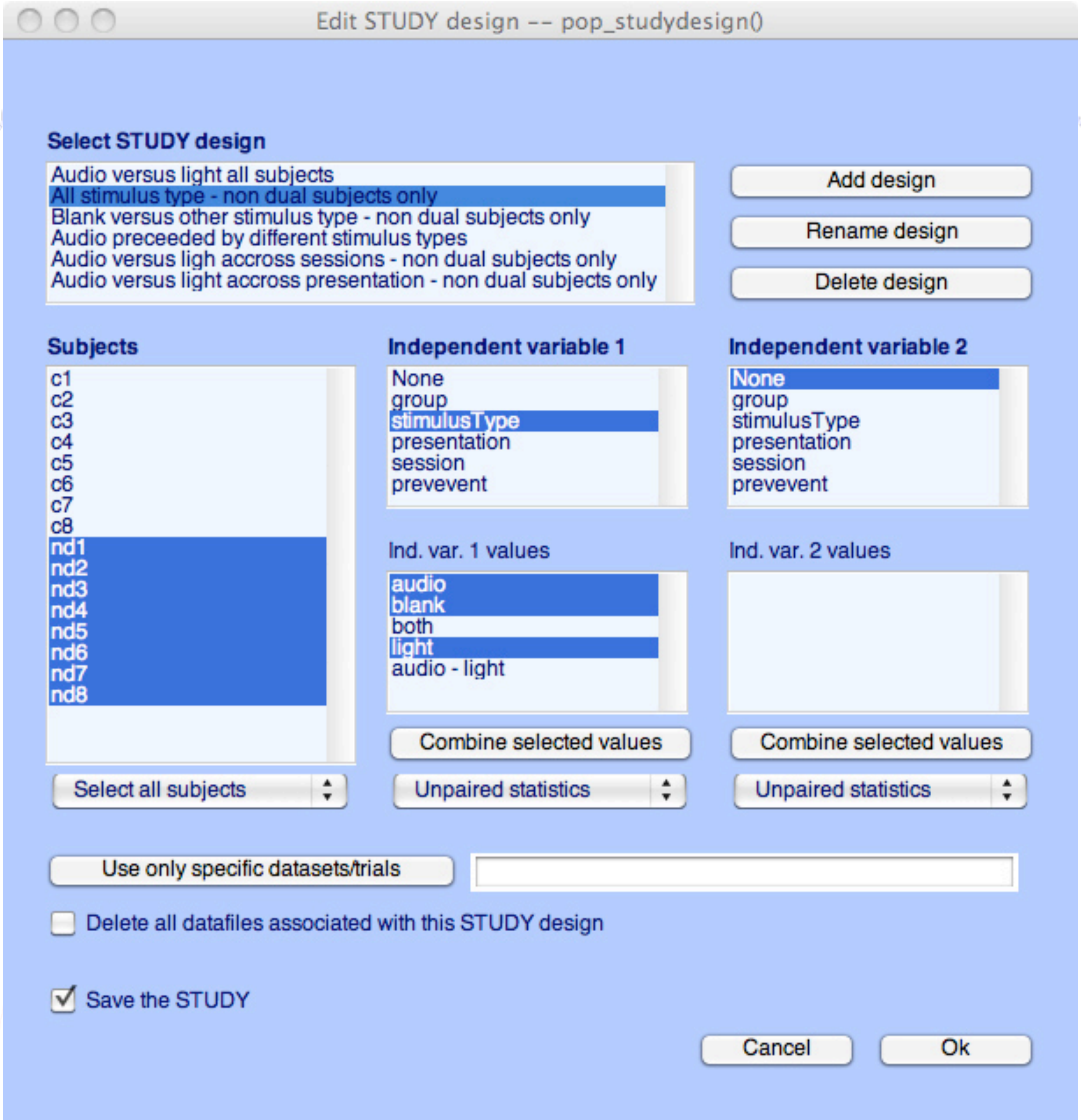


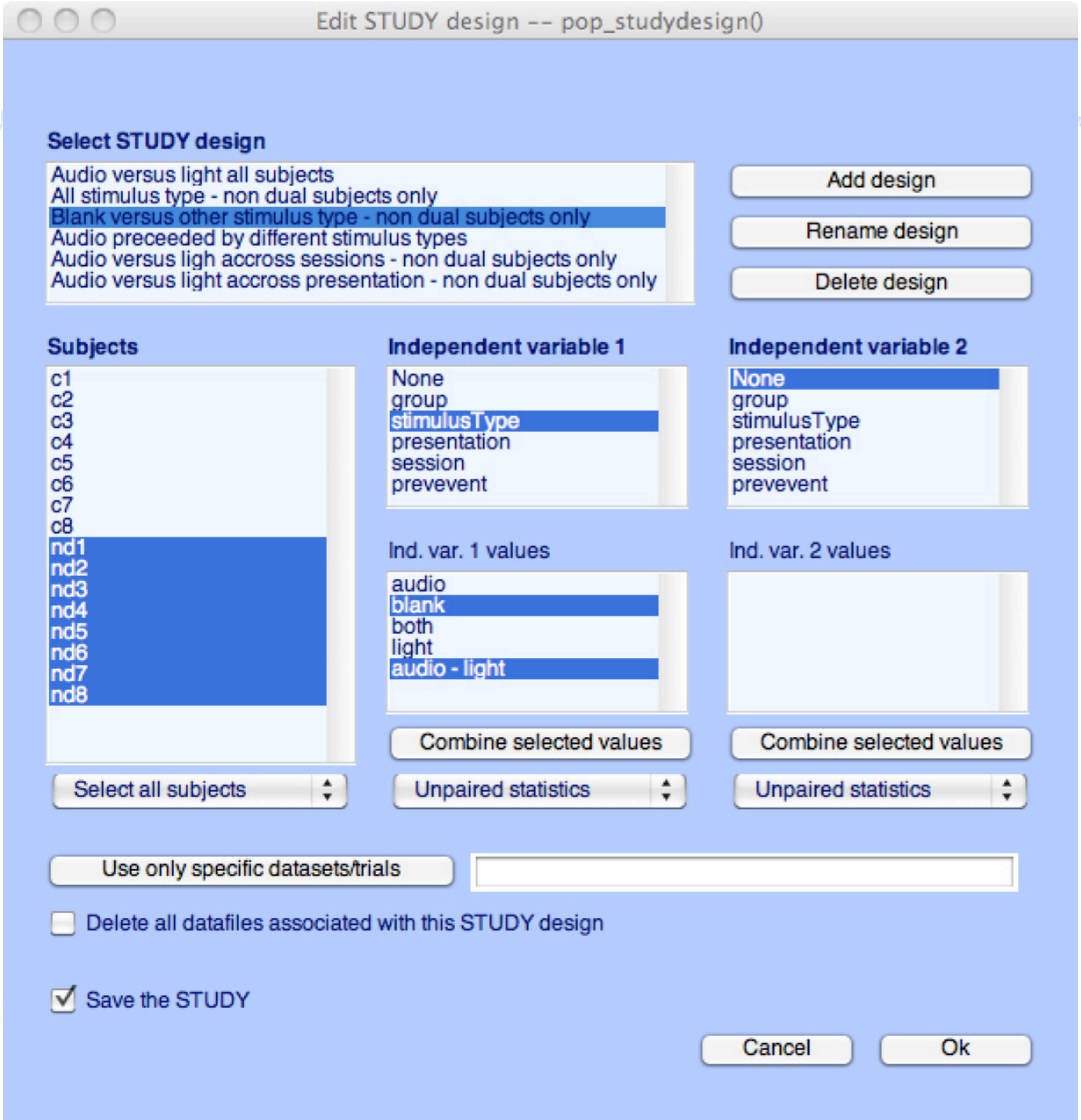
1x3 design

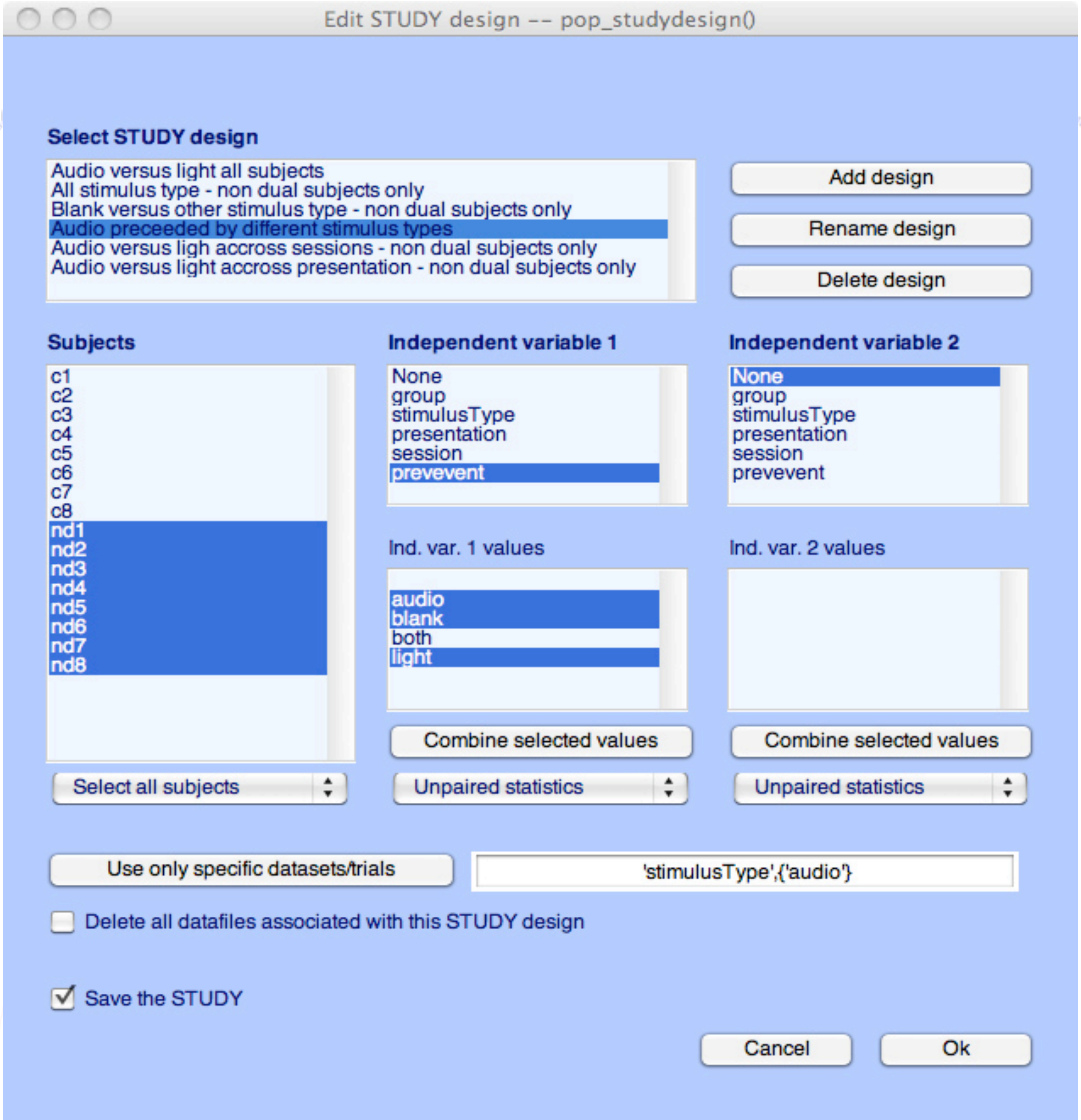


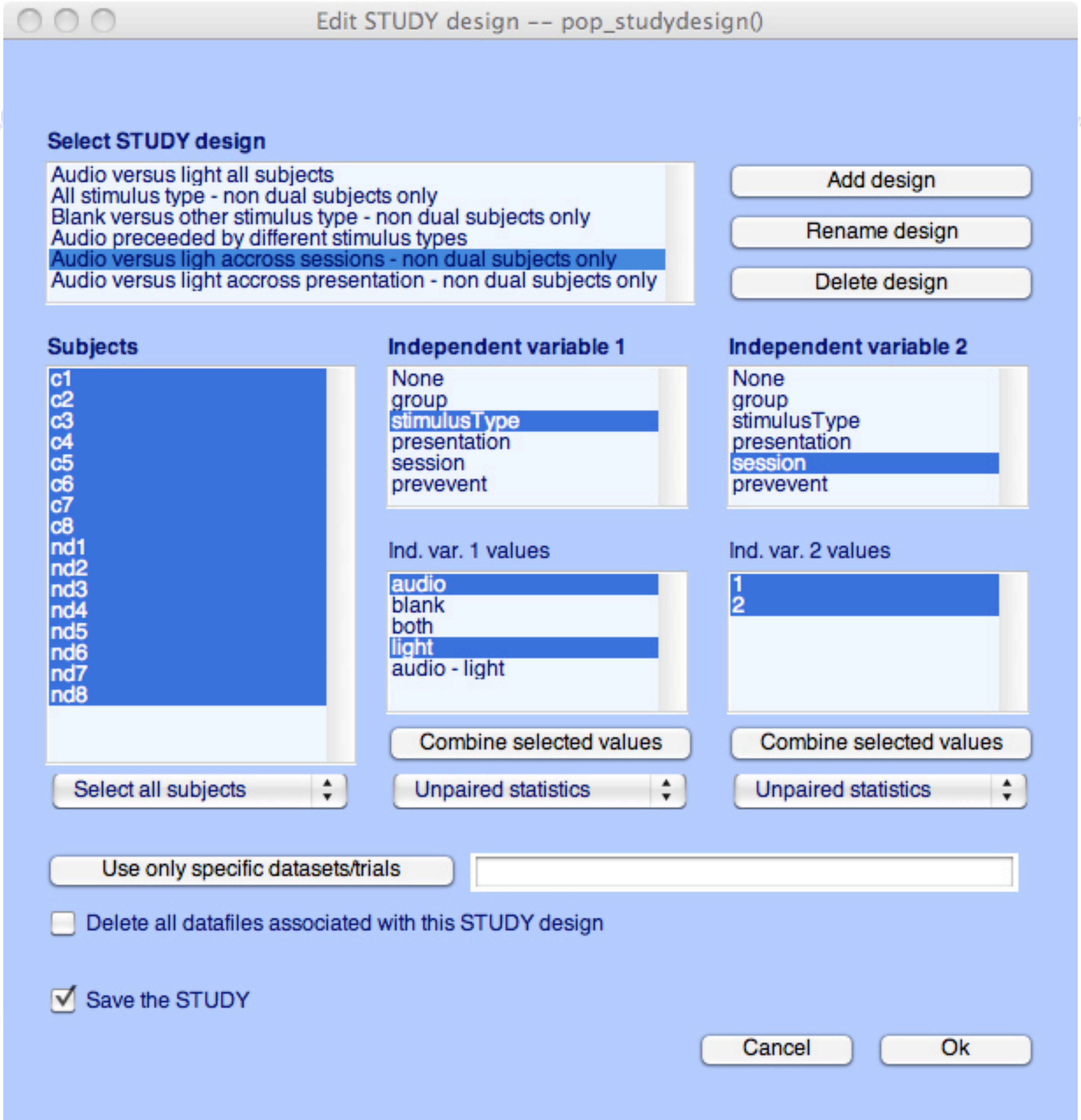


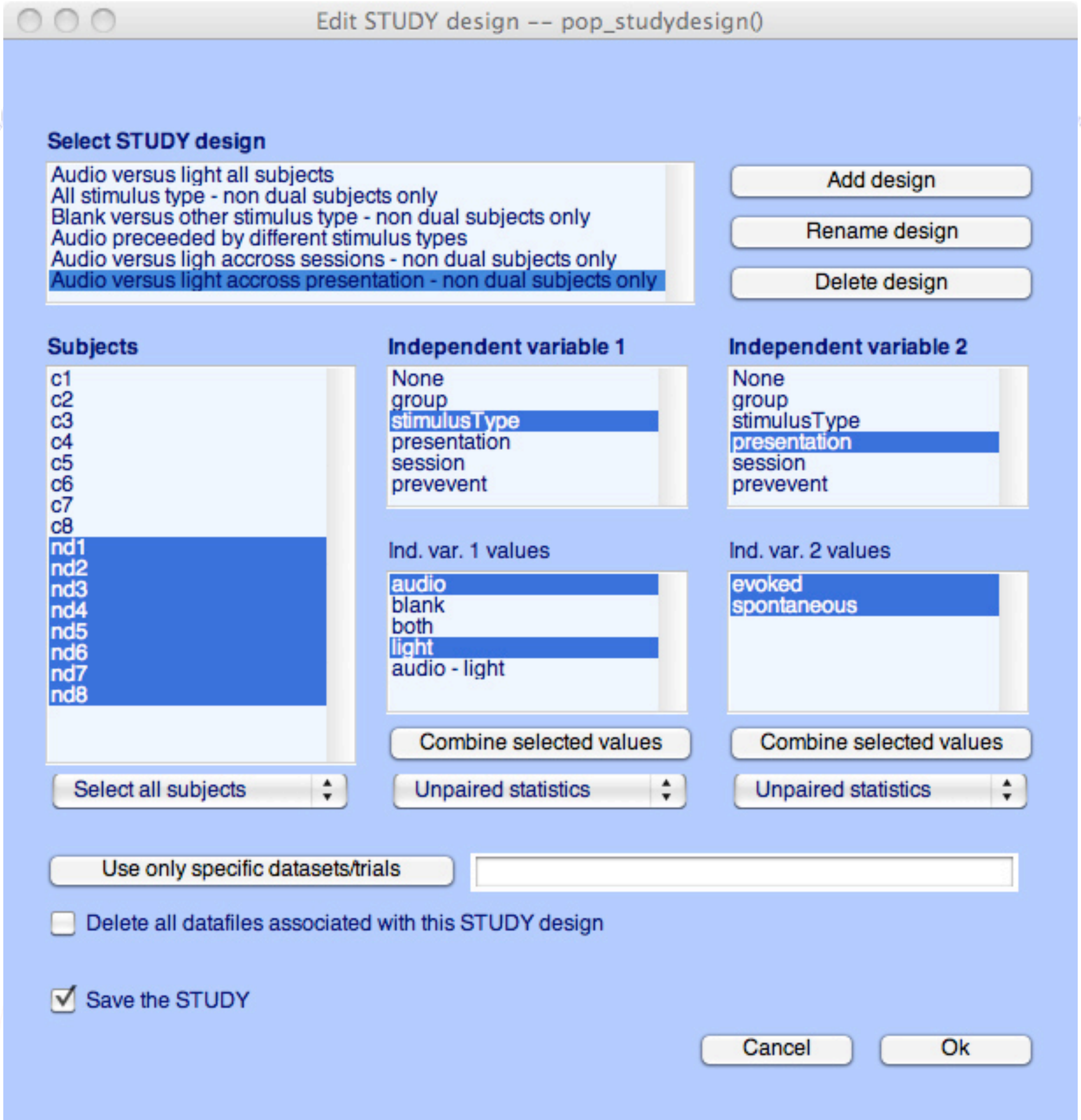
Edit STUDY design -- pop_studydesign()
Select STUDY design
Audio versus light all subjects
All stimulus type - non dual subjects only
Blank versus other stimulus type - non dual subjects only
Audio preceeded by different stimulus types
Audio versus ligh accross sessions - non dual subjects only
Audio versus light accross presentation - non dual subjects only
Add design
Rename design
Delete design
Subjects
c1
c2
c3
c4
c5
c6
c7
c8
nd1
nd2
nd3
nd4
nd5
nd6
nd7
nd8
Independent variable 1
None
group
stimulusType
presentation
session
prevevent
Independent variable 2
None
group
stimulusType
presentation
session
prevevent
Ind. var. 1 values
audio
blank
both
light
audio - light
Ind. var. 2 values
control
nondual
Combine selected values
Combine selected values
Select all subjects
Unpaired statistics
Unpaired statistics
Use only specific datasets/trials
Delete all datafiles associated with this STUDY design
Save the STUDY
Cancel
Ok


Edit STUDY design -- pop_studydesign()
Select STUDY design
Audio versus light all subjects
All stimulus type - non dual subjects only
Blank versus other stimulus type - non dual subjects only
Audio preceeded by different stimulus types
Audio versus ligh accross sessions - non dual subjects only
Audio versus light accross presentation - non dual subjects only
Add design
Rename design
Delete design
Subjects
c1
c2
c3
c4
c5
c6
c7
c8
nd1
nd2
nd3
nd4
nd5
nd6
nd7
nd8
Select all subjects
Independent variable 1
None
group
stimulusType
presentation
session
prevevent
Ind. var. 1 values
audio
blank
both
light
audio - light
Combine selected values
Unpaired statistics
Independent variable 2
None
group
stimulusType
presentation
session
prevevent
Ind. var. 2 values
Combine selected values
Unpaired statistics
Use only specific datasets/trials
Delete all datafiles associated with this STUDY design
Save the STUDY
Cancel
Ok


Edit STUDY design -- pop_studydesign()
Select STUDY design
Audio versus light all subjects
All stimulus type - non dual subjects only
Blank versus other stimulus type - non dual subjects only
Audio preceeded by different stimulus types
Audio versus ligh accross sessions - non dual subjects only
Audio versus light accross presentation - non dual subjects only
Add design
Rename design
Delete design
Subjects
c1
c2
c3
c4
c5
c6
c7
c8
nd1
nd2
nd3
nd4
nd5
nd6
nd7
nd8
Select all subjects
Independent variable 1
None
group
stimulusType
presentation
session
prevevent
Ind. var. 1 values
audio
blank
both
light
audio - light
Combine selected values
Unpaired statistics
Independent variable 2
None
group
stimulusType
presentation
session
prevevent
Ind. var. 2 values
Combine selected values
Unpaired statistics
Use only specific datasets/trials
Delete all datafiles associated with this STUDY design
Save the STUDY
Cancel
Ok


Edit STUDY design -- pop_studydesign()
Select STUDY design
Audio versus light all subjects
All stimulus type - non dual subjects only
Blank versus other stimulus type - non dual subjects only
Audio preceeded by different stimulus types
Audio versus ligh accross sessions - non dual subjects only
Audio versus light accross presentation - non dual subjects only
Add design
Rename design
Delete design
Subjects
c1
c2
c3
c4
c5
c6
c7
c8
nd1
nd2
nd3
nd4
nd5
nd6
nd7
nd8
Independent variable 1
None
group
stimulusType
presentation
session
prevevent
Independent variable 2
None
group
stimulusType
presentation
session
prevevent
Ind. var. 1 values
audio
blank
both
light
Ind. var. 2 values
Combine selected values
Combine selected values
Select all subjects
Unpaired statistics
Unpaired statistics
Use only specific datasets/trials
'stimulusType',{'audio'}
Delete all datafiles associated with this STUDY design
Save the STUDY
Cancel
Ok


Edit STUDY design -- pop_studydesign()
Select STUDY design
Audio versus light all subjects
All stimulus type - non dual subjects only
Blank versus other stimulus type - non dual subjects only
Audio preceeded by different stimulus types
Audio versus ligh accross sessions - non dual subjects only
Audio versus light accross presentation - non dual subjects only
Add design
Rename design
Delete design
Subjects
c1
c2
c3
c4
c5
c6
c7
c8
nd1
nd2
nd3
nd4
nd5
nd6
nd7
nd8
Select all subjects
Independent variable 1
None
group
stimulusType
presentation
session
prevevent
Ind. var. 1 values
audio
blank
both
light
audio - light
Combine selected values
Unpaired statistics
Independent variable 2
None
group
stimulusType
presentation
session
prevevent
Ind. var. 2 values
1
2
Combine selected values
Unpaired statistics
Use only specific datasets/trials
Delete all datafiles associated with this STUDY design
Save the STUDY
Cancel
Ok


Edit STUDY design -- pop_studydesign()
Select STUDY design
Audio versus light all subjects
All stimulus type - non dual subjects only
Blank versus other stimulus type - non dual subjects only
Audio preceeded by different stimulus types
Audio versus ligh accross sessions - non dual subjects only
Audio versus light accross presentation - non dual subjects only
Add design
Rename design
Delete design
Subjects
c1
c2
c3
c4
c5
c6
c7
c8
nd1
nd2
nd3
nd4
nd5
nd6
nd7
nd8
Independent variable 1
None
group
stimulusType
presentation
session
prevevent
Independent variable 2
None
group
stimulusType
presentation
session
prevevent
Ind. var. 1 values
audio
blank
both
light
audio - light
Ind. var. 2 values
evoked
spontaneous
Combine selected values
Combine selected values
Select all subjects
Unpaired statistics
Unpaired statistics
Use only specific datasets/trials
Delete all datafiles associated with this STUDY design
Save the STUDY
Cancel
Ok

STUDY design and plotting overview

STEP 1

Build a STUDY

STEP 2

Build design(s)

STEP 3

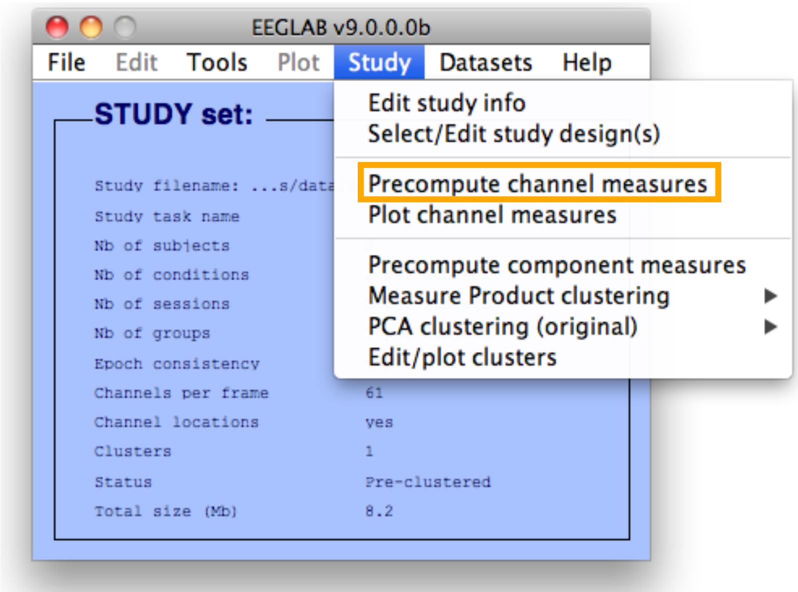
Precompute the data

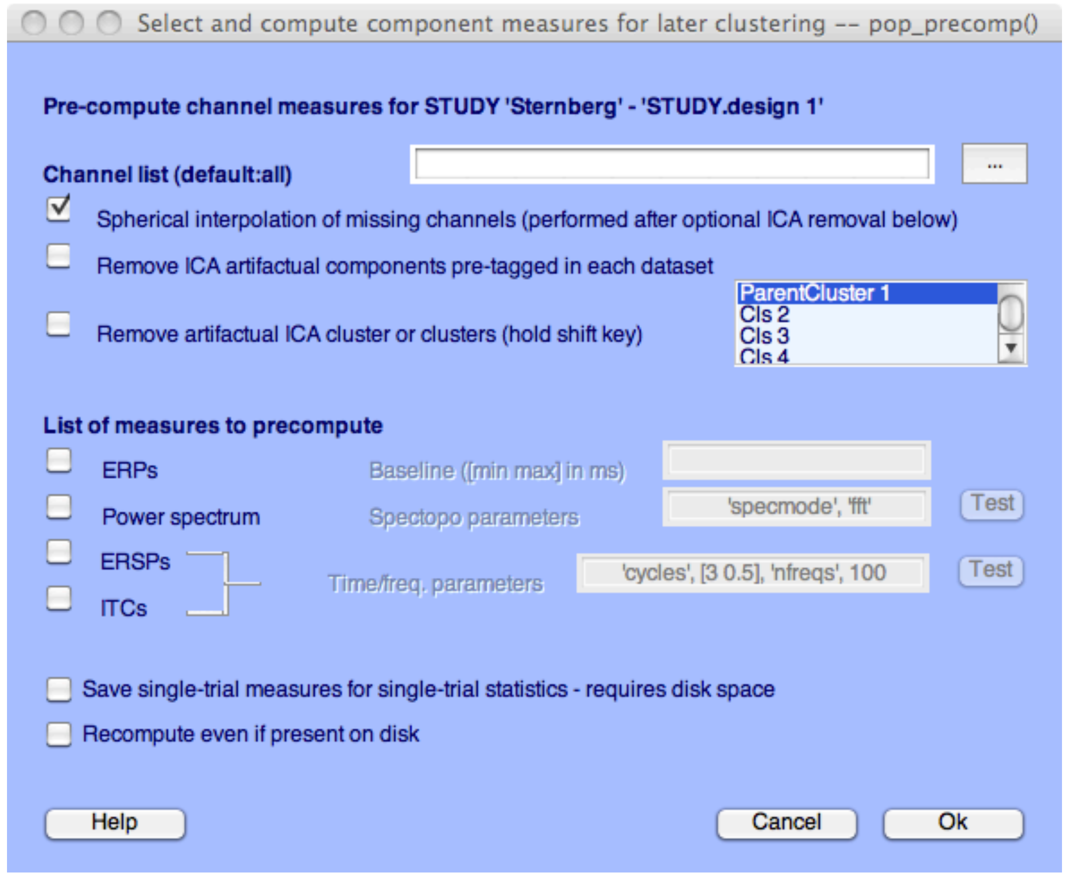
STEP 4

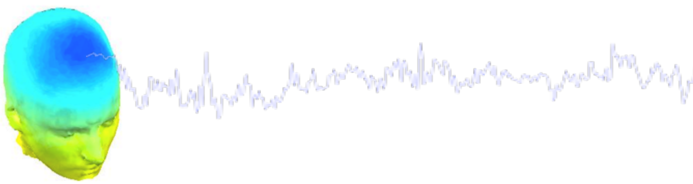
Plot the data

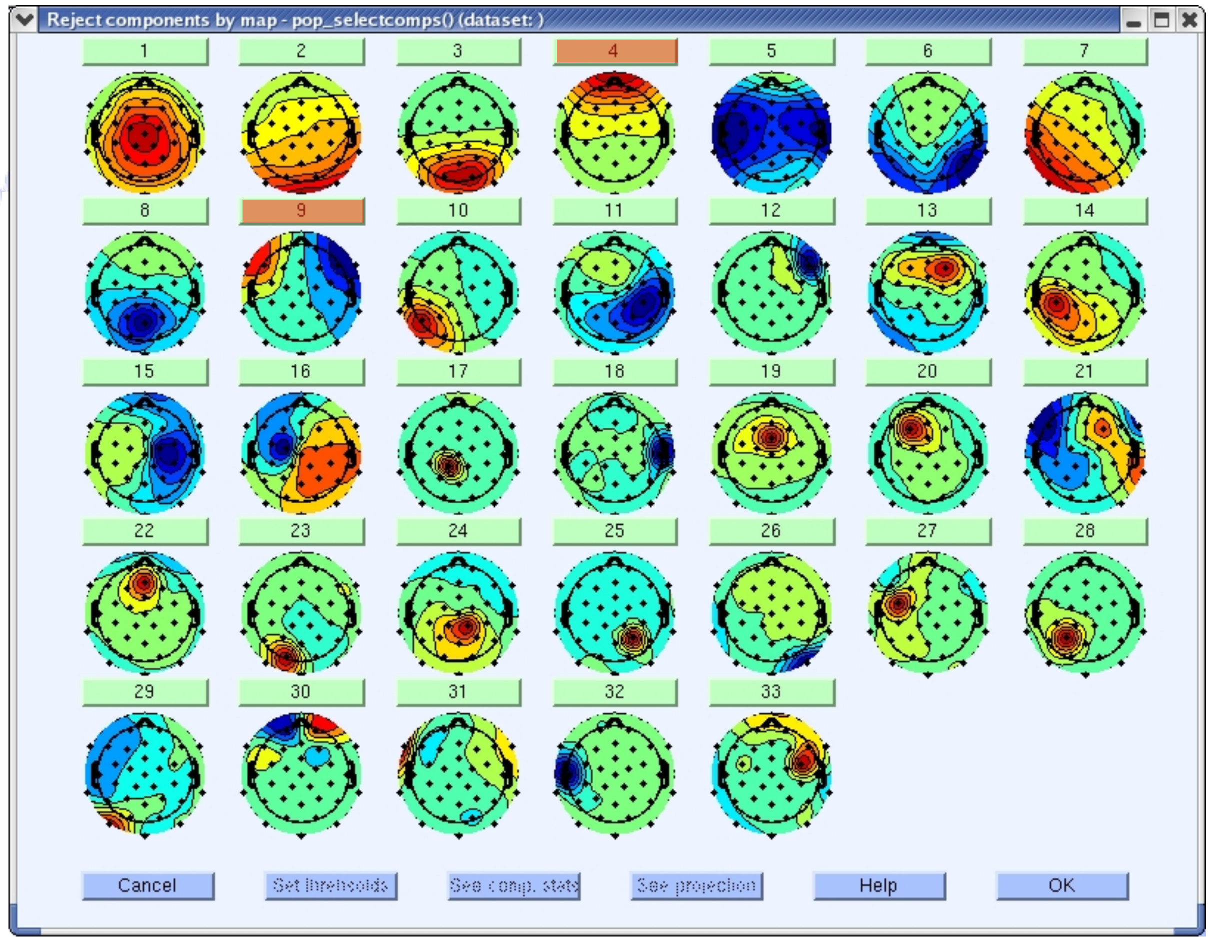
Exercise...

Precompute data measures

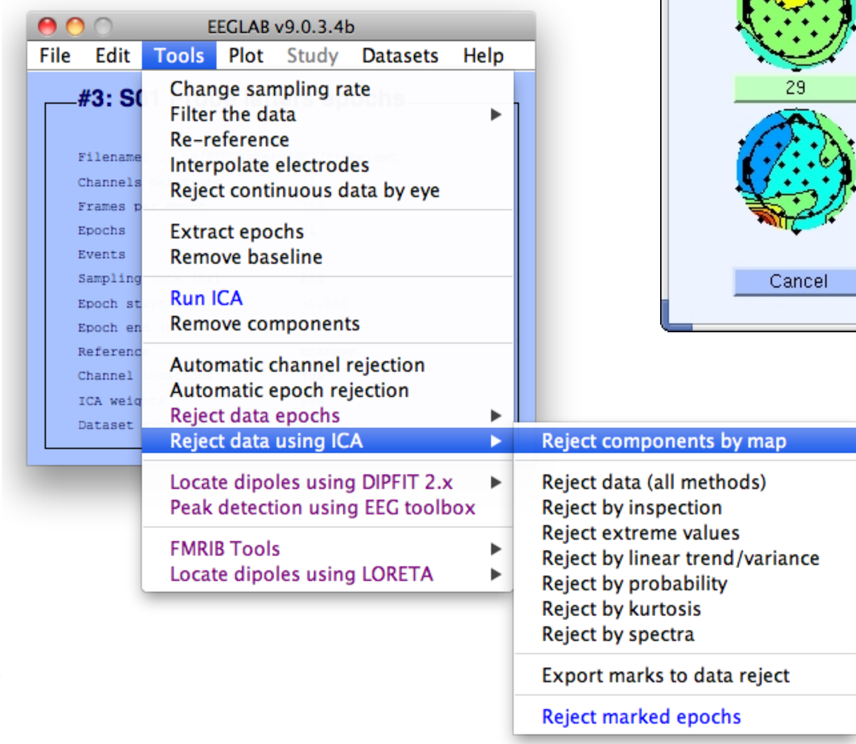




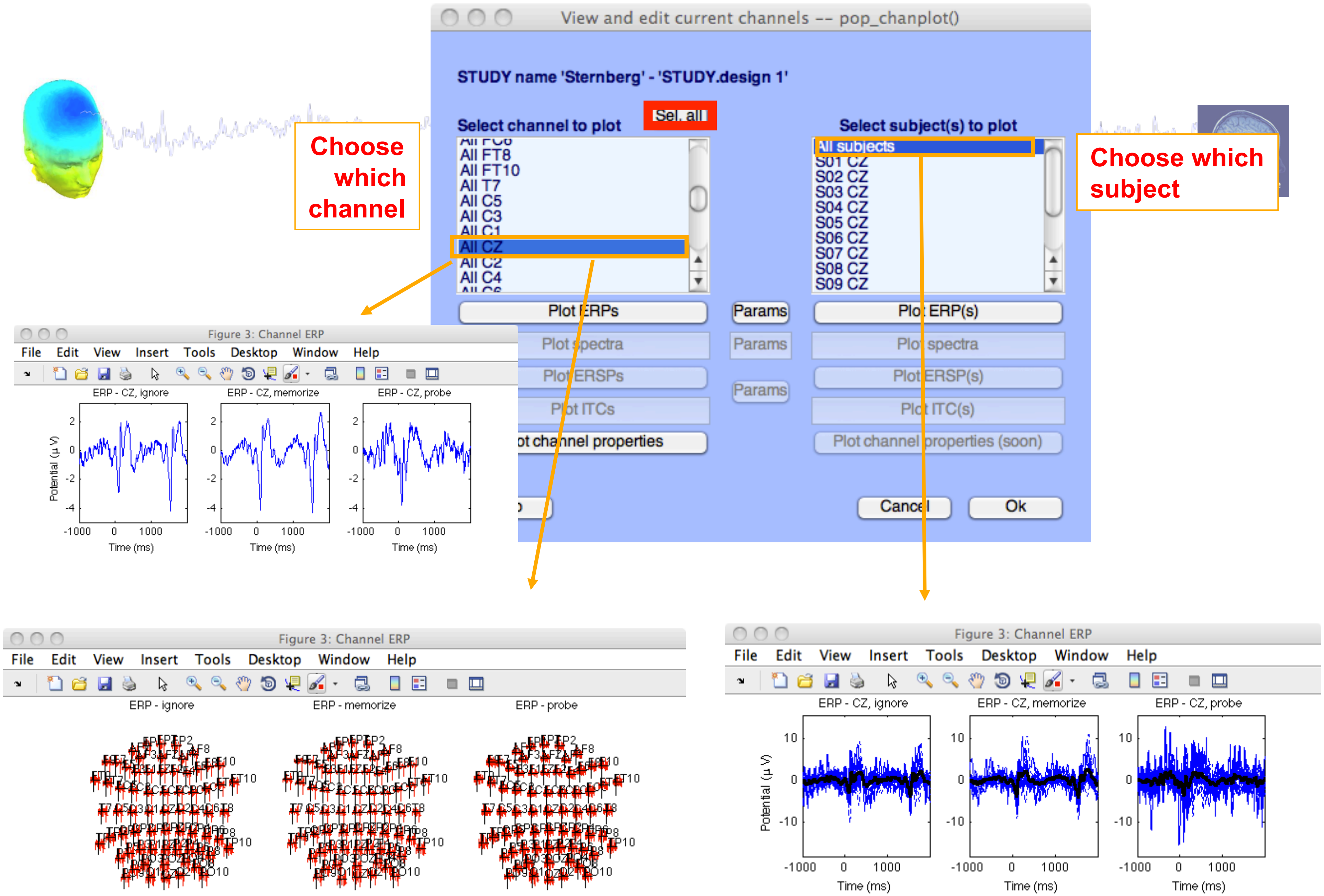




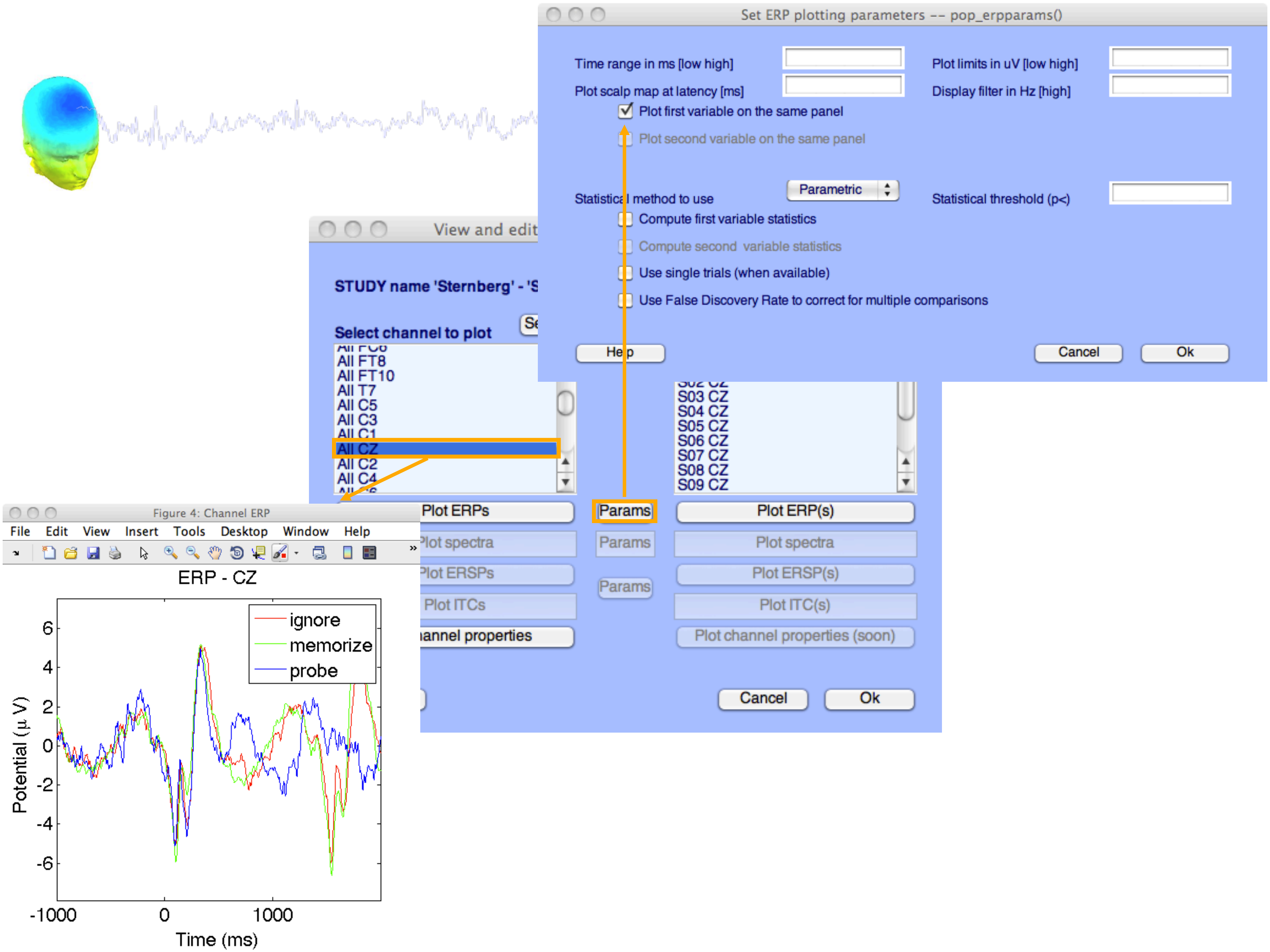
Reject components by map - pop_selectcomps() (dataset:)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
Cancel
Set thresholds
See comp. stats
See projection
Help
OK



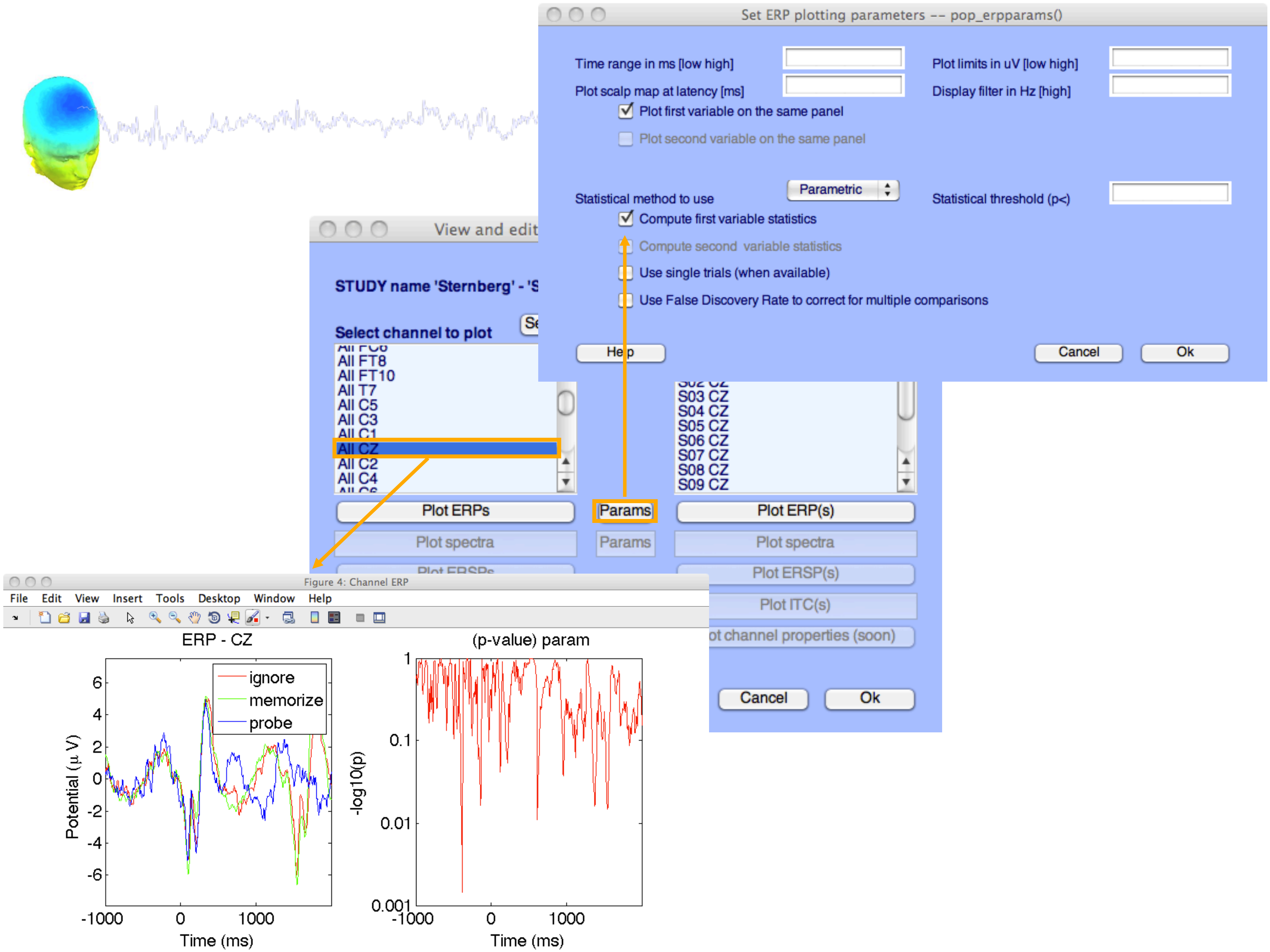
EEGLAB v9.0.3.4b
File
Edit
Tools
Plot
Study
Datasets
Help
#3: S
Filename
Channels
Frames p
Epochs
Events
Sampling
Epoch st
Epoch en
Referenc
Channel
ICA weig
Dataset
Change sampling rate
Filter the data
Re-reference
Interpolate electrodes
Reject continuous data by eye
Extract epochs
Remove baseline
Run ICA
Remove components
Automatic channel rejection
Automatic epoch rejection
Reject data epochs
Reject data using ICA
Locate dipoles using DIPFIT 2.x
Peak detection using EEG toolbox
FMRIB Tools
Locate dipoles using LORETA
Reject components by map
Reject data (all methods)
Reject by inspection
Reject extreme values
Reject by linear trend/variance
Reject by probability
Reject by kurtosis
Reject by spectra
Export marks to data reject
Reject marked epochs



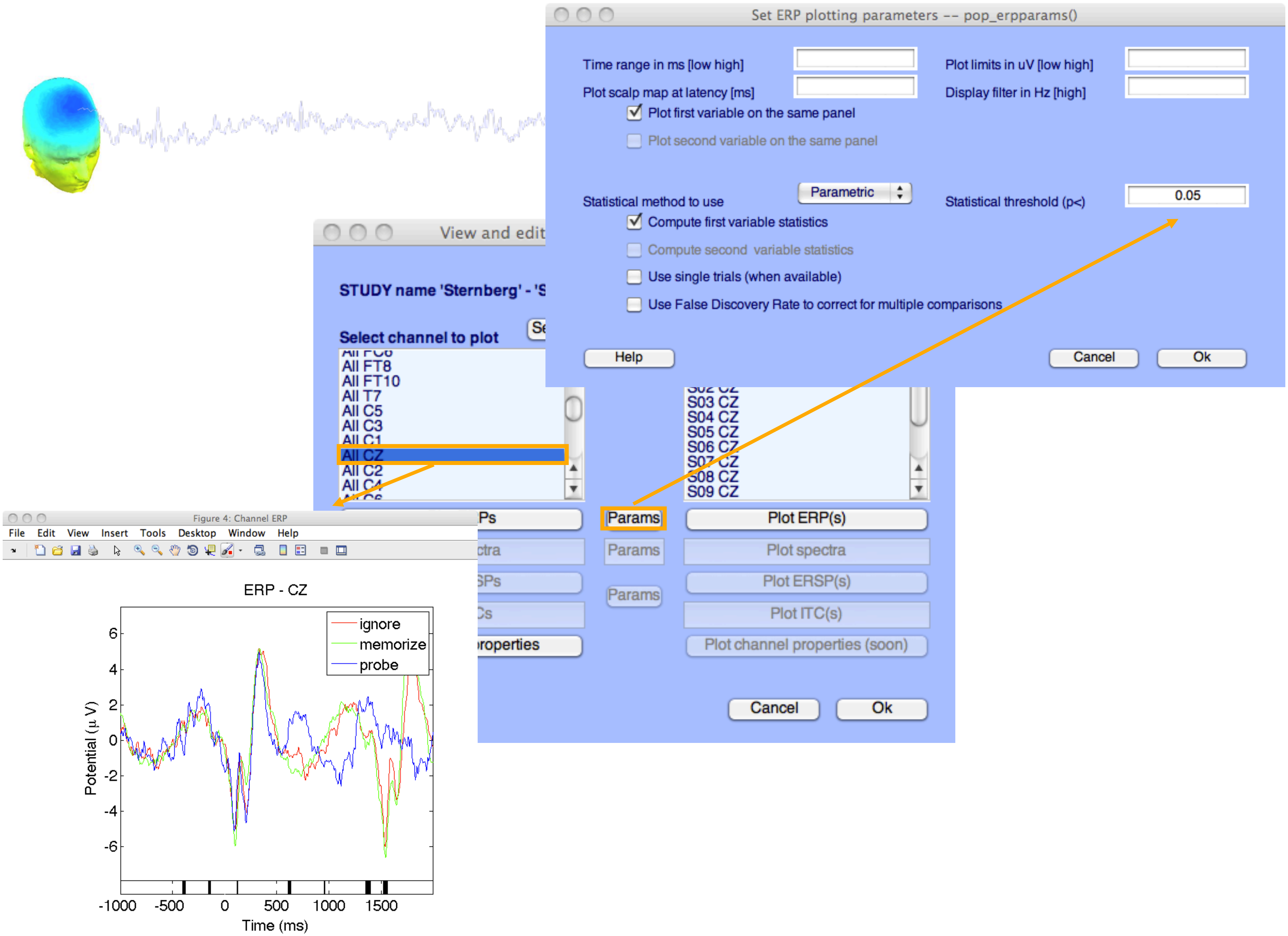
View and edit current channels -- pop_chanplot()
STUDY name 'Sternberg' - 'STUDY.design 1'
Select channel to plot
Sel. all
Select subject(s) to plot
All FT8
All FT10
All T7
All C5
All C3
All C1
All CZ
All C2
All C4
All subjects
S01 CZ
S02 CZ
S03 CZ
S04 CZ
S05 CZ
S06 CZ
S07 CZ
S08 CZ
S09 CZ
Plot ERPs
Params
Plot ERP(s)
Plot spectra
Plot ERSPs
Plot ERSP(s)
Plot ITCs
Plot ITC(s)
Plot channel properties (soon)
Cancel
Ok
Choose which channel
Choose which subject
Figure 3: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - CZ, ignore
ERP - CZ, memorize
ERP - CZ, probe
Potential (µ V)
Time (ms)
ERP - ignore
ERP - memorize
ERP - probe



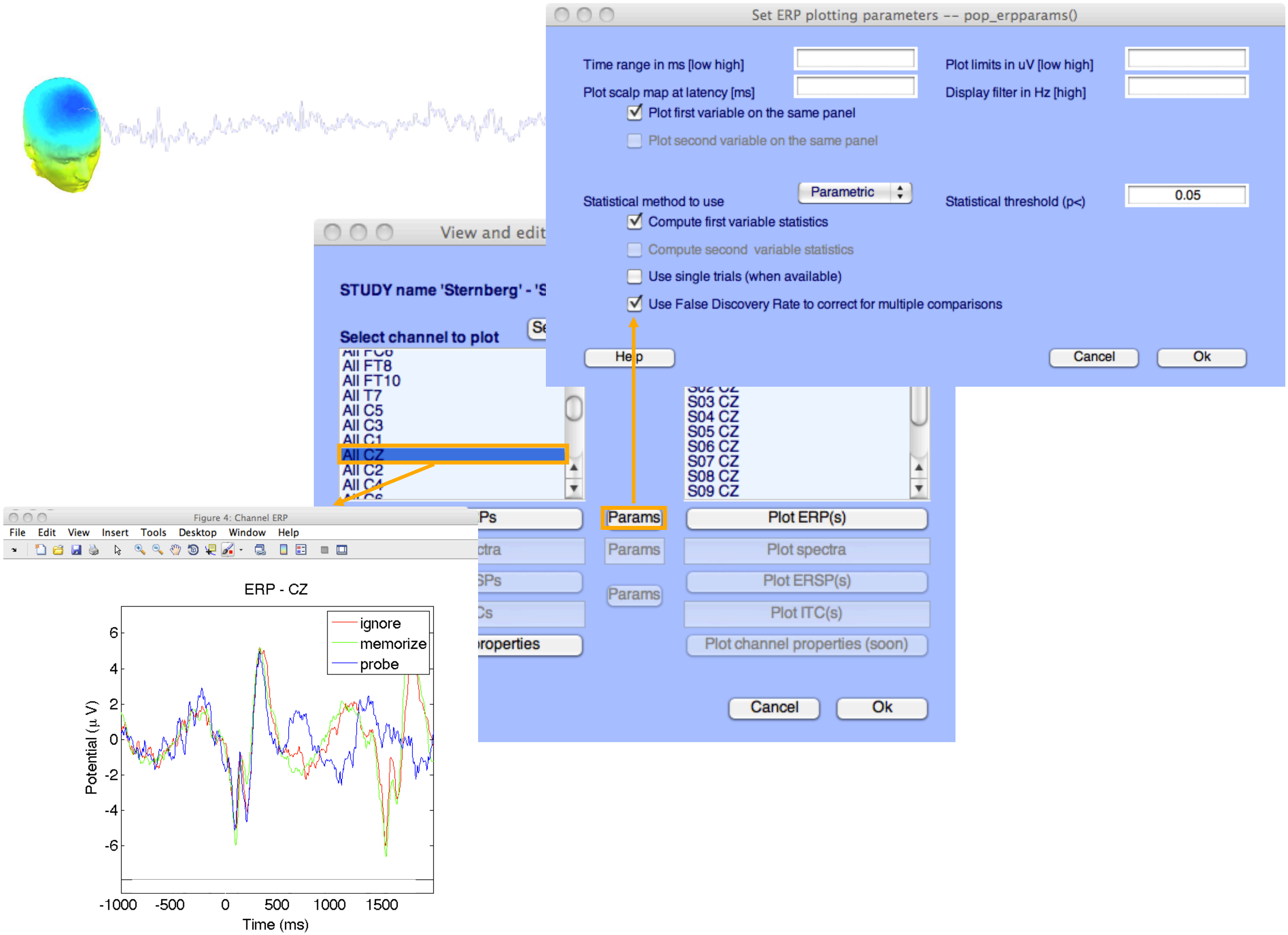
Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Parametric
Statistical threshold (p<)
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All FT8
All FT10
All T7
All C5
All C3
All C1
All CZ
All C2
All C4
S03 CZ
S04 CZ
S05 CZ
S06 CZ
S07 CZ
S08 CZ
S09 CZ
Plot ERPs
Params
Plot ERP(s)
Plot spectra
Params
Plot spectra
Plot ERSPs
Params
Plot ERSP(s)
Plot ITCs
Plot ITC(s)
Plot channel properties (soon)
Cancel
Ok
Figure 4: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - CZ
ignore
memorize
probe
Potential (µ V)
6
4
2
0
-2
-4
-6
-1000
0
1000
Time (ms)

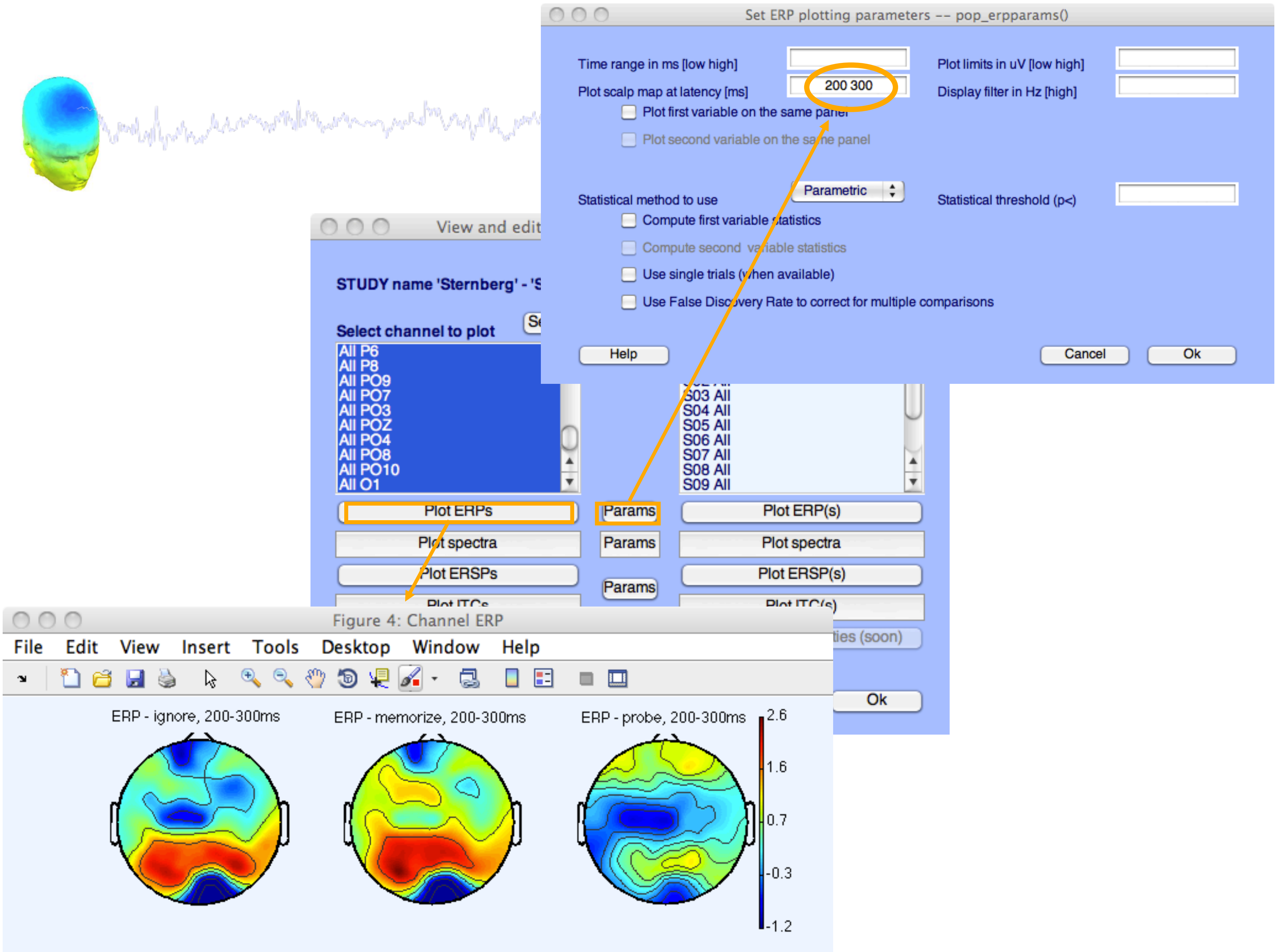


Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Parametric
Statistical threshold (p<)
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All FT8
All FT10
All T7
All C5
All C3
All C1
All CZ
All C2
All C4
S03 CZ
S04 CZ
S05 CZ
S06 CZ
S07 CZ
S08 CZ
S09 CZ
Plot ERPs
Params
Plot ERP(s)
Plot spectra
Params
Plot spectra
Plot ERSP(s)
Plot ITC(s)
Cancel
Ok
Figure 4: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - CZ
ignore
memorize
probe
Potential (µ V)
Time (ms)
(p-value) param
-log10(p)
Time (ms)

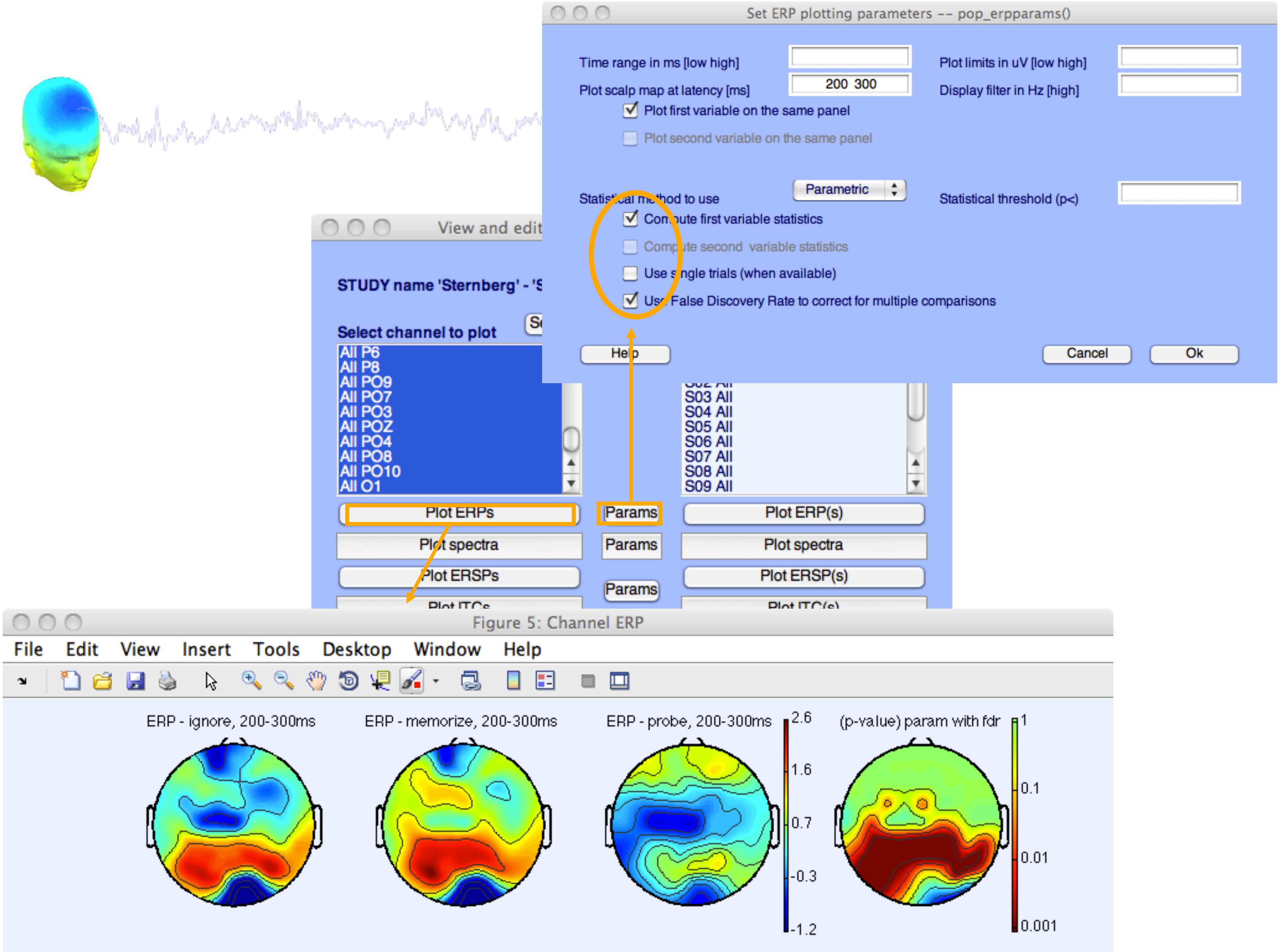


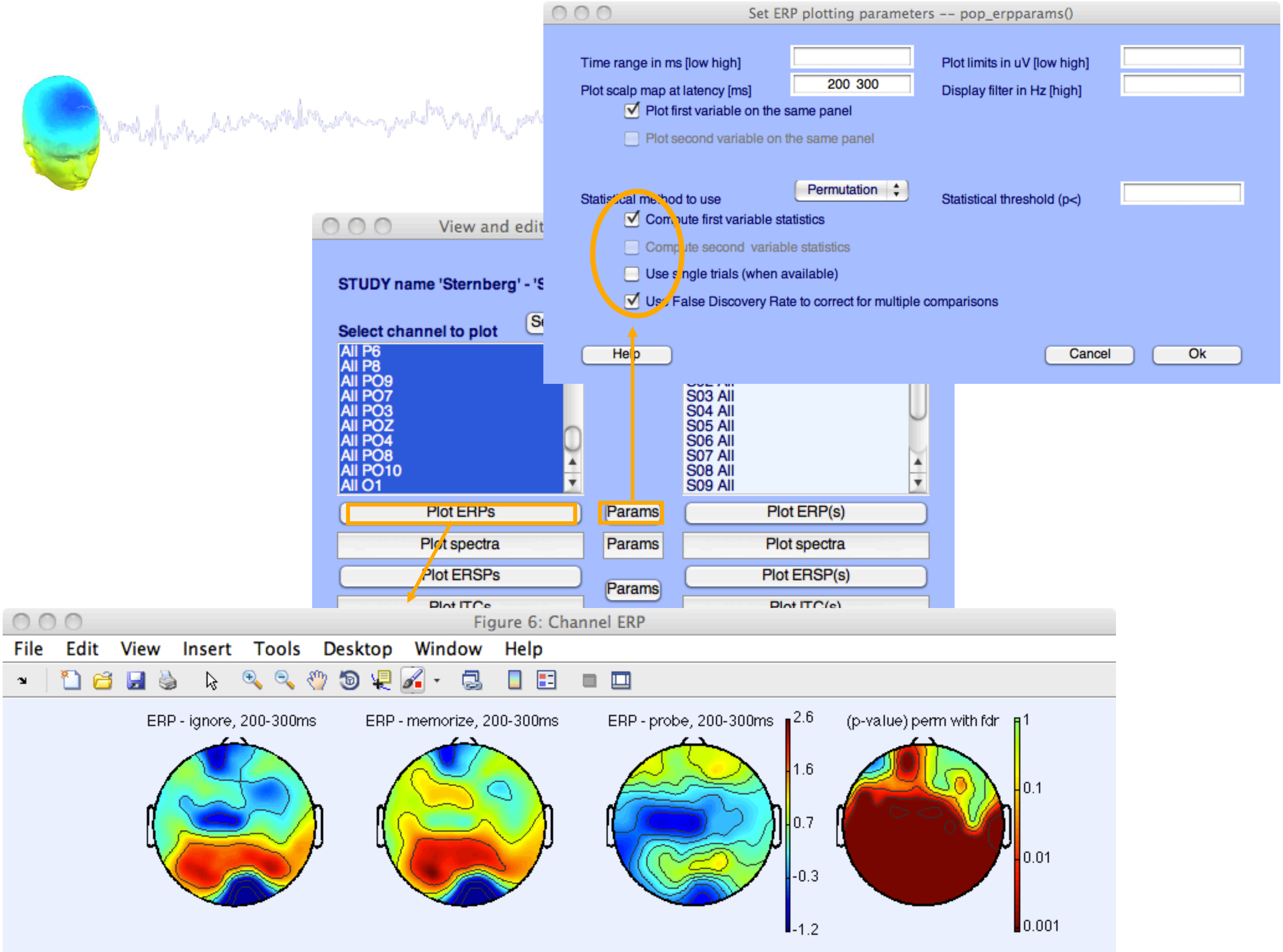
Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Parametric
Statistical threshold (p<)
0.05
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All FT8
All FT10
All T7
All C5
All C3
All C1
All CZ
All C2
All C4
S03 CZ
S04 CZ
S05 CZ
S06 CZ
S07 CZ
S08 CZ
S09 CZ
Params
Plot ERP(s)
Params
Plot spectra
Params
Plot ERSP(s)
Plot ITC(s)
Plot channel properties (soon)
Cancel
Ok
Figure 4: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - CZ
ignore
memorize
probe
Potential (µ V)
Time (ms)


Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Parametric
Statistical threshold (p<)
0.05
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All FT8
All FT10
All T7
All C5
All C3
All C1
All CZ
All C2
All C4
S03 CZ
S04 CZ
S05 CZ
S06 CZ
S07 CZ
S08 CZ
S09 CZ
Params
Plot ERP(s)
Params
Plot spectra
Params
Plot ERSP(s)
Plot ITC(s)
Plot channel properties (soon)
Cancel
Ok
Figure 4: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - CZ
ignore
memorize
probe
Potential (μ V)
6
4
2
0
-2
-4
-6
-1000 -500 0 500 1000 1500
Time (ms)



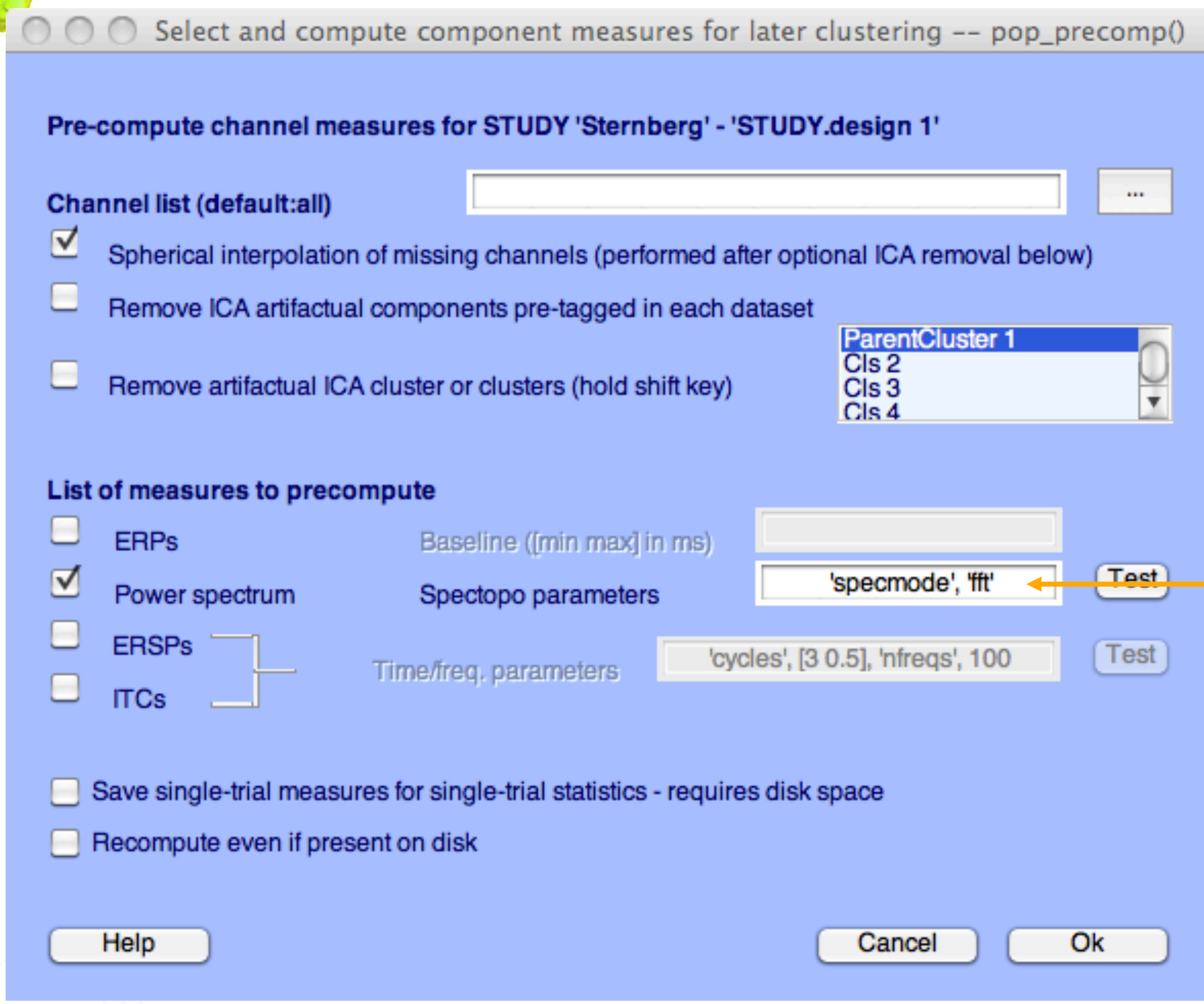
Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
200 300
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Parametric
Statistical threshold (p<)
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All P6
All P8
All PO9
All PO7
All PO3
All POZ
All PO4
All PO8
All PO10
All O1
S03 All
S04 All
S05 All
S06 All
S07 All
S08 All
S09 All
Plot ERPs
Params
Plot ERP(s)
Plot spectra
Params
Plot spectra
Plot ERSPs
Params
Plot ERSP(s)
Figure 4: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - ignore, 200-300ms
ERP - memorize, 200-300ms
ERP - probe, 200-300ms
2.6
1.6
0.7
-0.3
-1.2
Ok


Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
200 300
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Parametric
Statistical threshold (p<)
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All P6
All P8
All PO9
All PO7
All PO3
All POZ
All PO4
All PO8
All PO10
All O1
S03 All
S04 All
S05 All
S06 All
S07 All
S08 All
S09 All
Plot ERPs
Params
Plot ERP(s)
Plot spectra
Params
Plot spectra
Plot ERSPs
Params
Plot ERSP(s)
Figure 5: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - ignore, 200-300ms
ERP - memorize, 200-300ms
ERP - probe, 200-300ms
2.6
1.6
0.7
-0.3
-1.2
(p-value) param with fdr
1
0.1
0.01
0.001

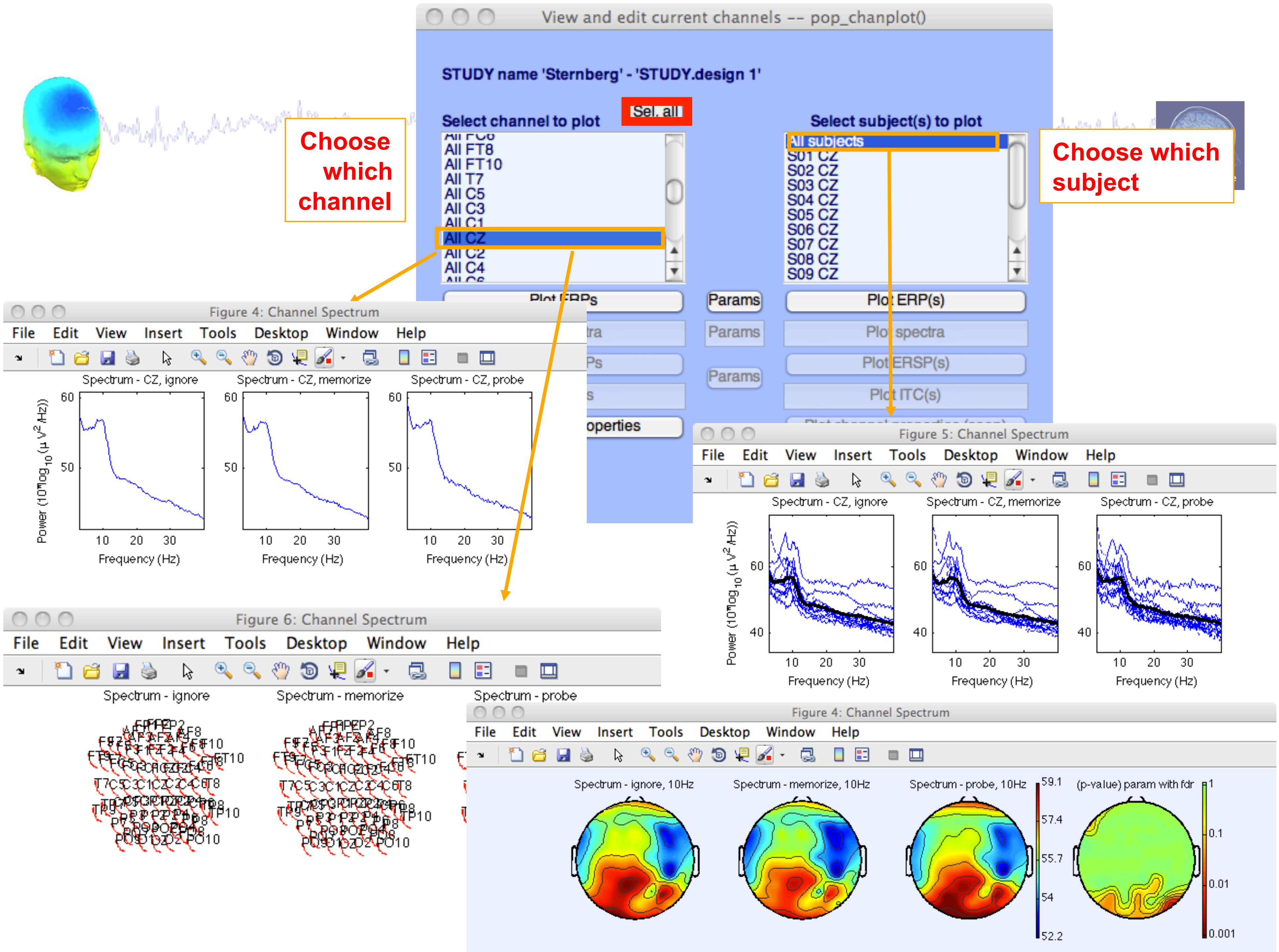


Set ERP plotting parameters -- pop_erpparams()
Time range in ms [low high]
Plot limits in uV [low high]
Plot scalp map at latency [ms]
200 300
Display filter in Hz [high]
Plot first variable on the same panel
Plot second variable on the same panel
Statistical method to use
Permutation
Statistical threshold (p<)
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok
View and edit
STUDY name 'Sternberg' - 'S
Select channel to plot
All P6
All P8
All PO9
All PO7
All PO3
All POZ
All PO4
All PO8
All PO10
All O1
S03 All
S04 All
S05 All
S06 All
S07 All
S08 All
S09 All
Plot ERPs
Params
Plot ERP(s)
Plot spectra
Params
Plot spectra
Plot ERSPs
Params
Plot ERSP(s)
Plot ITCs
Plot ITC(s)
Figure 6: Channel ERP
File Edit View Insert Tools Desktop Window Help
ERP - ignore, 200-300ms
ERP - memorize, 200-300ms
ERP - probe, 200-300ms
2.6
1.6
0.7
-0.3
-1.2
(p-value) perm with fdr
1
0.1
0.01
0.001

Computing Spectrum

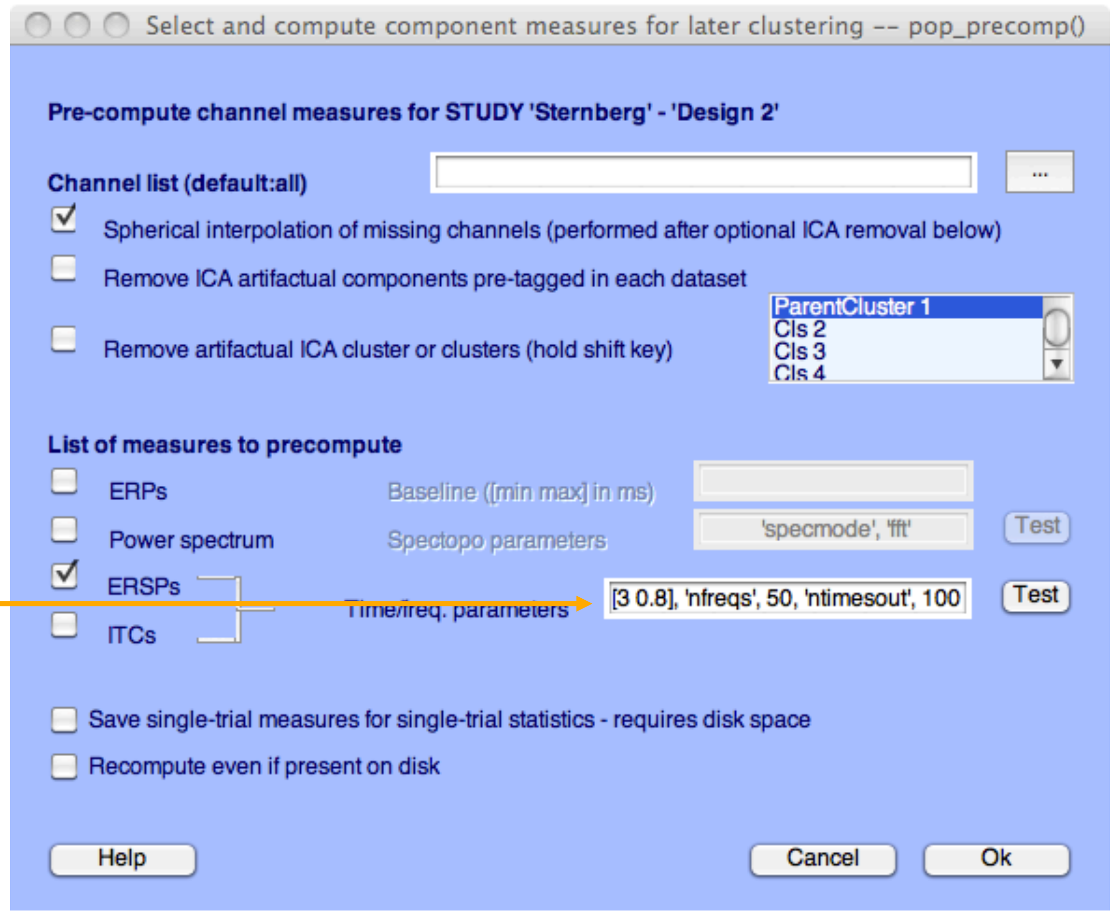


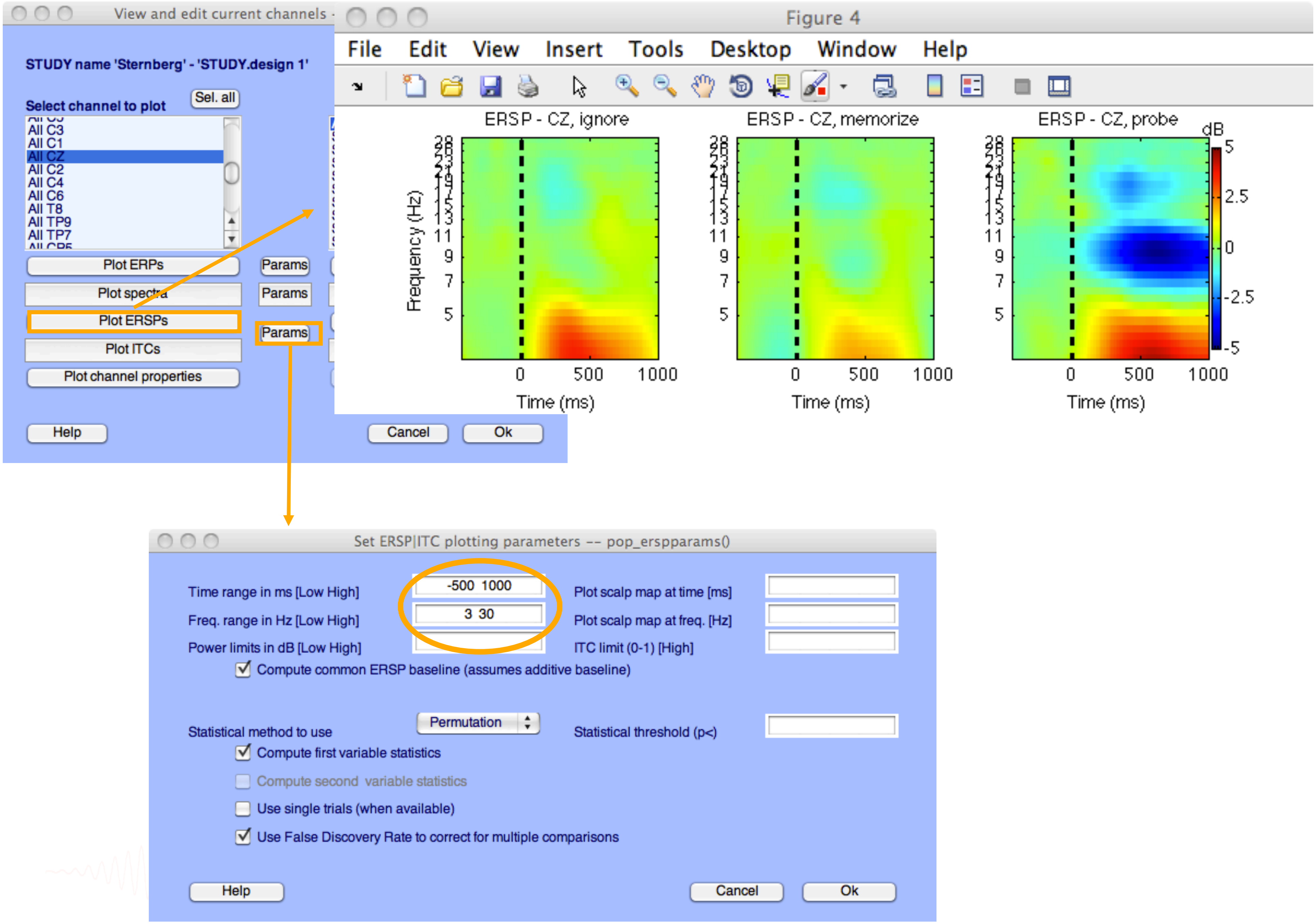
Use 'timerange' option to select time range, see "help std_spec"

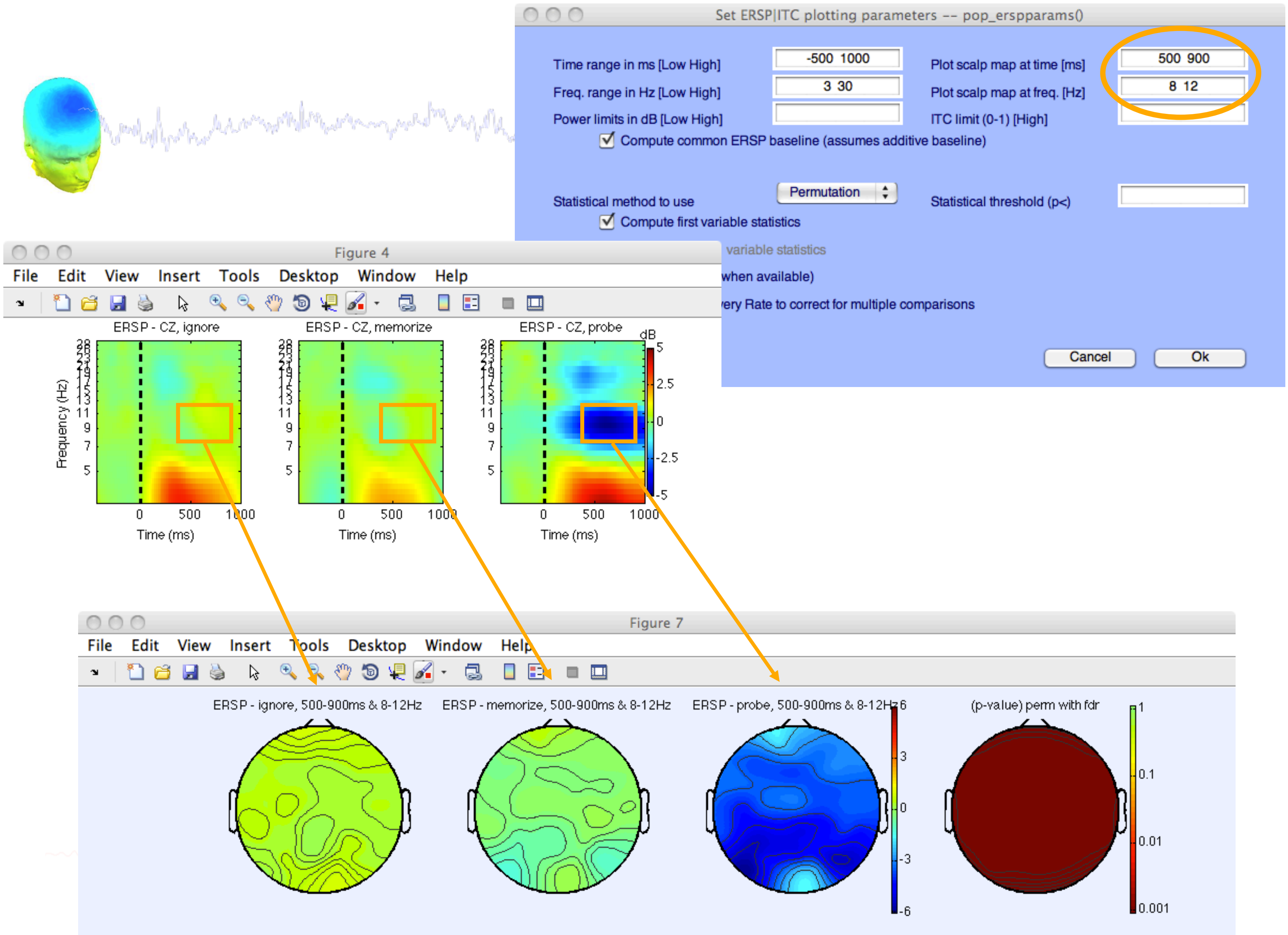

View and edit current channels -- pop_chanplot()
STUDY name 'Sternberg' - 'STUDY.design 1'
Sel. all
Select channel to plot
All FT8
All FT10
All T7
All C5
All C3
All C1
All CZ
All C2
All C4
Select subject(s) to plot
All subjects
S01 CZ
S02 CZ
S03 CZ
S04 CZ
S05 CZ
S06 CZ
S07 CZ
S08 CZ
S09 CZ
Params
Plot ERP(s)
Plot spectra
Plot ERSP(s)
Plot ITC(s)
Choose which channel
Choose which subject
Figure 4: Channel Spectrum
File Edit View Insert Tools Desktop Window Help
Spectrum - CZ, ignore
Spectrum - CZ, memorize
Spectrum - CZ, probe
Power (10*log10(μ V²/Hz))
Frequency (Hz)
Figure 5: Channel Spectrum
Figure 6: Channel Spectrum
Spectrum - ignore
Spectrum - memorize
Spectrum - probe
Spectrum - ignore, 10Hz
Spectrum - memorize, 10Hz
Spectrum - probe, 10Hz
(p-value) param with fdr

Computing ERSP

'cycles', [3 0.8], 'nfreqs', 50, 'ntimesout', 100

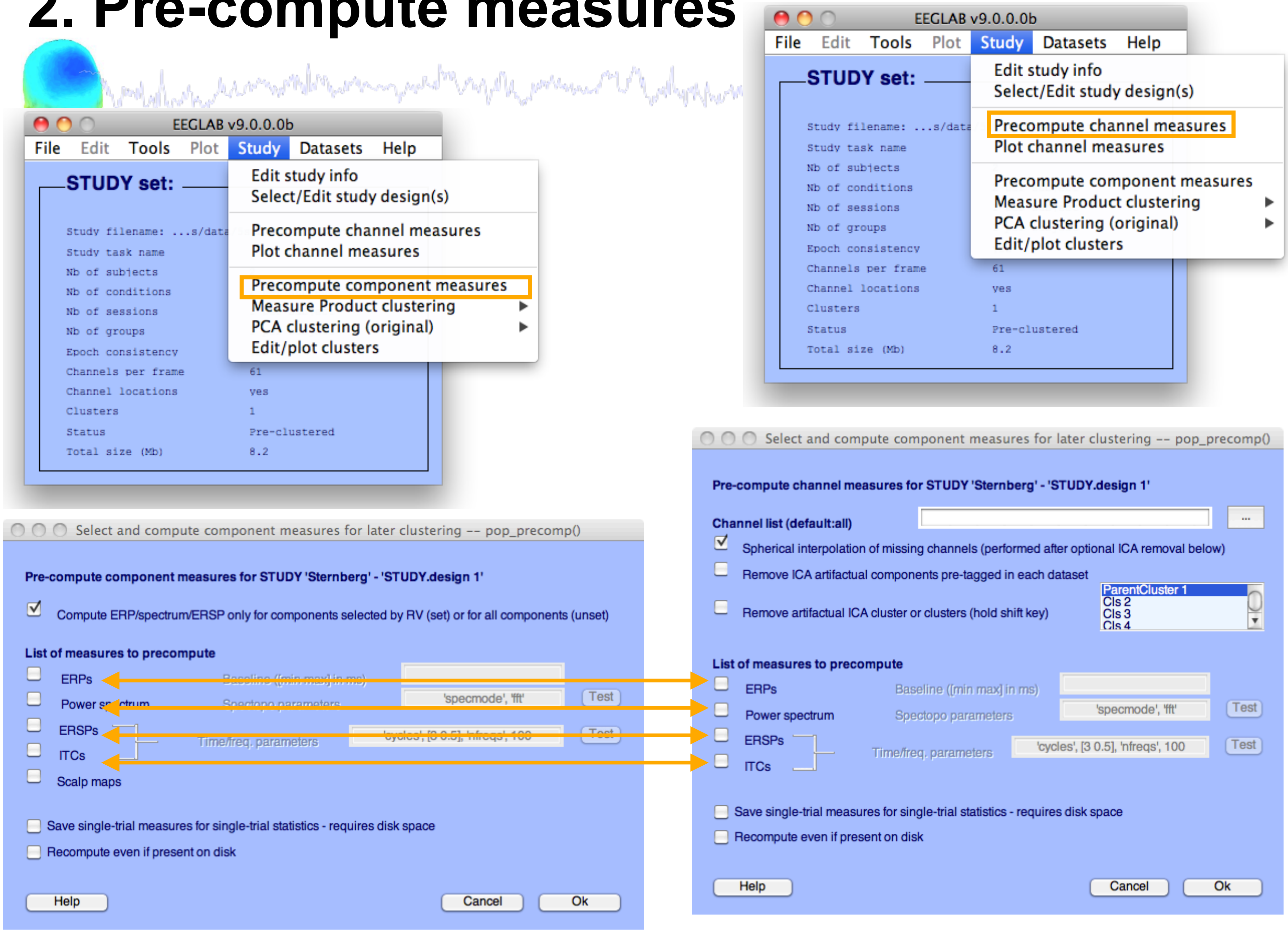



View and edit current channels -
STUDY name 'Sternberg' - 'STUDY.design 1'
Select channel to plot
Sel. all
All C3
All C1
All CZ
All C2
All C4
All C6
All T8
All TP9
All TP7
Plot ERPs
Plot spectra
Plot ERSPs
Plot ITCs
Plot channel properties
Params
Params
Params
Help
Cancel
Ok
Figure 4
File
Edit
View
Insert
Tools
Desktop
Window
Help
ERSP - CZ, ignore
ERSP - CZ, memorize
ERSP - CZ, probe
Frequency (Hz)
Time (ms)
dB
5
2.5
0
-2.5
-5
0
500
1000
11
9
7
5
Set ERSP|ITC plotting parameters -- pop_erspparams()
Time range in ms [Low High]
-500 1000
Freq. range in Hz [Low High]
3 30
Power limits in dB [Low High]
Plot scalp map at time [ms]
Plot scalp map at freq. [Hz]
ITC limit (0-1) [High]
Compute common ERSP baseline (assumes additive baseline)
Statistical method to use
Permutation
Statistical threshold (p<)
Compute first variable statistics
Compute second variable statistics
Use single trials (when available)
Use False Discovery Rate to correct for multiple comparisons
Help
Cancel
Ok

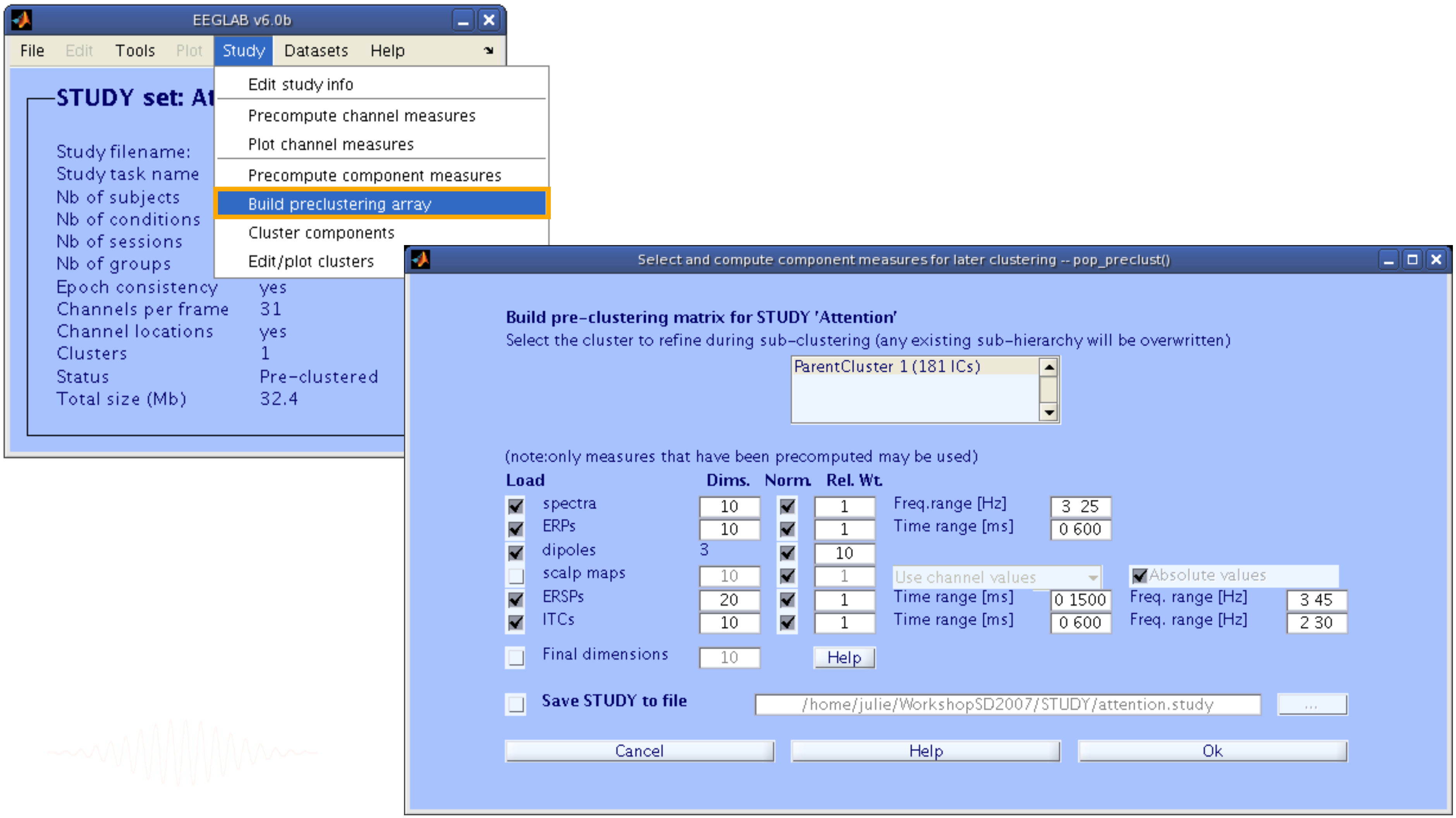


Set ERSP|ITC plotting parameters -- pop_erspparams()
Time range in ms [Low High]
-500 1000
Plot scalp map at time [ms]
500 900
Freq. range in Hz [Low High]
3 30
Plot scalp map at freq. [Hz]
8 12
Power limits in dB [Low High]
ITC limit (0-1) [High]
Compute common ERSP baseline (assumes additive baseline)
Statistical method to use
Permutation
Statistical threshold (p<)
Compute first variable statistics
variable statistics
when available)
ery Rate to correct for multiple comparisons
Cancel
Ok
Figure 4
File Edit View Insert Tools Desktop Window Help
ERSP - CZ, ignore
ERSP - CZ, memorize
ERSP - CZ, probe
Frequency (Hz)
Time (ms)
dB
Figure 7
ERSP - ignore, 500-900ms & 8-12Hz
ERSP - memorize, 500-900ms & 8-12Hz
ERSP - probe, 500-900ms & 8-12Hz
(p-value) perm with fdr

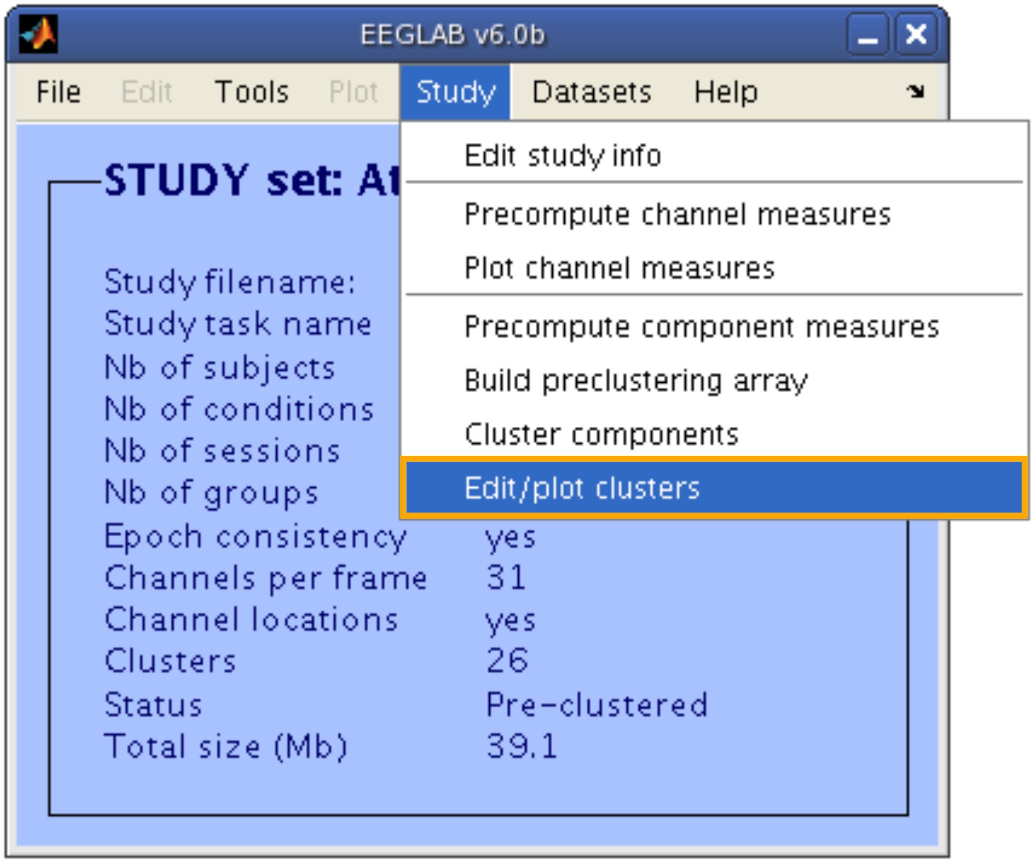
2. Pre-compute measures



3. Cluster components

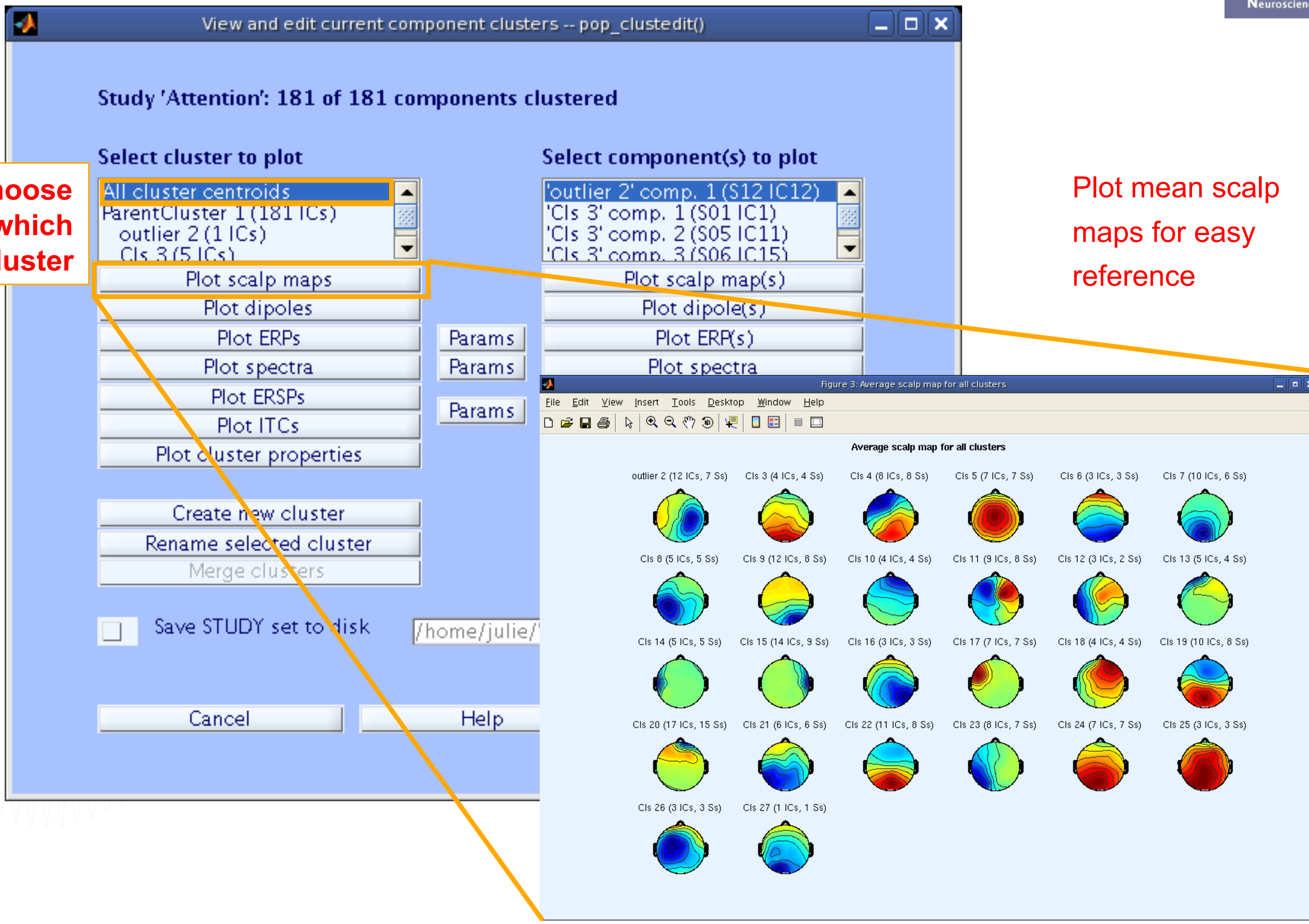


View and edit clusters



Plot cluster data

Choose which cluster

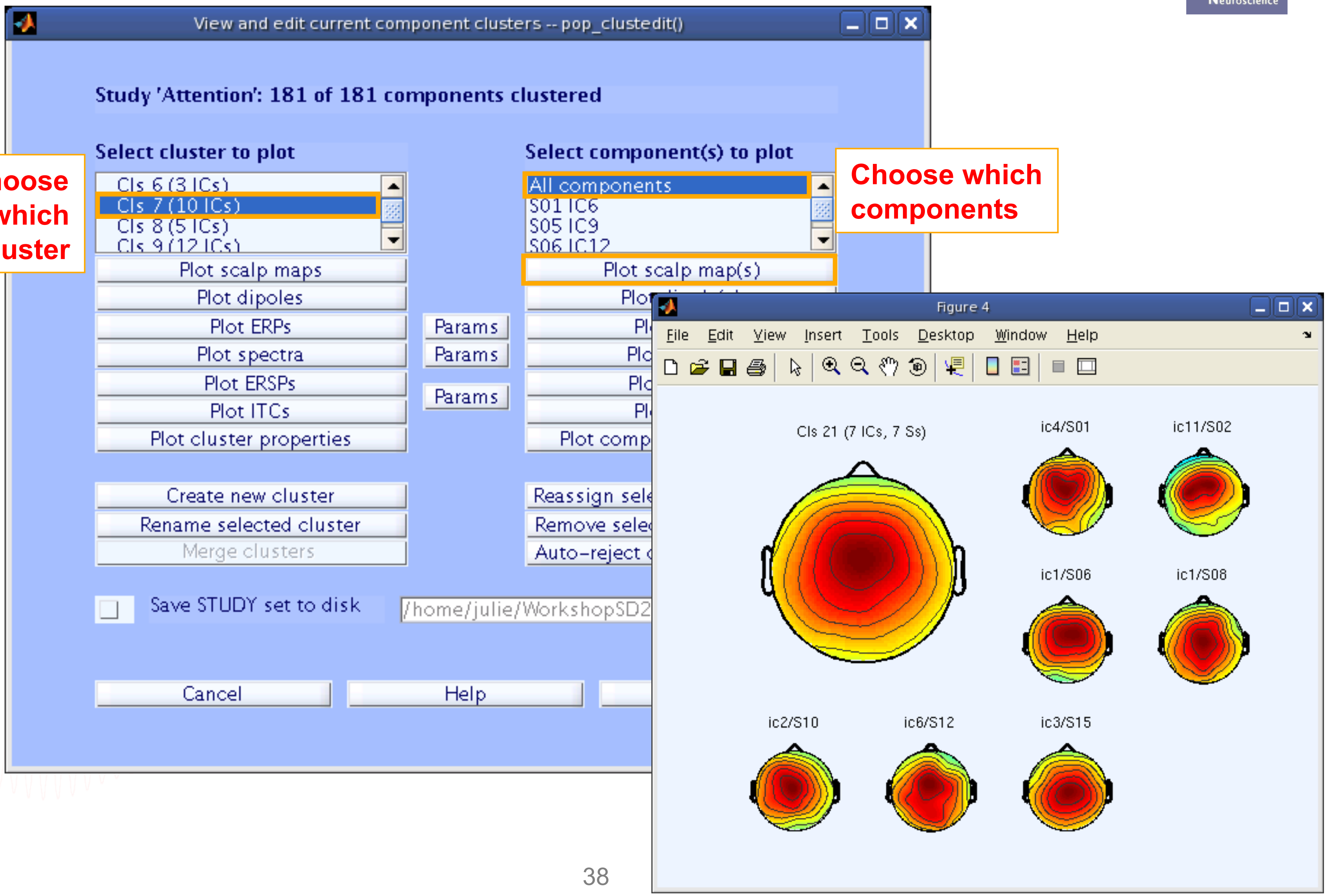


Plot mean scalp maps for easy reference

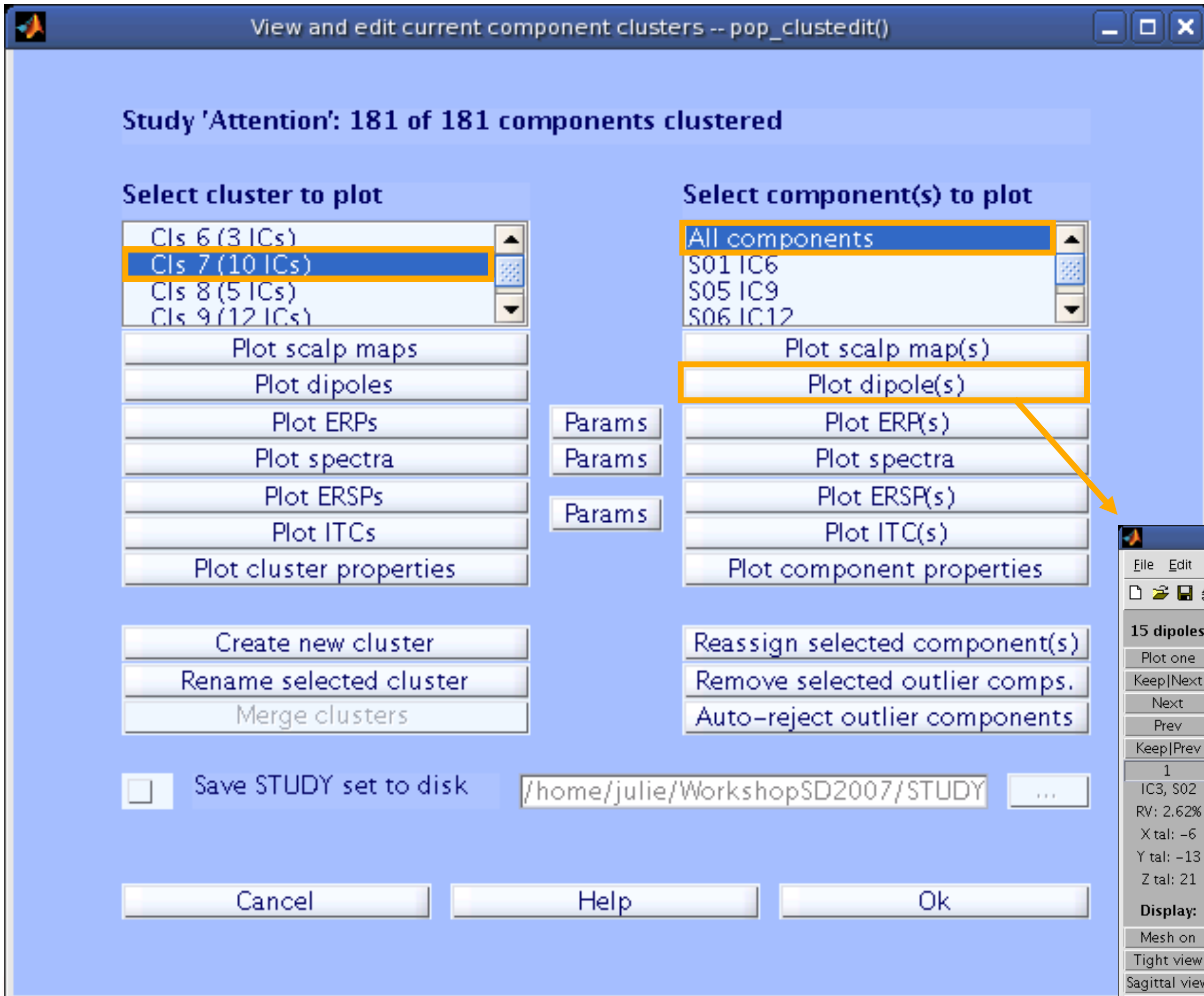
Plot cluster data

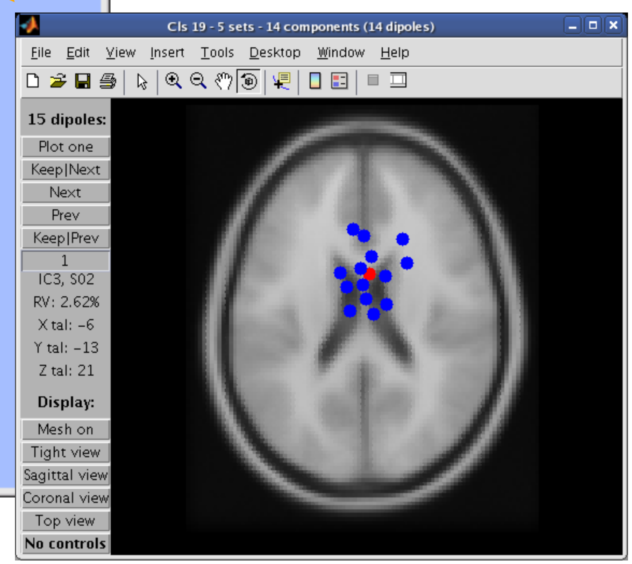
Choose which cluster

Choose which components

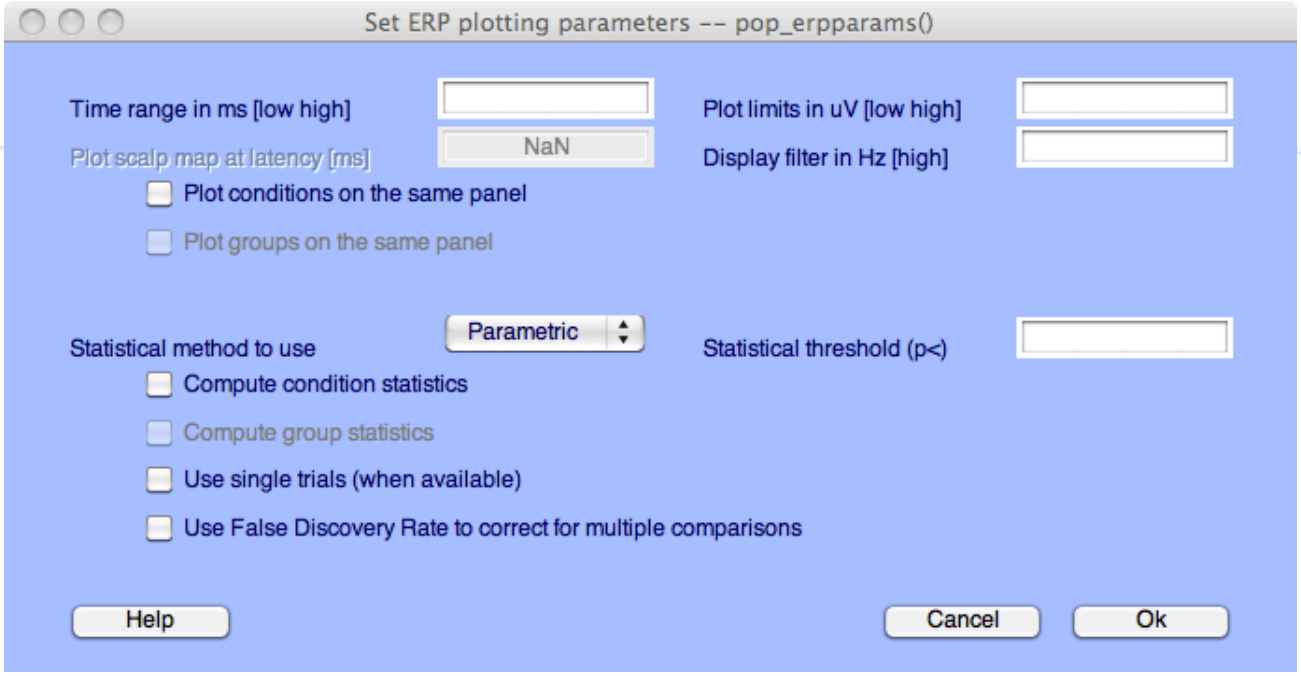


Plot cluster data

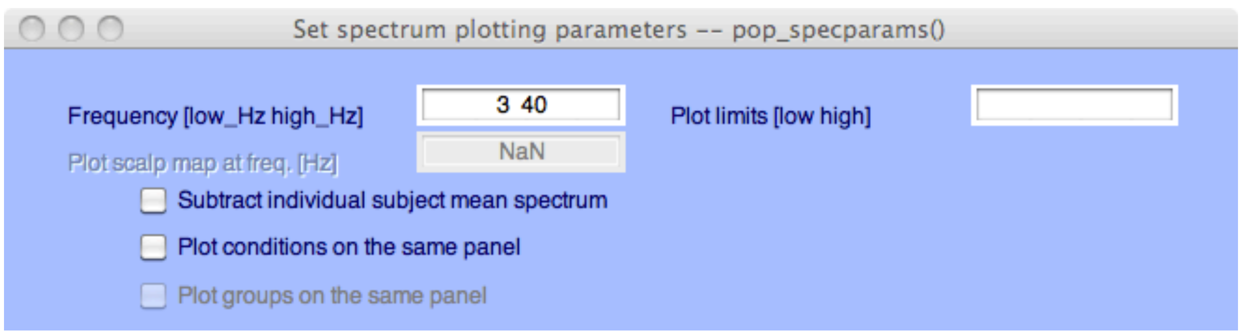




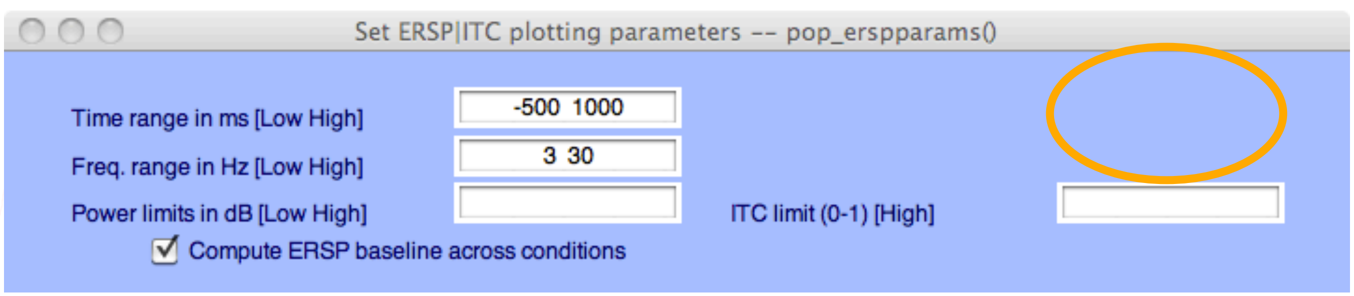
ERP



Spectrum



ESRP/ITC



Exercises

Suggestion for exercises:

Load stern.study in STUDY folder

From the GUI, plot grand average ERP for all channels. Experiment with statistics.

Build a STUDY design to compare Ignore letter grouped with Memorize letter with Probe letters. Recompute spectrum and plot spectrum for electrode Fz using statistics. Do the same for the frontal midline component cluster (cluster 19).