

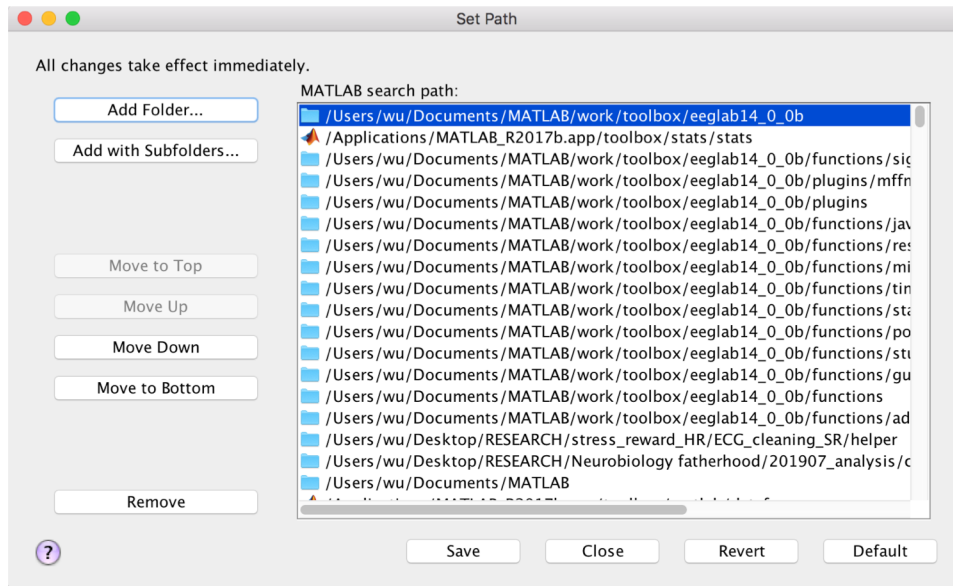
EEGLAB GUI

Developmental Electrophysiology Laboratory

Yale Child Study Center

Jia Wu, Ph.D.

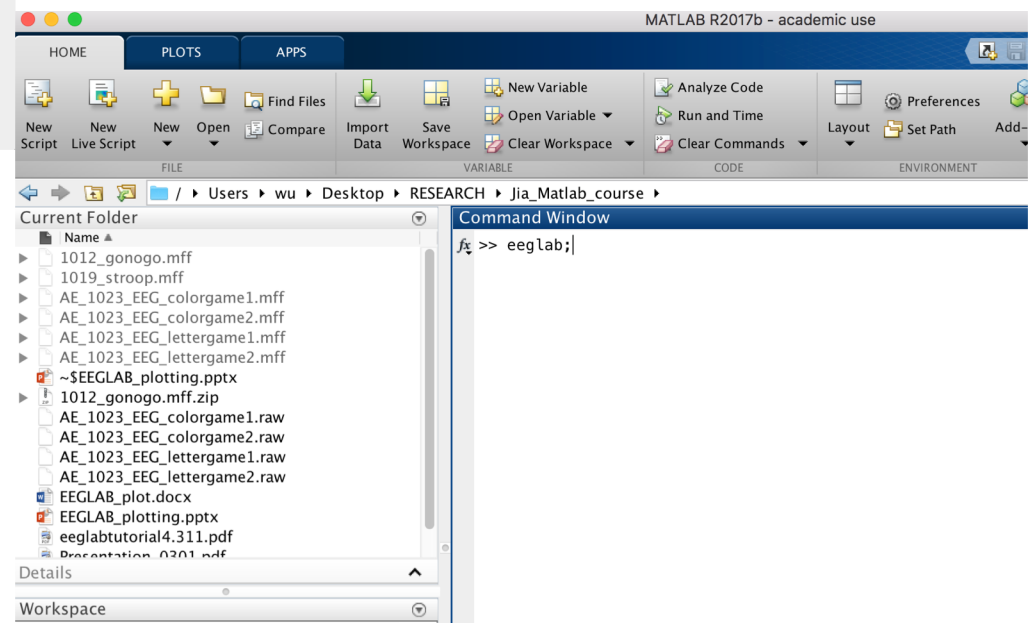
07/19/2019



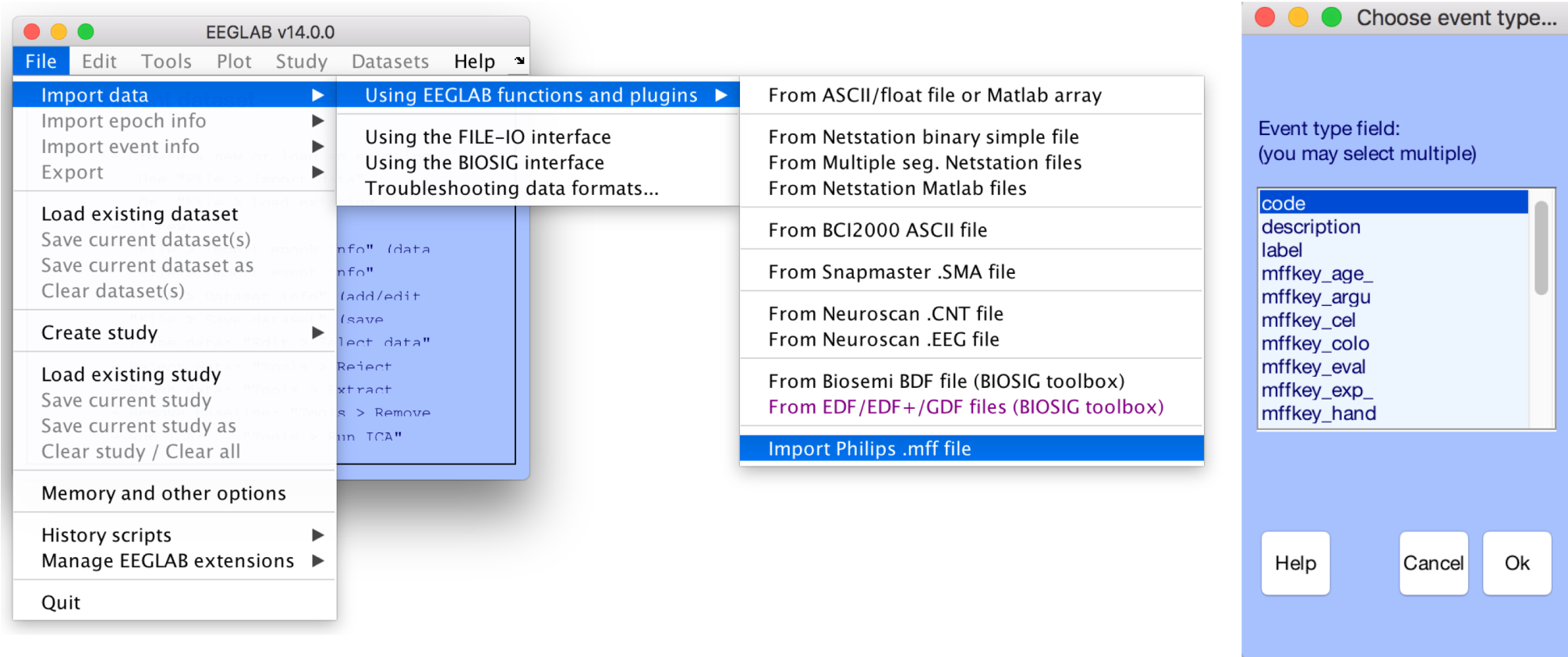
1: Include the eeglab folder in the search path by clicking 'set path'.

If you save it, no need to do it next time.

2: go to your working directory, usually where your data and scripts are. Then type 'eeglab;' then press 'Enter' on the command line to open the GUI.

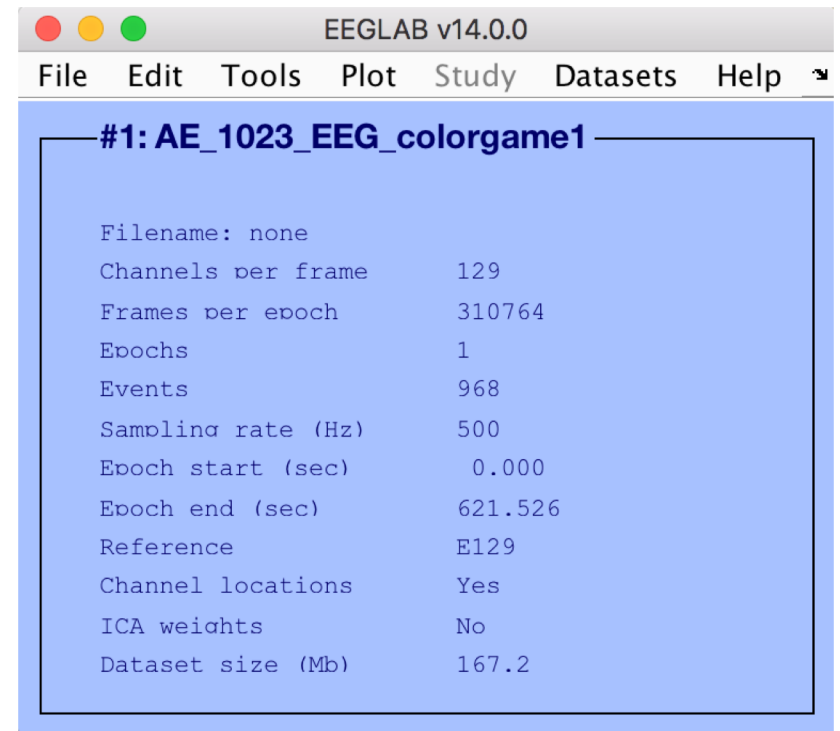
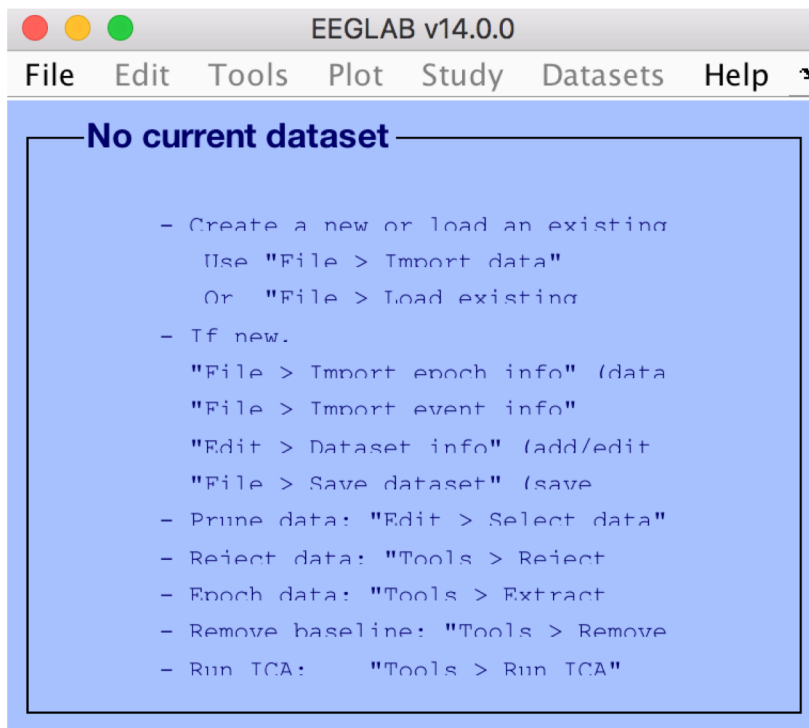


3. Import the data

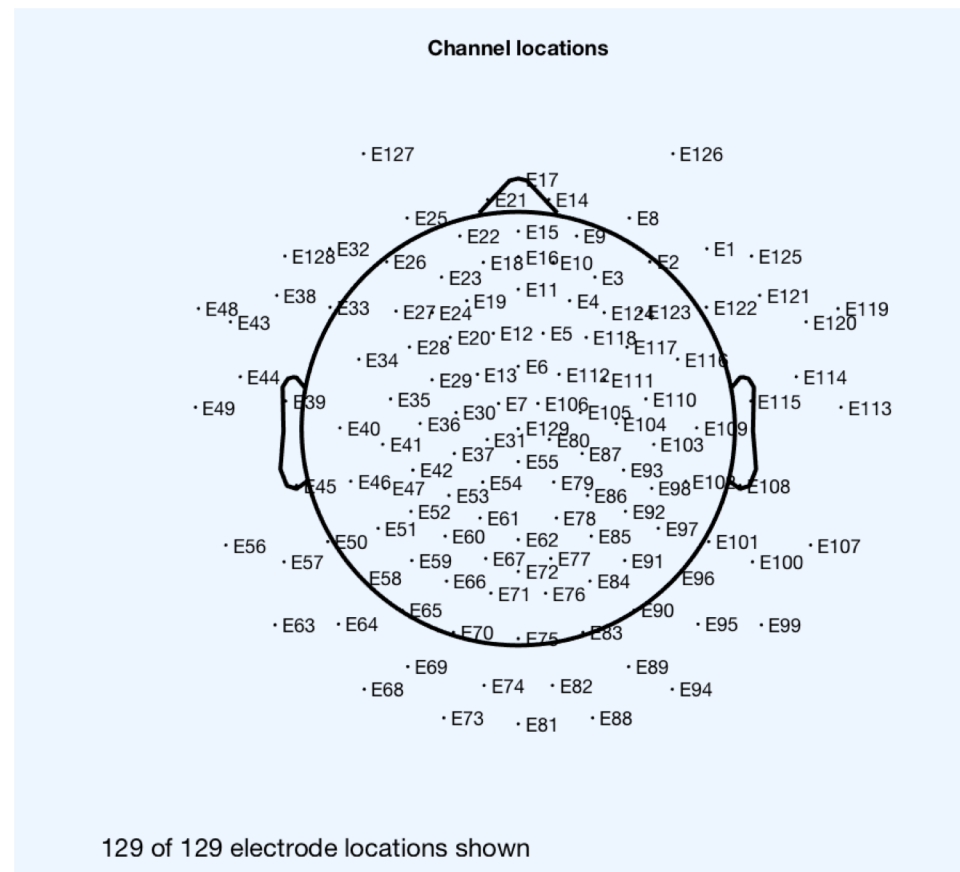
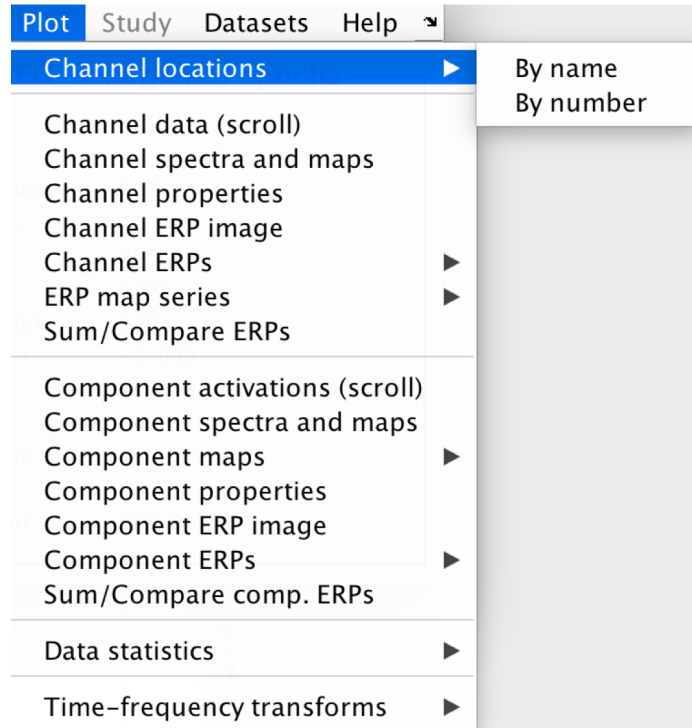


4. Inspect the data

4.1. Dataset information



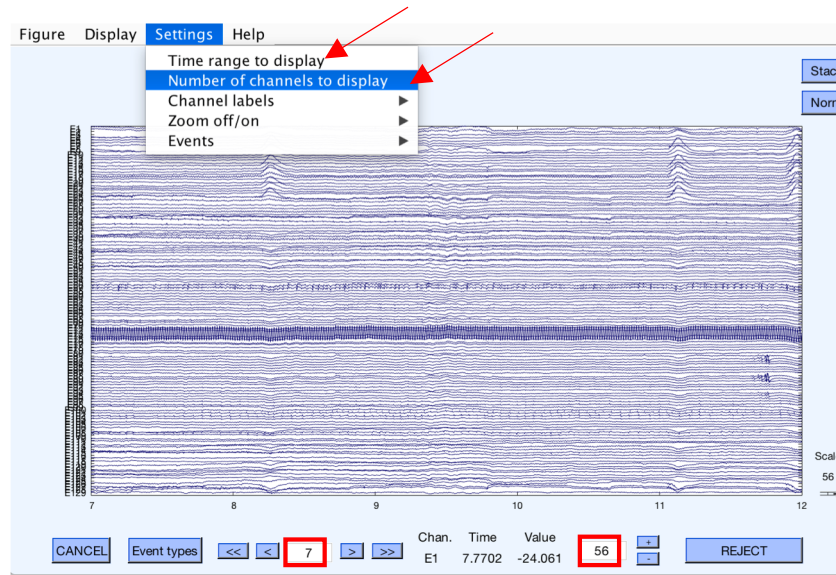
4.2. Channel information



4.3. Overall data quality

Plot Study Datasets Help

- Channel locations
- Channel data (scroll)**
 - Channel spectra and maps
 - Channel properties
 - Channel ERP image
 - Channel ERPs
 - ERP map series
 - Sum/Compare ERPs
- Component activations (scroll)
 - Component spectra and maps
 - Component maps
 - Component properties
 - Component ERP image
 - Component ERPs
 - Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms



New window length (s):

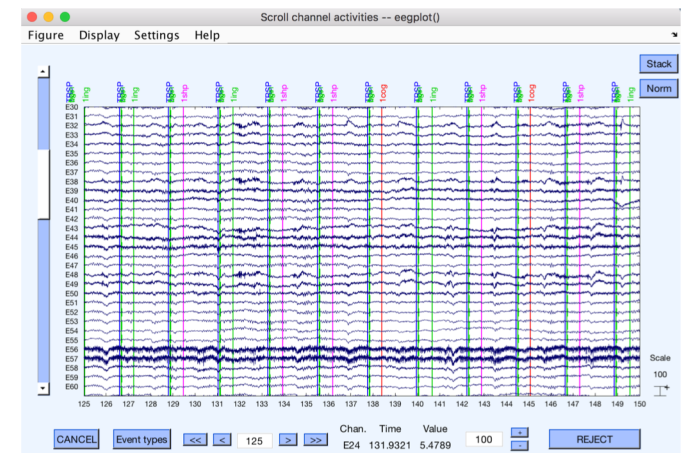
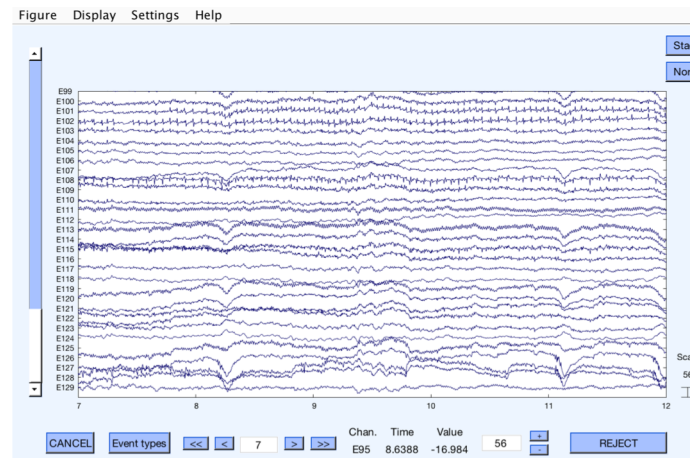
25

Help Cancel Ok

Number of channels to display:

30

Help Cancel Ok



4.4. Spectral properties

Plot Study Datasets Help

- Channel locations
- Channel data (scroll)
- Channel spectra and maps**
- Channel properties
- Channel ERP image
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activations (scroll)
- Component spectra and maps
- Component maps
- Component properties
- Component ERP image
- Component ERPs
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms

Channel spectra and maps -- pop_spectopo()

Epoch time range to analyze [min_ms max_ms]: 0 621526

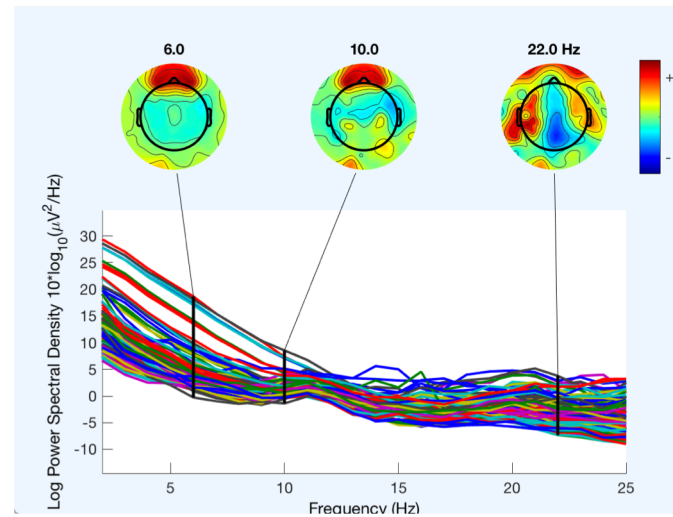
Percent data to sample (1 to 100): 15

Frequencies to plot as scalp maps (Hz): 6 10 22

Plotting frequency range [lo_Hz hi_Hz]: 2 25

Spectral and scalp map options (see topoplot): 'electrodes', 'off'

Help Cancel Ok



Channel spectra and maps -- pop_spectopo()

Epoch time range to analyze [min_ms max_ms]: 0 621526

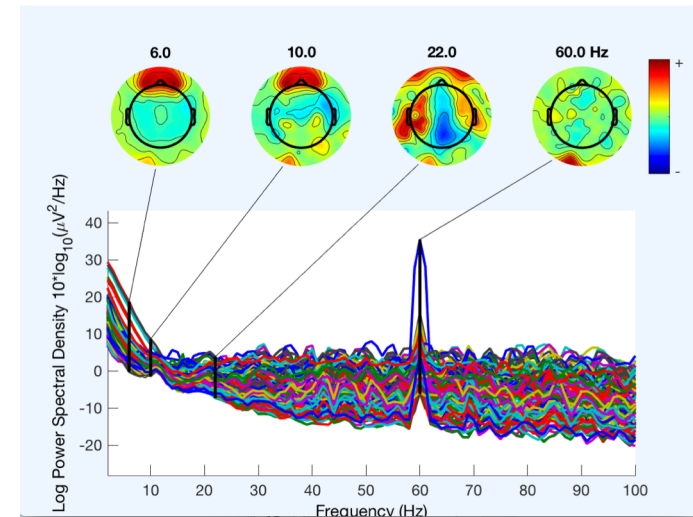
Percent data to sample (1 to 100): 15

Frequencies to plot as scalp maps (Hz): 6 10 22 60

Plotting frequency range [lo_Hz hi_Hz]: 2 100

Spectral and scalp map options (see topoplot): 'electrodes', 'off'

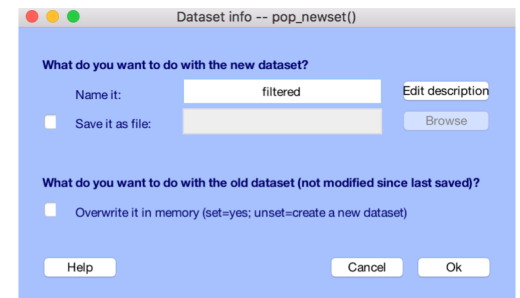
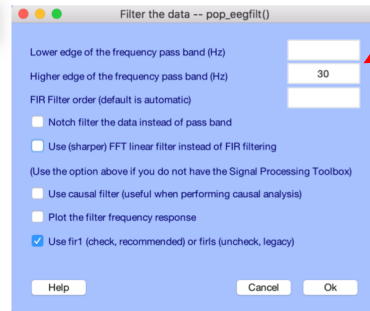
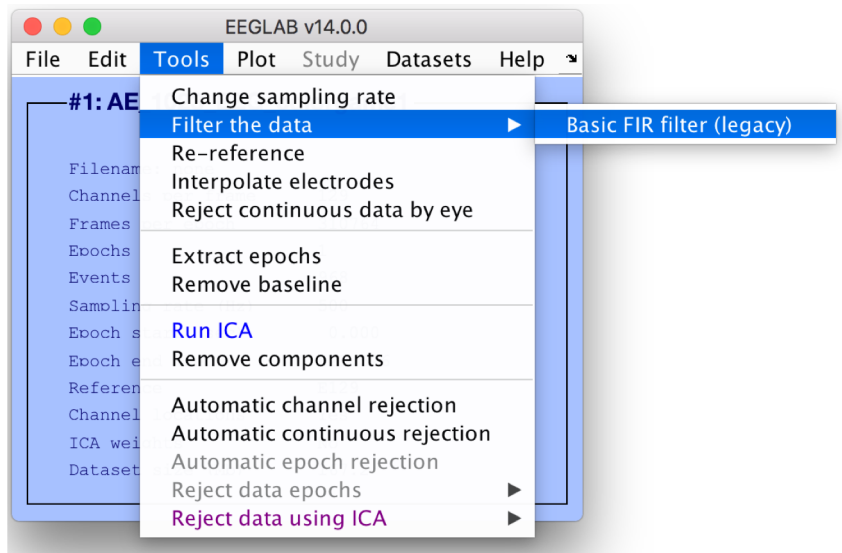
Help Cancel Ok



5. Preprocessing-nonICA

1. Filtering
2. Segmentation
3. Channel rejection and replacement, automatic and manual
4. Averaged reference
5. Epoch detection and rejection, automatic and manual
6. Baseline correction

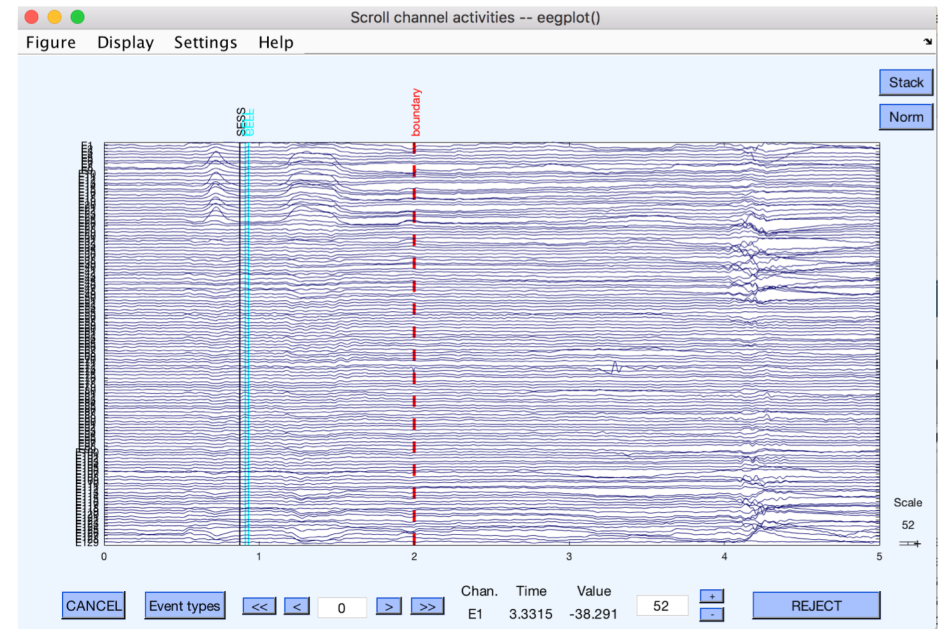
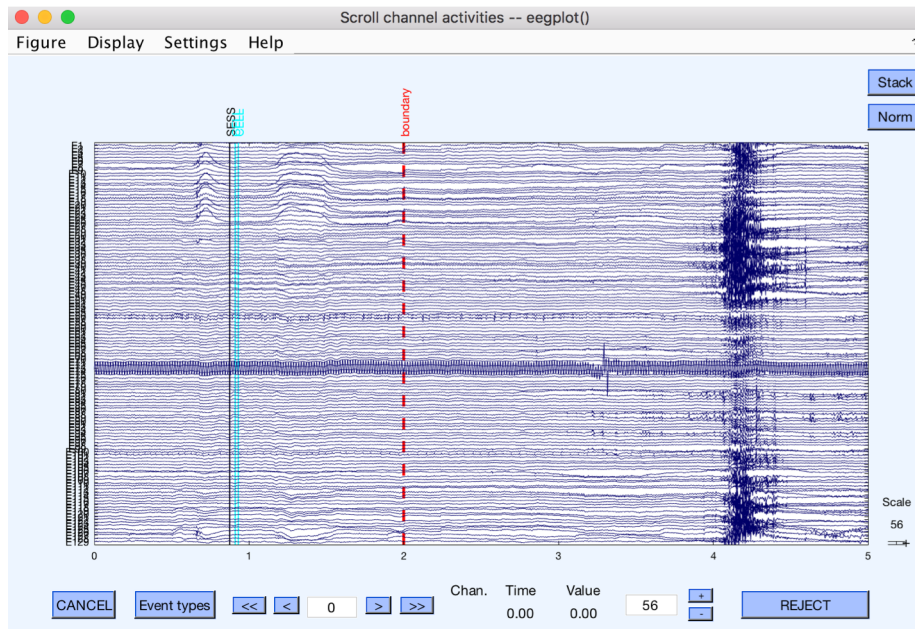
5.1 Filtering (and then write down bad channels)



Before

Filtering

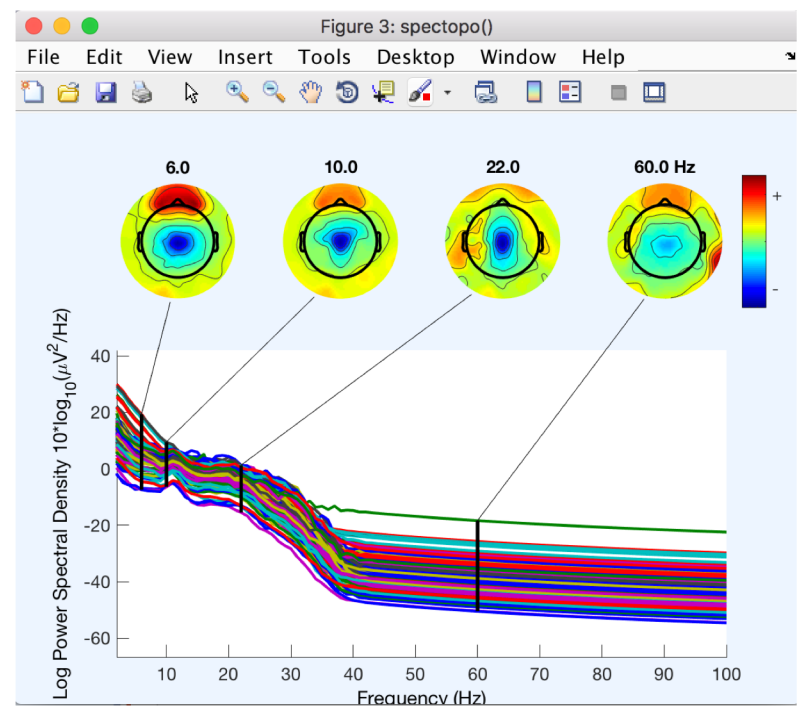
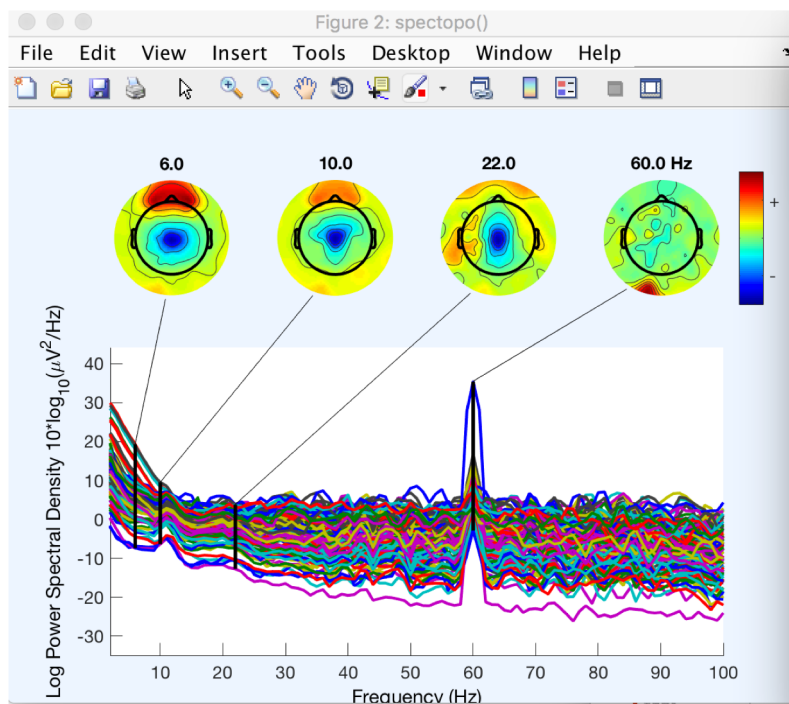
After



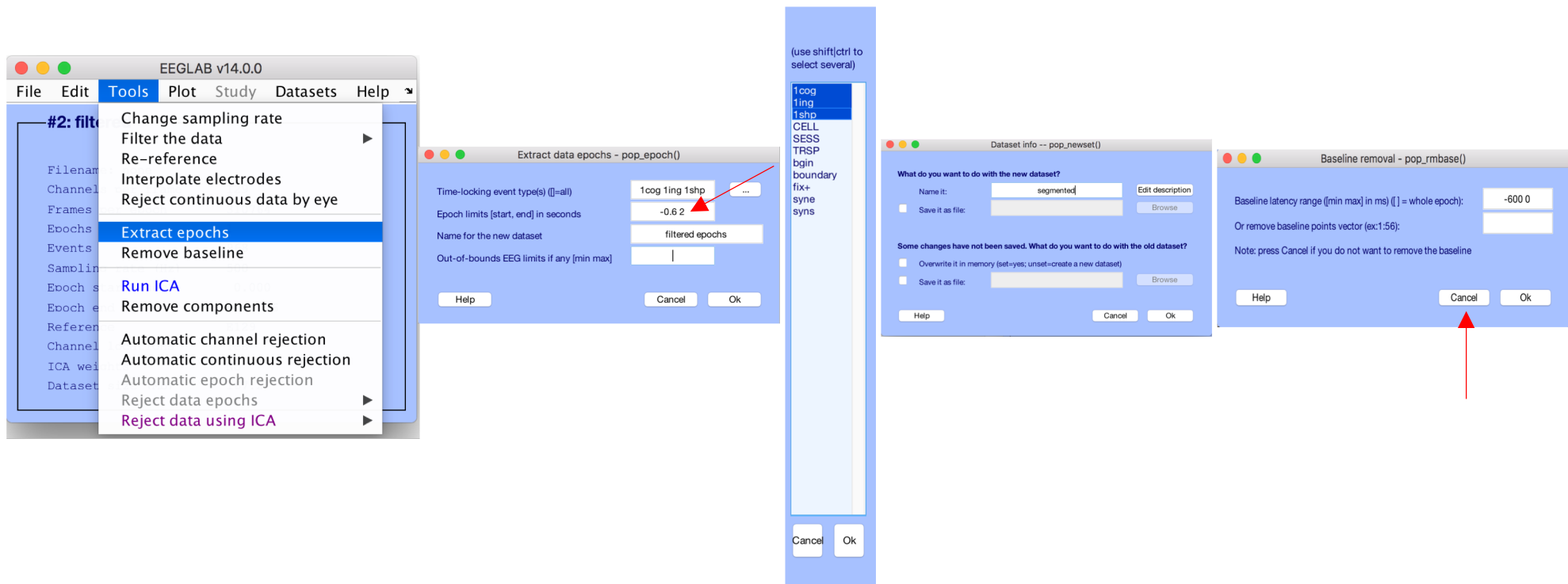
Before

Filtering

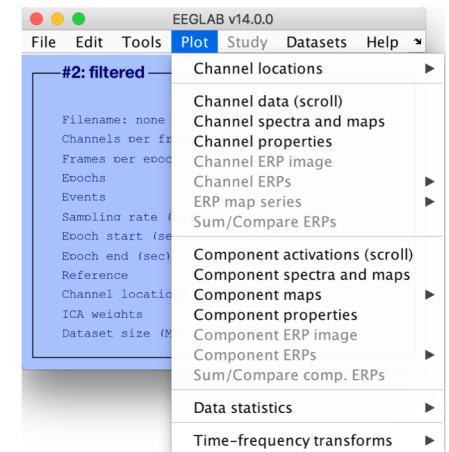
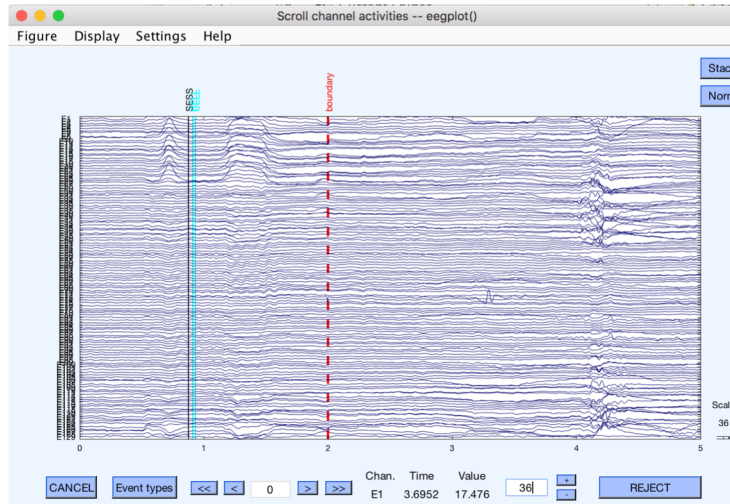
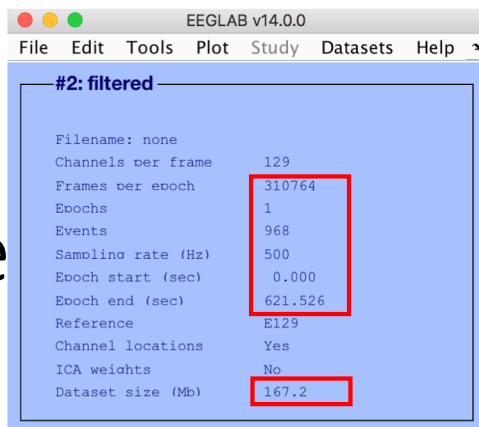
After



5.2 Segmentation: EEG to ERPs

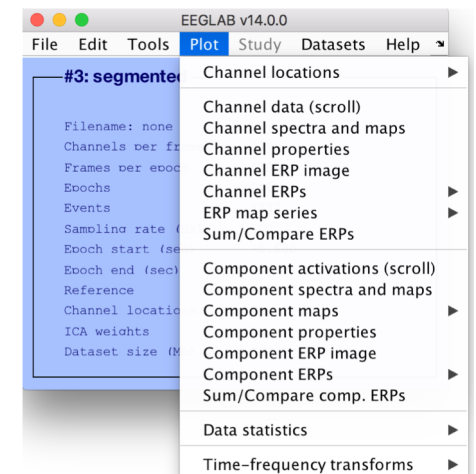
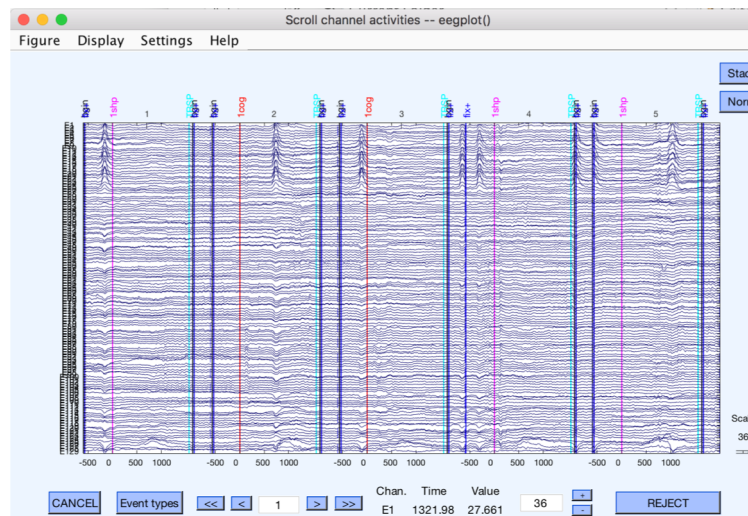
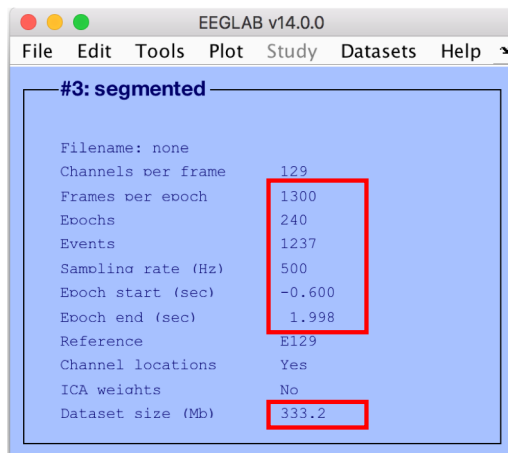


Before



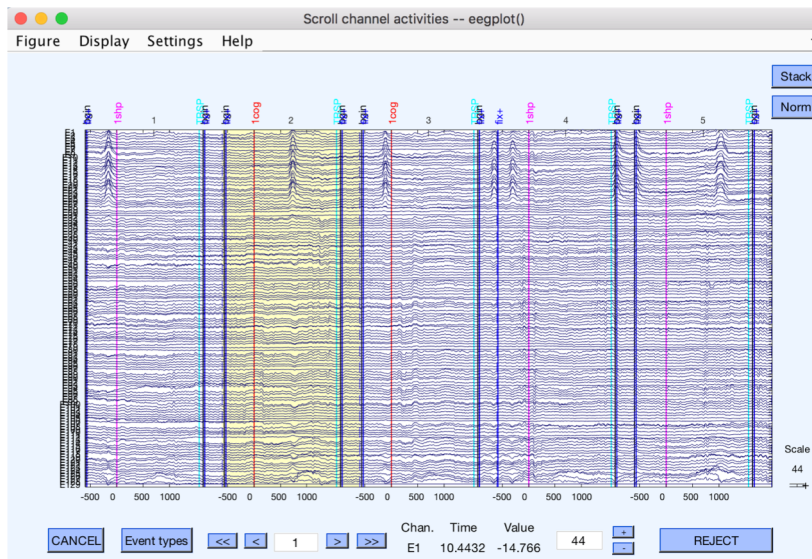
Segmentation

After



Important

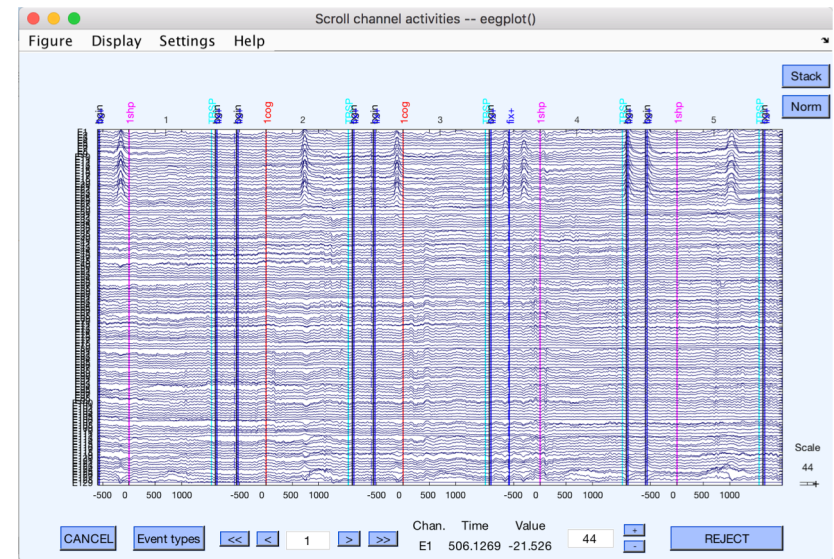
- After you have segmented data, if you clicked the inside of the data scroll view, it would highlight the trial you clicked. If you meant to reject the trial, click the 'reject' button. If not, click the same area again to deselect it, otherwise the program will mark the trial and it will be rejected in later procedures.



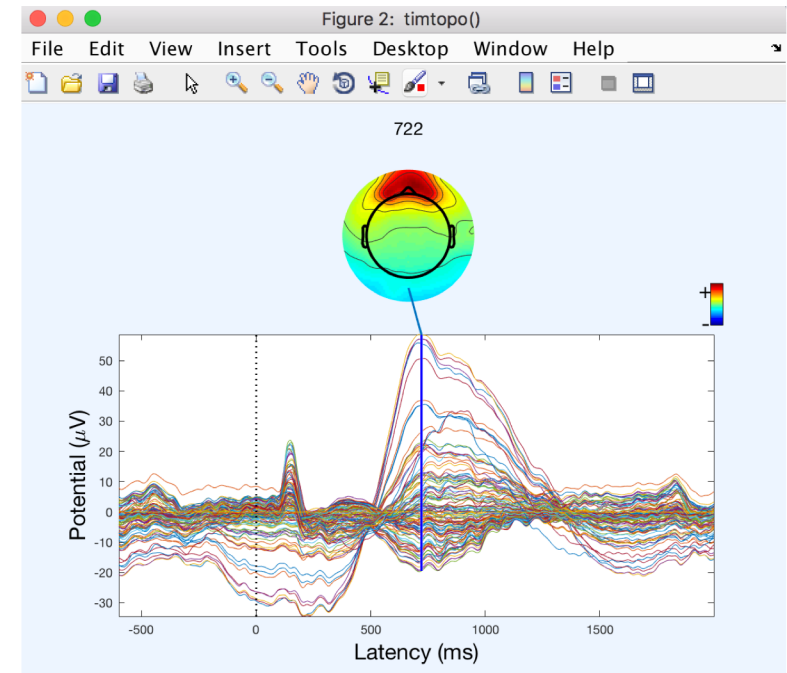
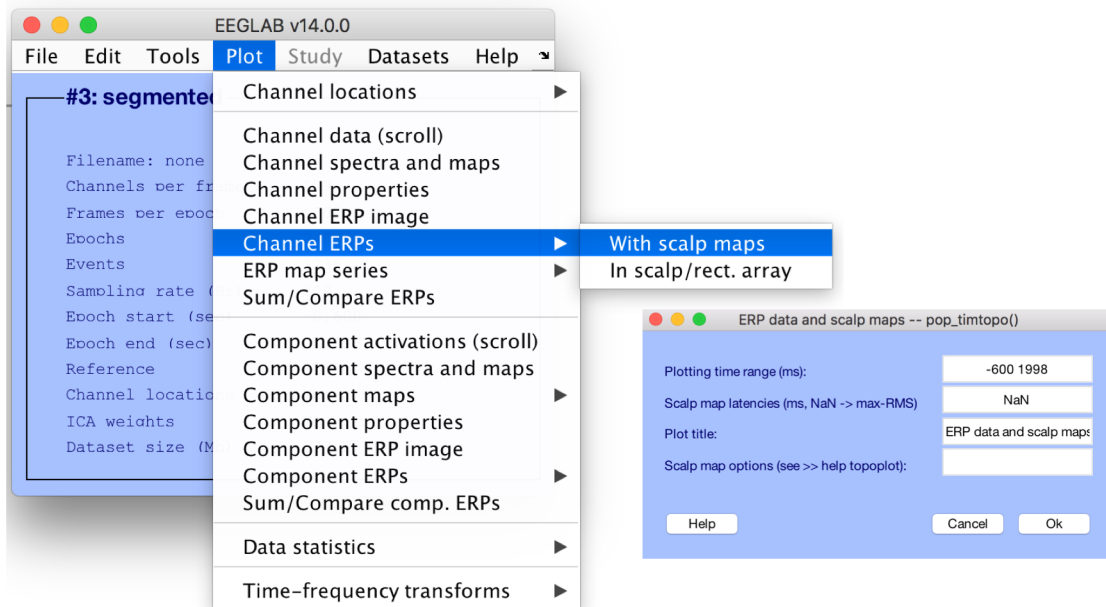
Oops,
I don't mean
to mark it



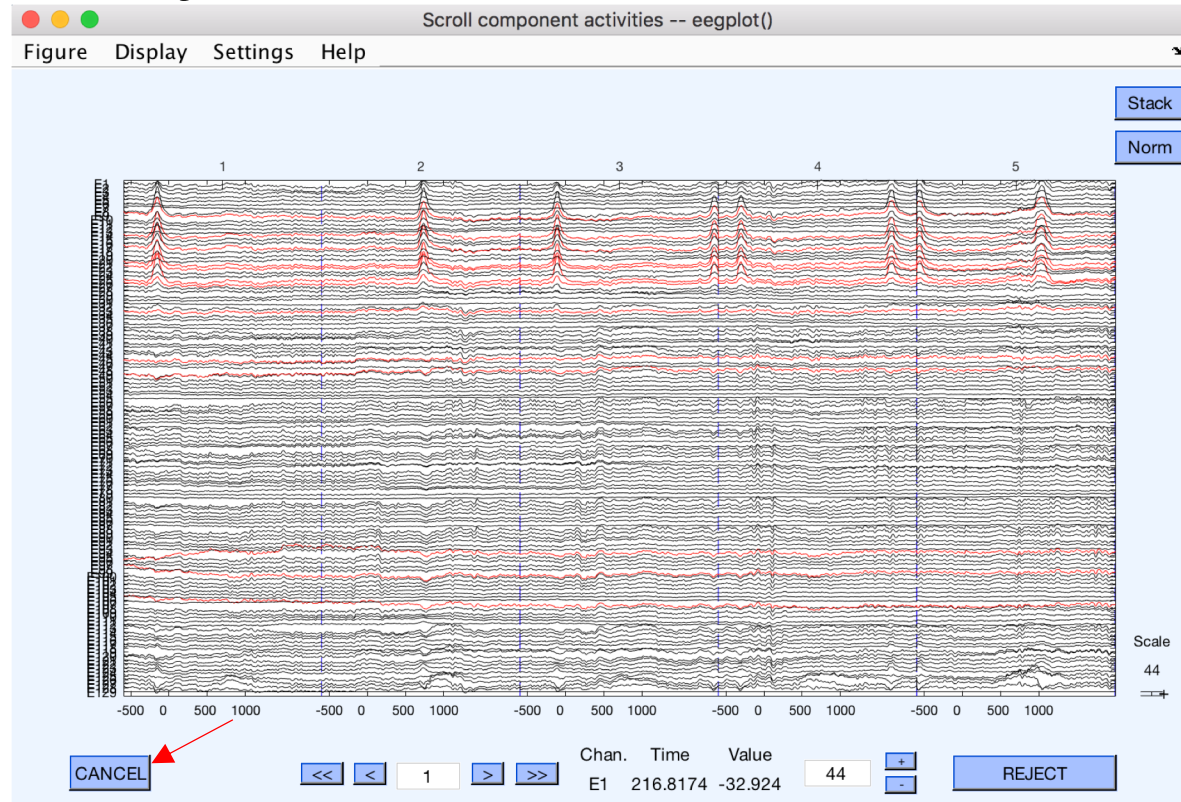
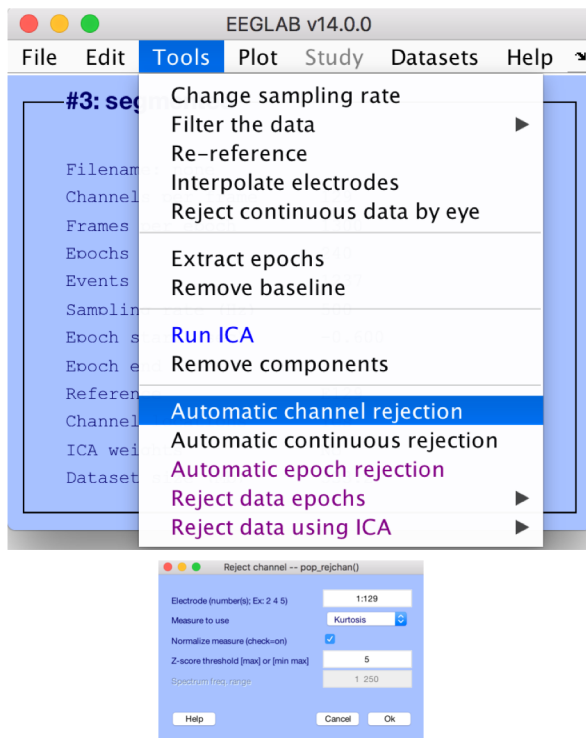
Click on it
again to
remove the
mark



Plot all ERPs



5.3 Bad channel rejection (automatic)



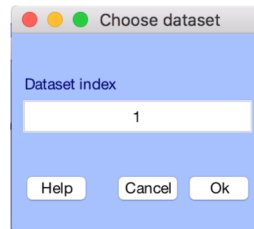
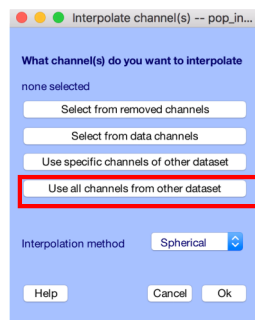
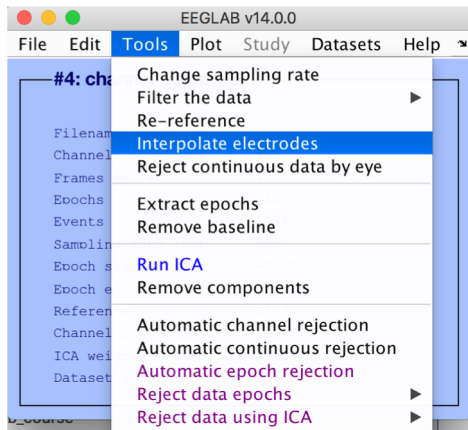
Channels in red are marked as bad channels. However, from visual inspection the channels looked fine. So I would just cancel the rejection.

5.3 Bad channel rejection (manual)

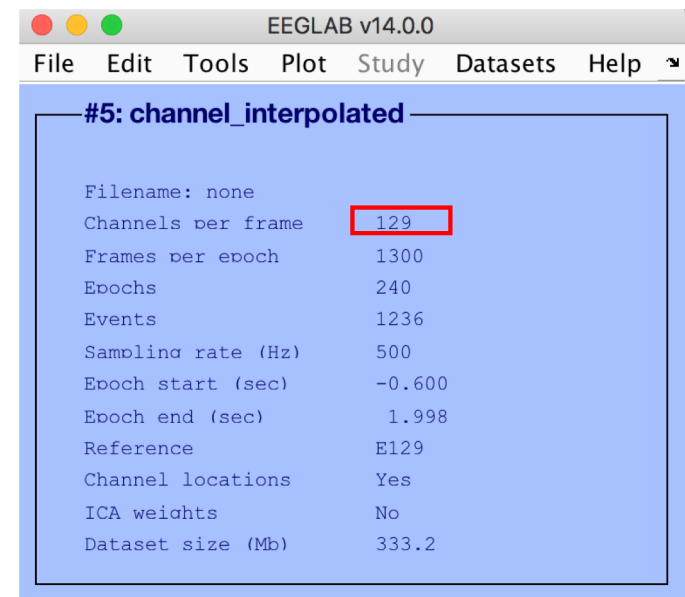
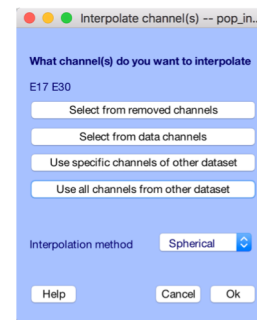
Example: reject channel 17 and 30.



5.3 Channel interpolation



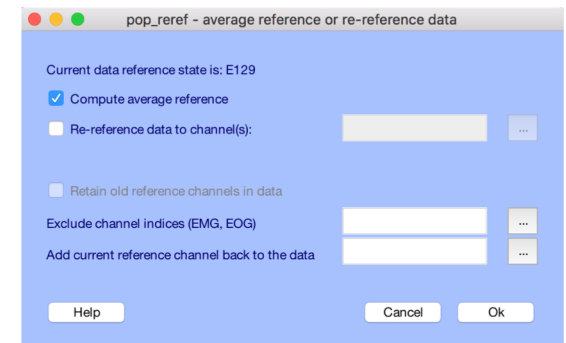
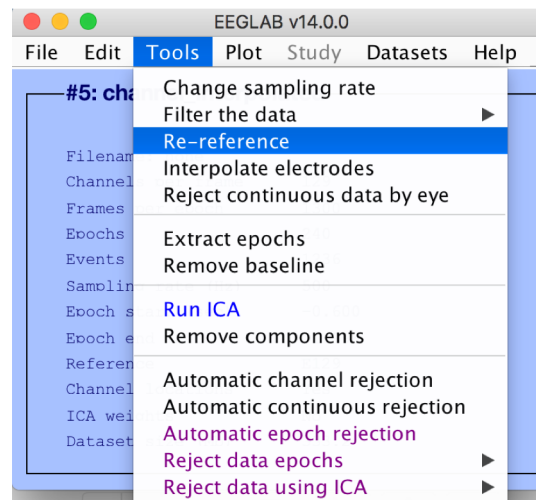
Choose any dataset that has the full set of channels



Either after automatic or manual channel rejection, use this tool to interpolate the bad channels so to recover the full 129 channels.

5.4 Averaged Reference

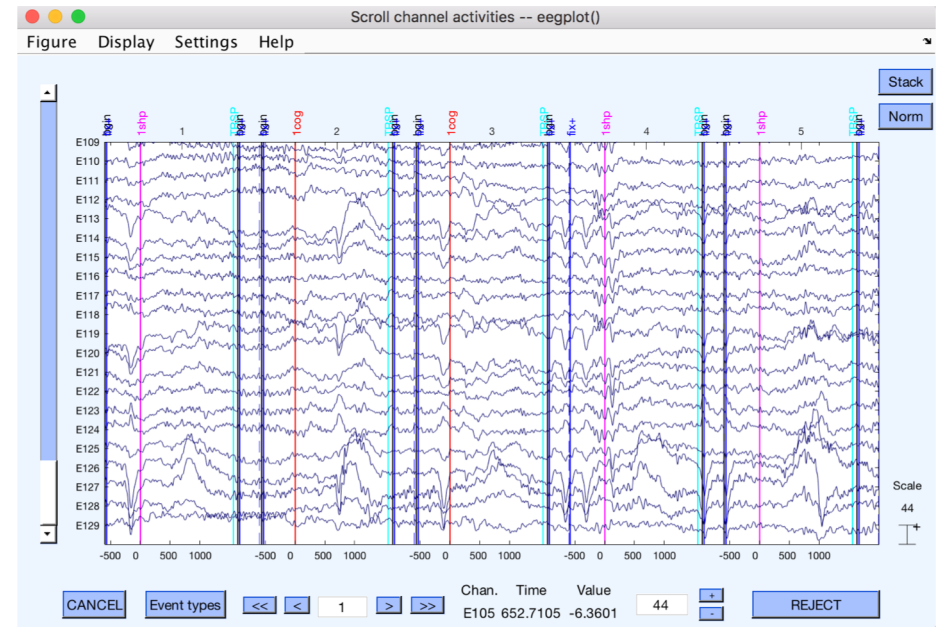
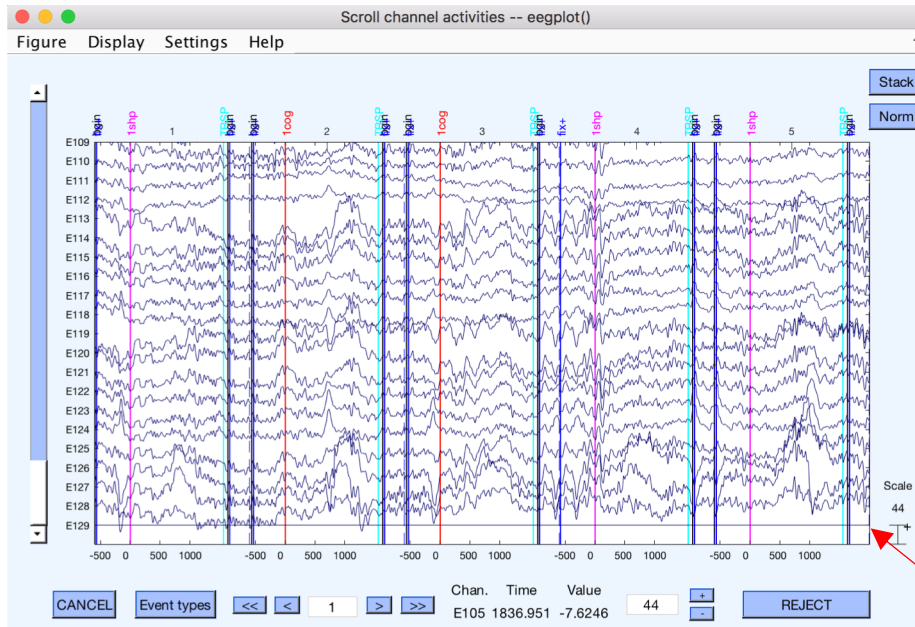
I found out that the reason 'Automatic epoch rejection' failed earlier in the class was because channel 129 was flat. One of the probability computation wouldn't run. So I moved the averaged reference here before epoch rejection.



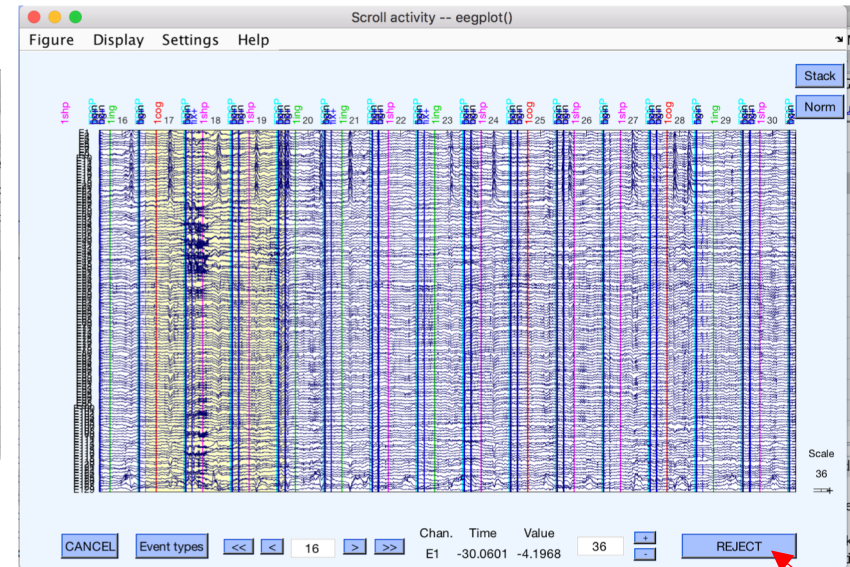
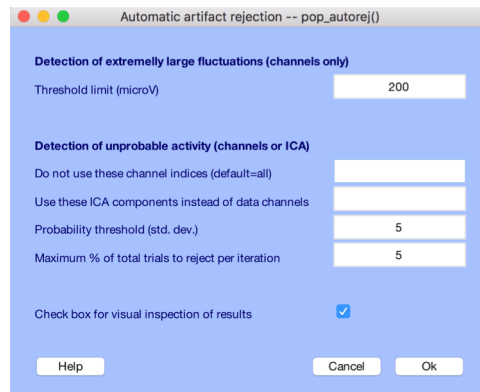
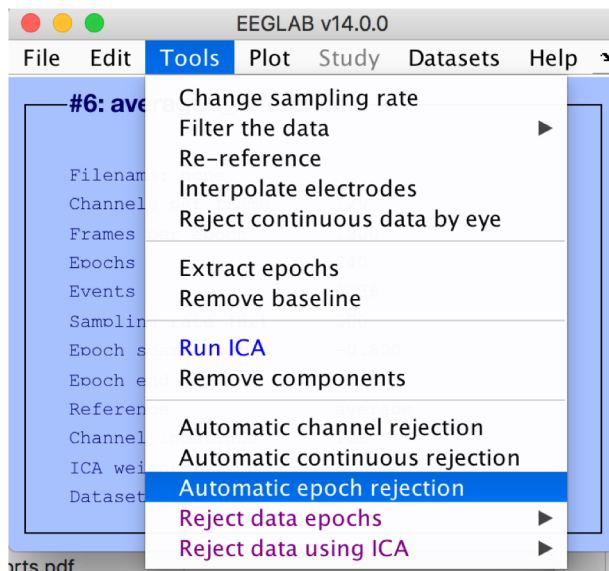
Before

Averaged Reference

After

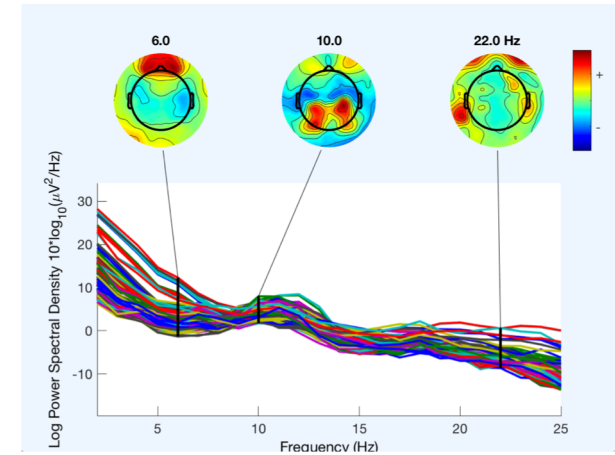
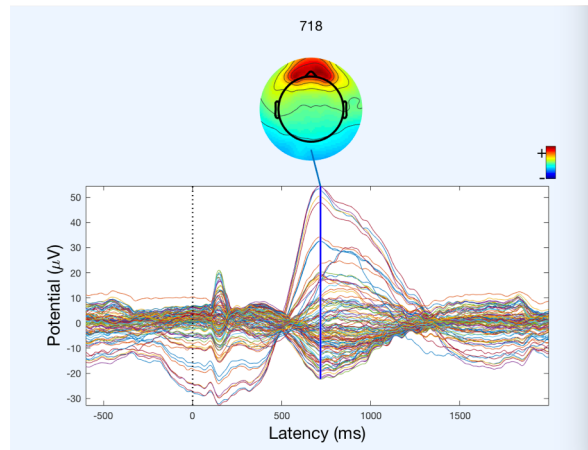
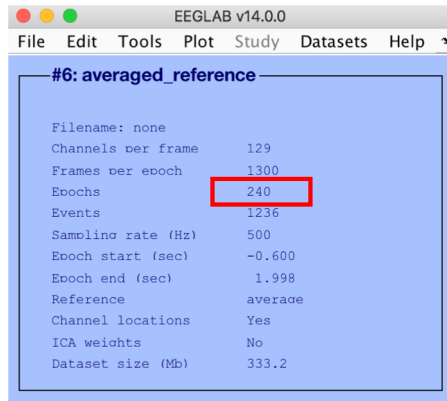


5.5 Epoch rejection (automatic and manual)



- The program will show you all the epochs it thinks are bad.
- You can make corrections.
- You can also select additional epochs and manually reject them
- For simplicity you can just use the program recommended bad epochs.

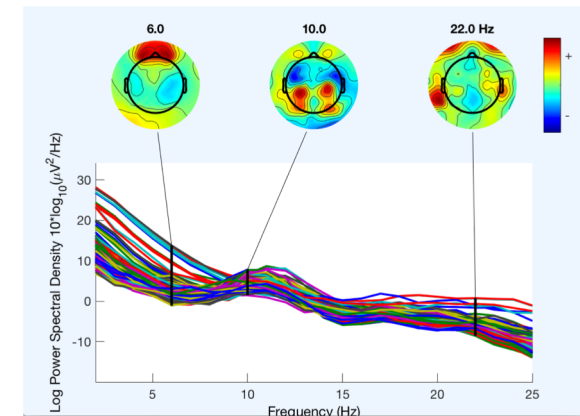
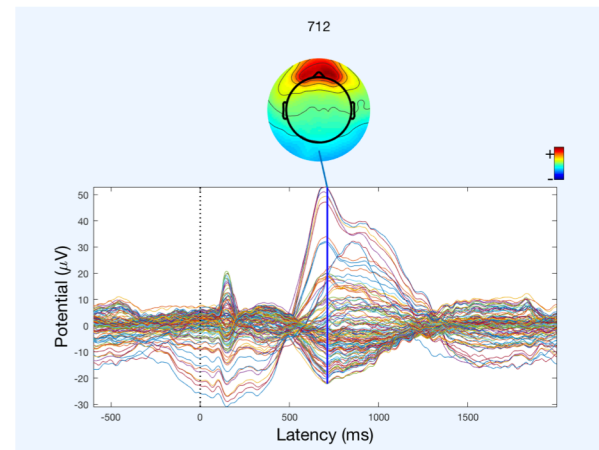
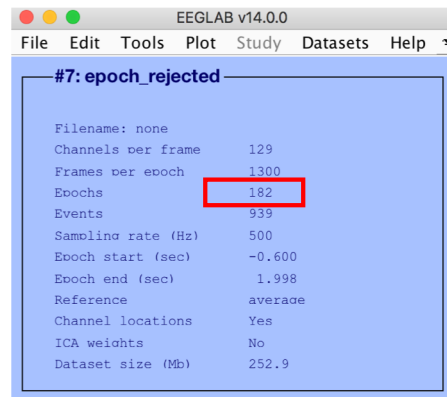
Before



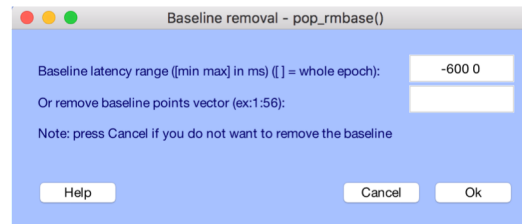
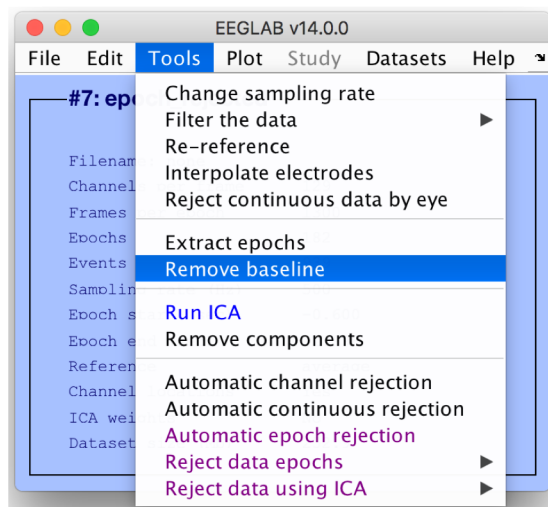
Epoch
rejection

Not much difference because for this dataset, the epochs rejected are similar to the epochs kept. It would be more different for data that is more noisy

After



5.6 Baseline Correction



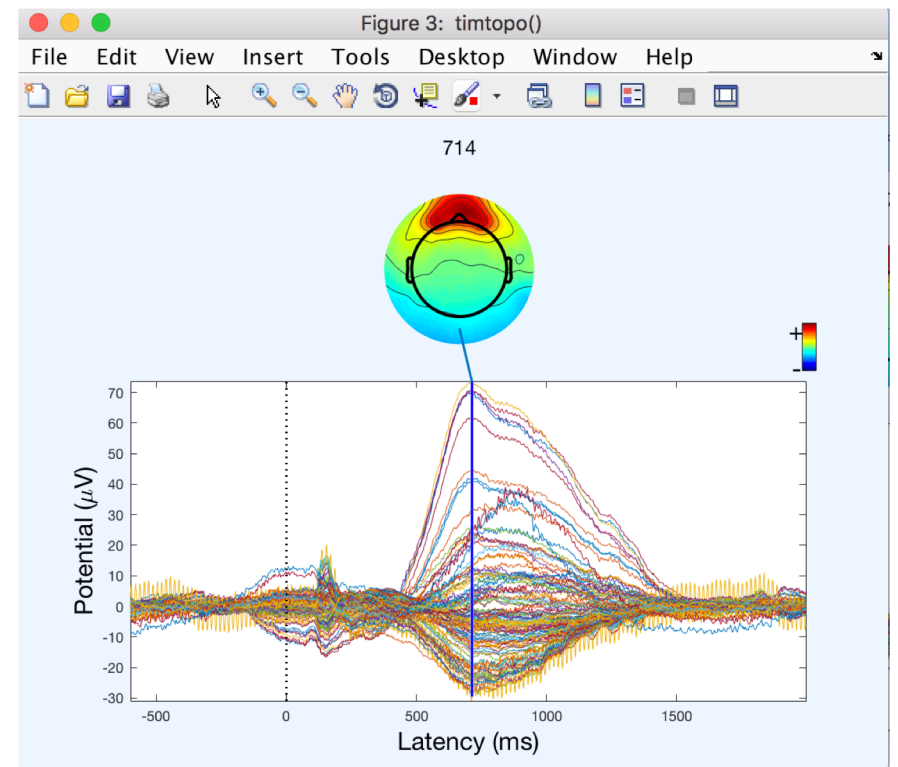
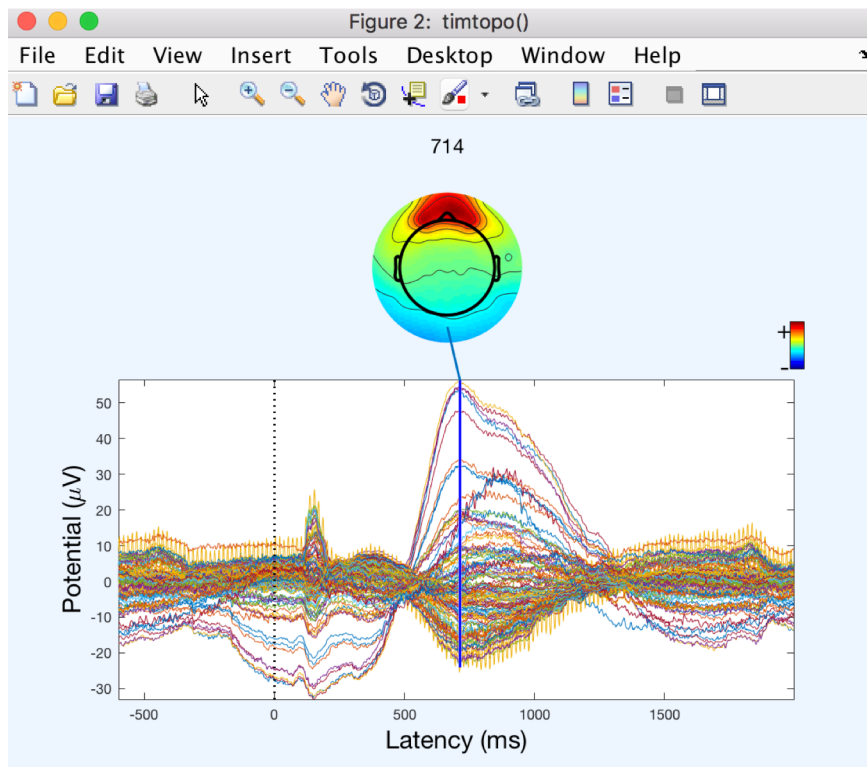
Oddly, the program did not give you an option of creating a new dataset.

So just remember you have done it, even though the name didn't reflect it.

Before

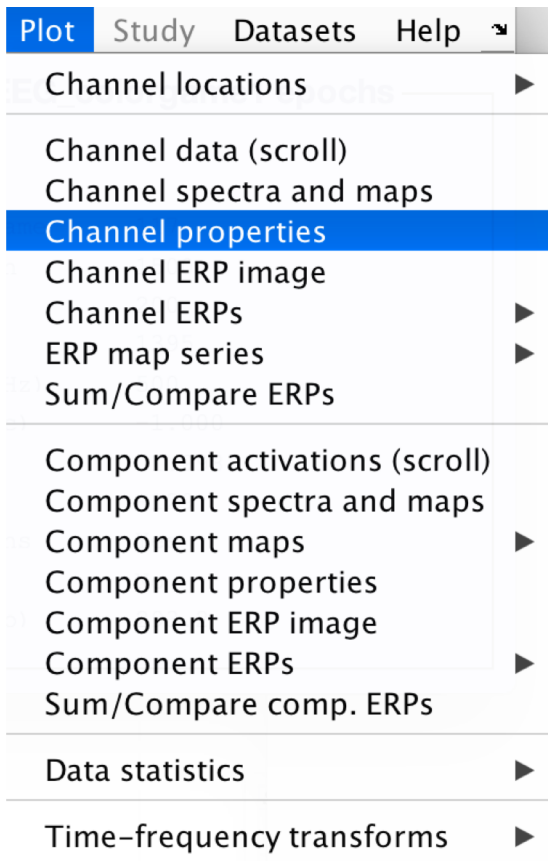
Baseline
Correction

After



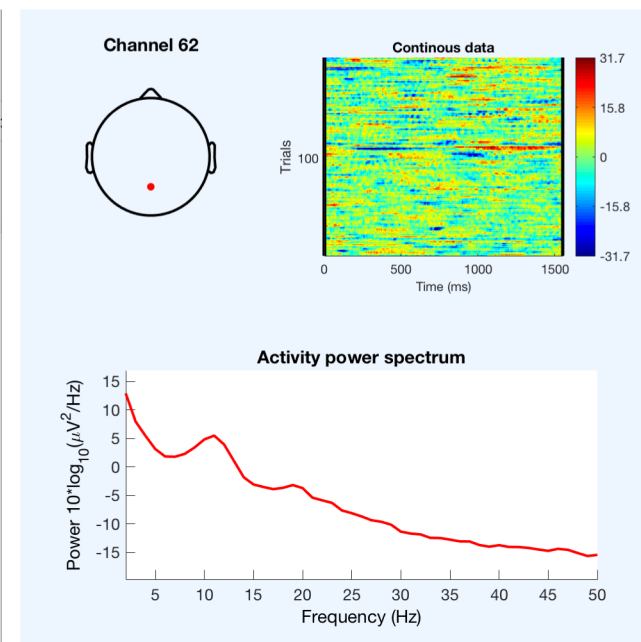
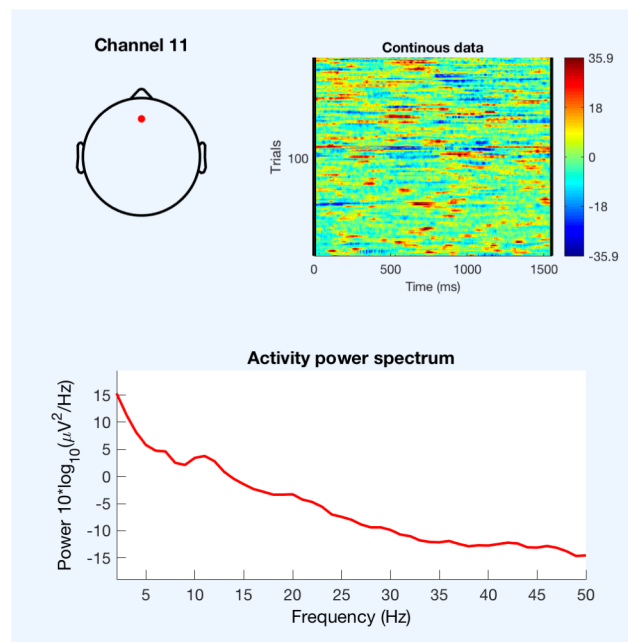
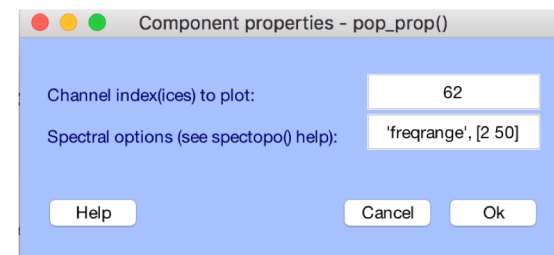
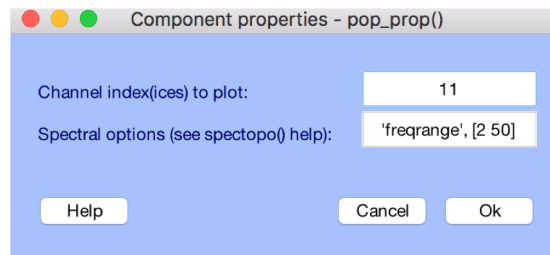
6. Plotting

- After this step, the data is considered clean!
- You can make all sort of observations of the data.

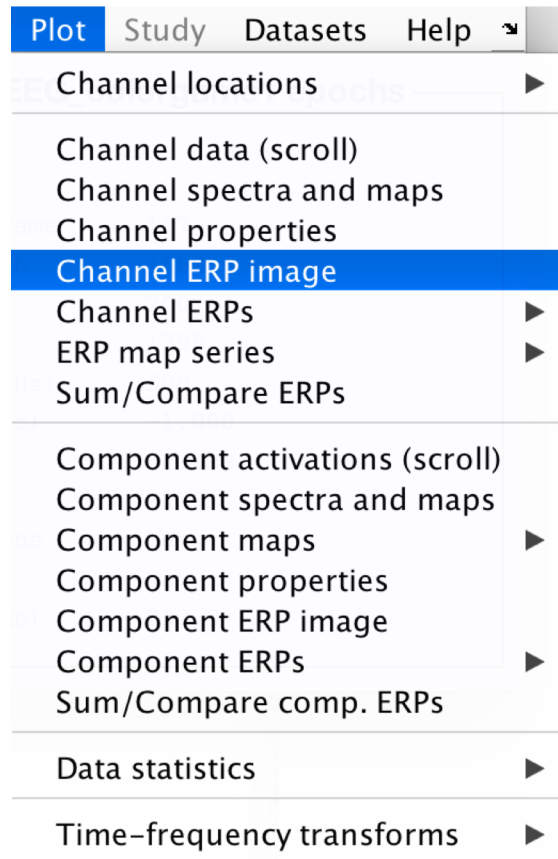


One channel, all data, all frequency distribution

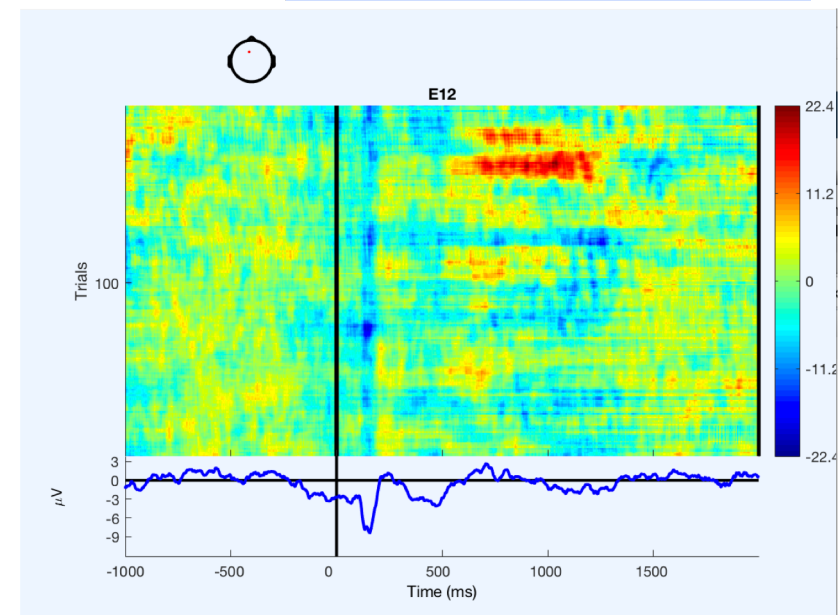
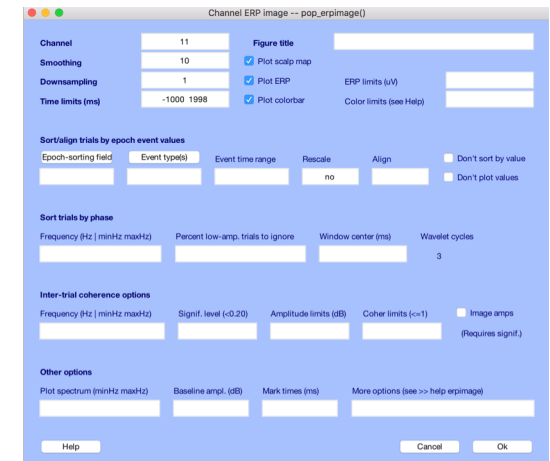
Plot individual channel properties, including ERP and power spectrum



Plot individual channel properties, including single trial ERPs and the average of all trials



One or more channels, all trials all conditions



Plot Study Datasets Help

Channel locations

Channel data (scroll)

Channel spectra and maps

Channel properties

Channel ERP image

Channel ERPs

ERP map series

Sum/Compare ERPs

Component activations (scroll)

Component spectra and maps

Component maps

Component properties

Component ERP image

Component ERPs

Sum/Compare comp. ERPs

Data statistics

Time-frequency transforms

All ERPs from all channels, and topomap at the highest amplitude.

With scalp maps

In scalp/rect. array

ERPs of All channels, all trials, separating conditions by color

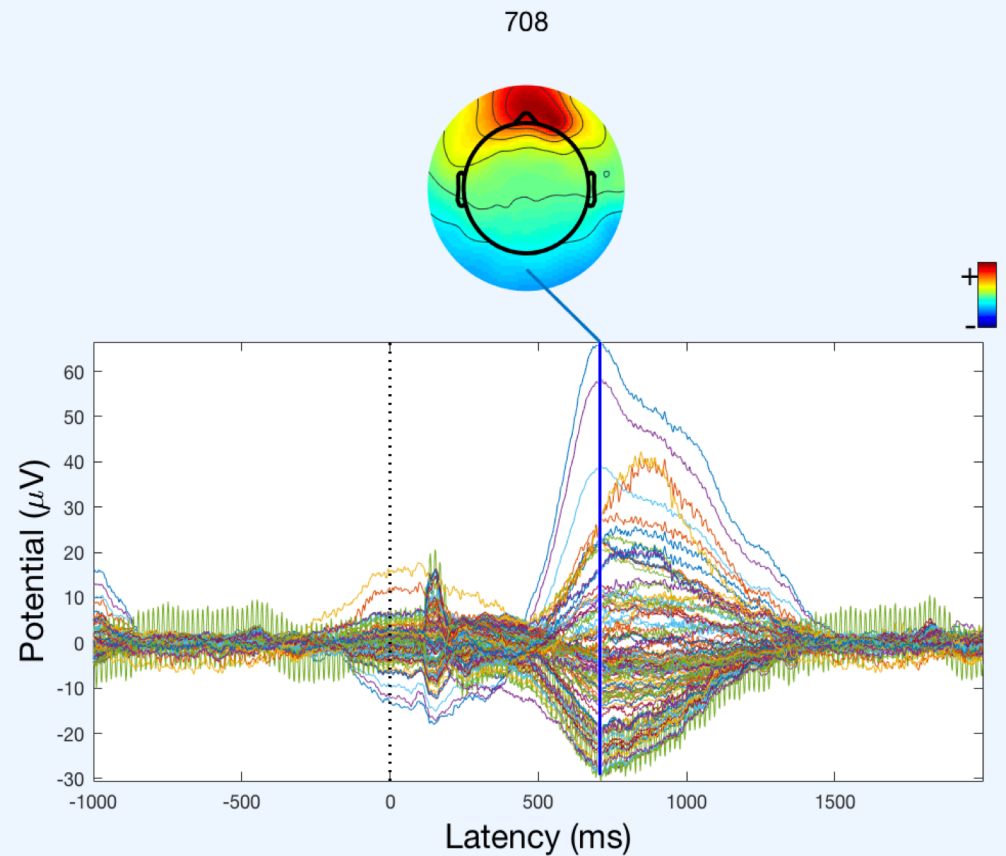
ERP data and scalp maps -- pop_timtopo()

Plotting time range (ms): -1000 1998

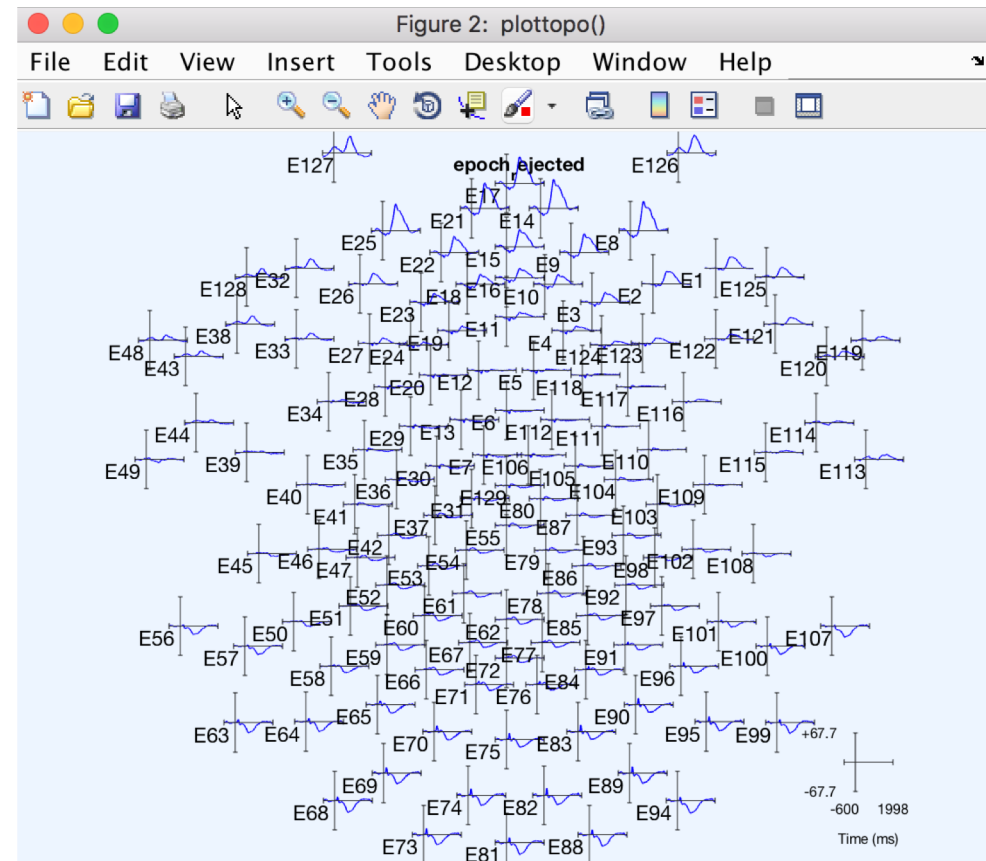
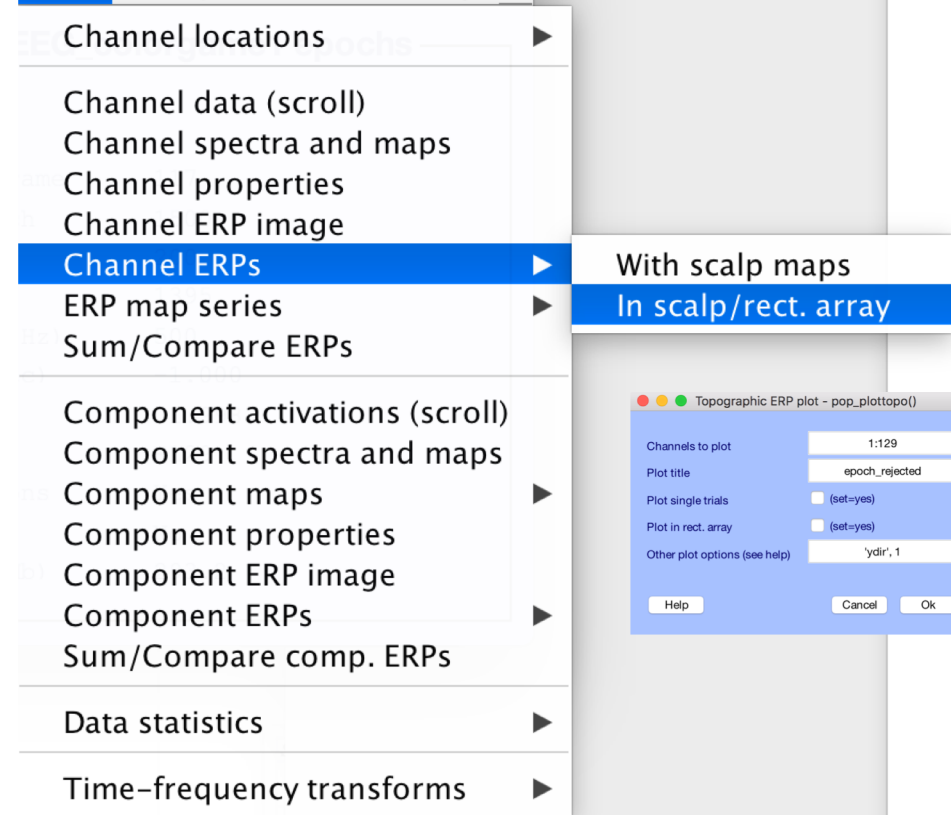
Scalp map latencies (ms, NaN -> max-RMS) NaN

Plot title: ERP data and scalp maps

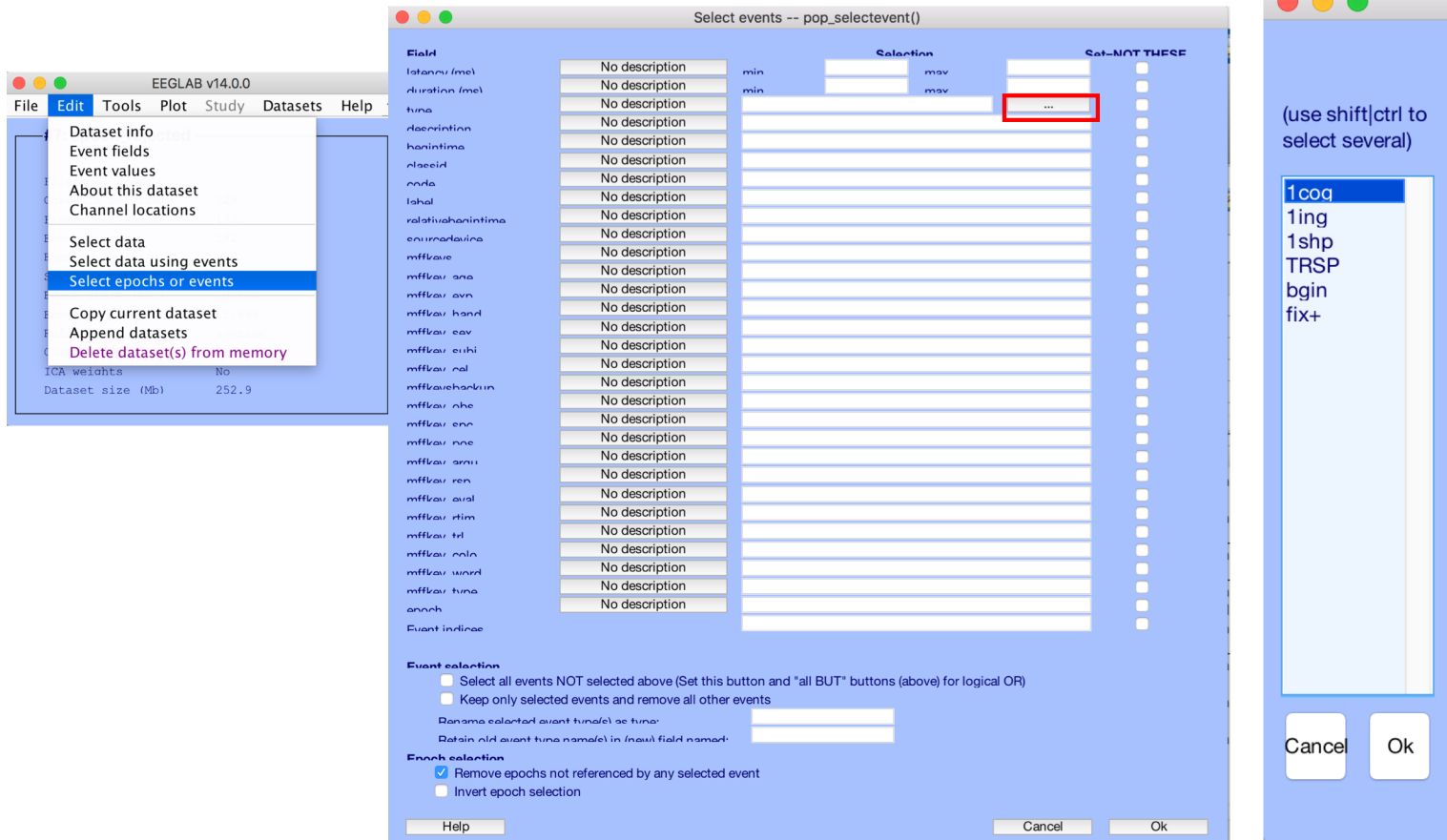
Scalp map options (see >> help topoplot):



Plot Study Datasets Help



7. Average into separate conditions



EEGLAB v14.0.0

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) from memory

ICA weights No
Dataset size (Mb) 252.9

Select events -- pop_selectevent()

Field	Description	min	max	Selection	Set-NOT THESE
latency (ms)	No description				
duration (ms)	No description				
tune	No description				
description	No description				
handtime	No description				
riseid	No description				
note	No description				
label	No description				
relativehandtime	No description				
enumeration	No description				
mfkvar	No description				
mfkvar ana	No description				
mfkvar avn	No description				
mfkvar hand	No description				
mfkvar eav	No description				
mfkvar eish	No description				
mfkvar nel	No description				
mfkvar ehankun	No description				
mfkvar rhe	No description				
mfkvar enr	No description				
mfkvar rne	No description				
mfkvar anru	No description				
mfkvar ren	No description				
mfkvar oval	No description				
mfkvar rtm	No description				
mfkvar trl	No description				
mfkvar rln	No description				
mfkvar ward	No description				
mfkvar tune	No description				
anrnh	No description				
Event indices					

Event selection

- ☐ Select all events NOT selected above (Set this button and "all BUT" buttons (above) for logical OR)
- ☐ Keep only selected events and remove all other events

Rename selected event (name):

Retain old event name(s) in (new) field name(s):

Epoch selection

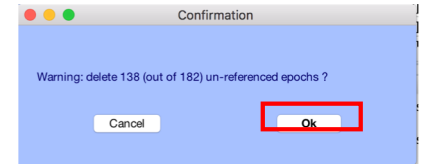
- ☒ Remove epochs not referenced by any selected event
- ☐ Invert epoch selection

Help Cancel Ok

(use shift|ctrl to select several)

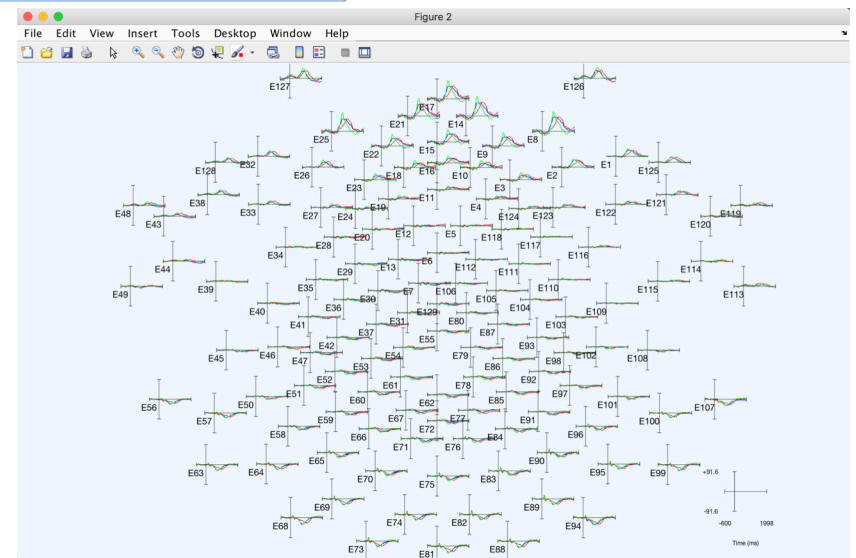
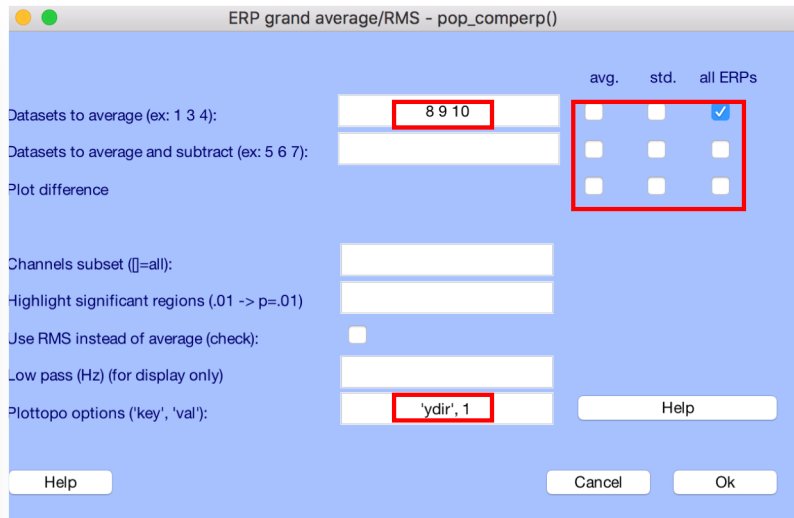
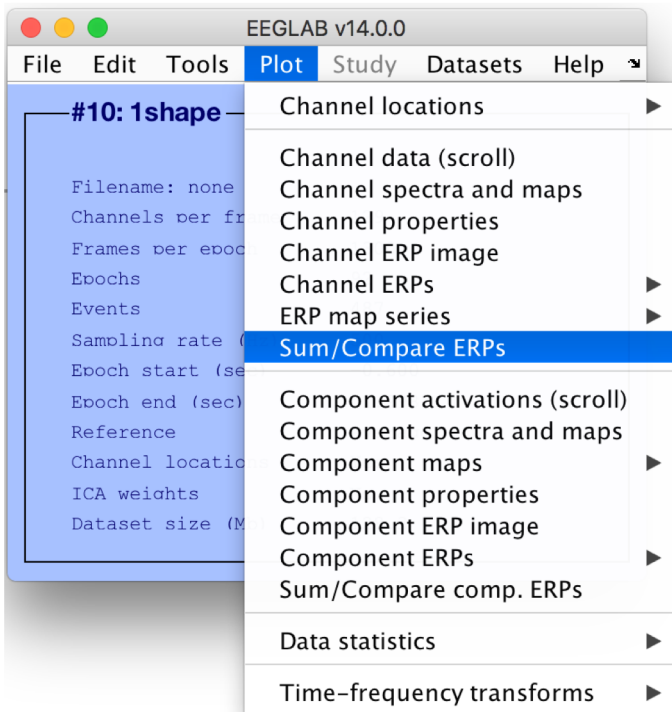
1coq
1ing
1shp
TRSP
bgin
fix+

Cancel Ok

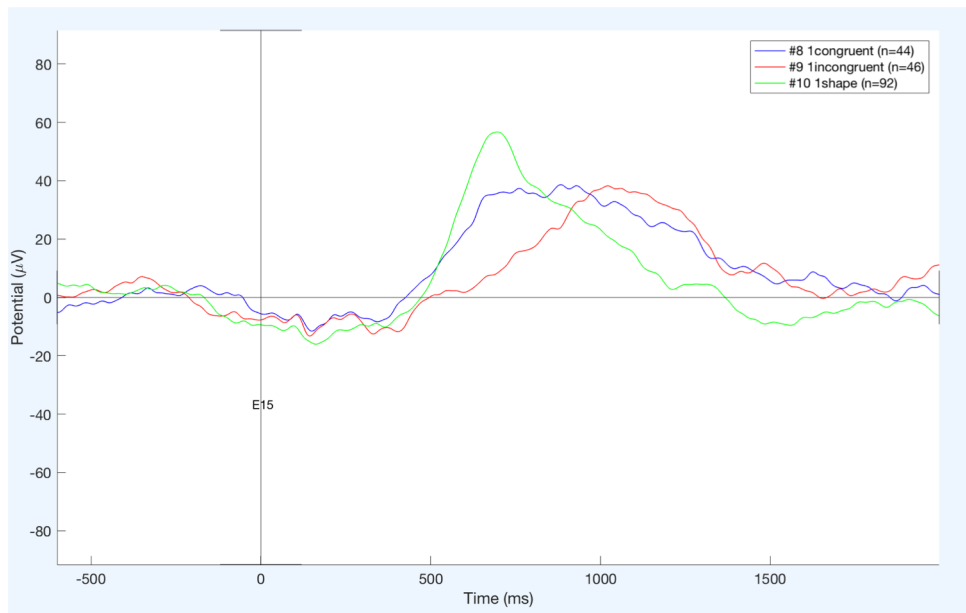


- Starting from the 'epoch_rejected' dataset, do the same for each condition:
- 1cong-- The congruent words before snack
- 1ing-- The incongruent words before snack
- 1shp-- The shapes before snack
- You will end up with 3 additional datasets, in my case they are dataset 8, 9, 10. Name them '1congruent', '1incongruent', and '1shape'.

Dataset 8:1congruent
Dataset 9:1incongruent
✓ Dataset 10:1shape



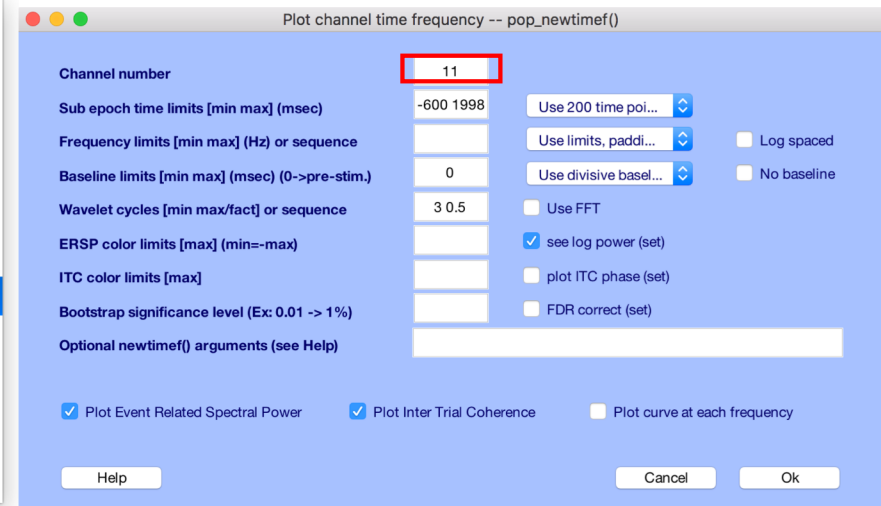
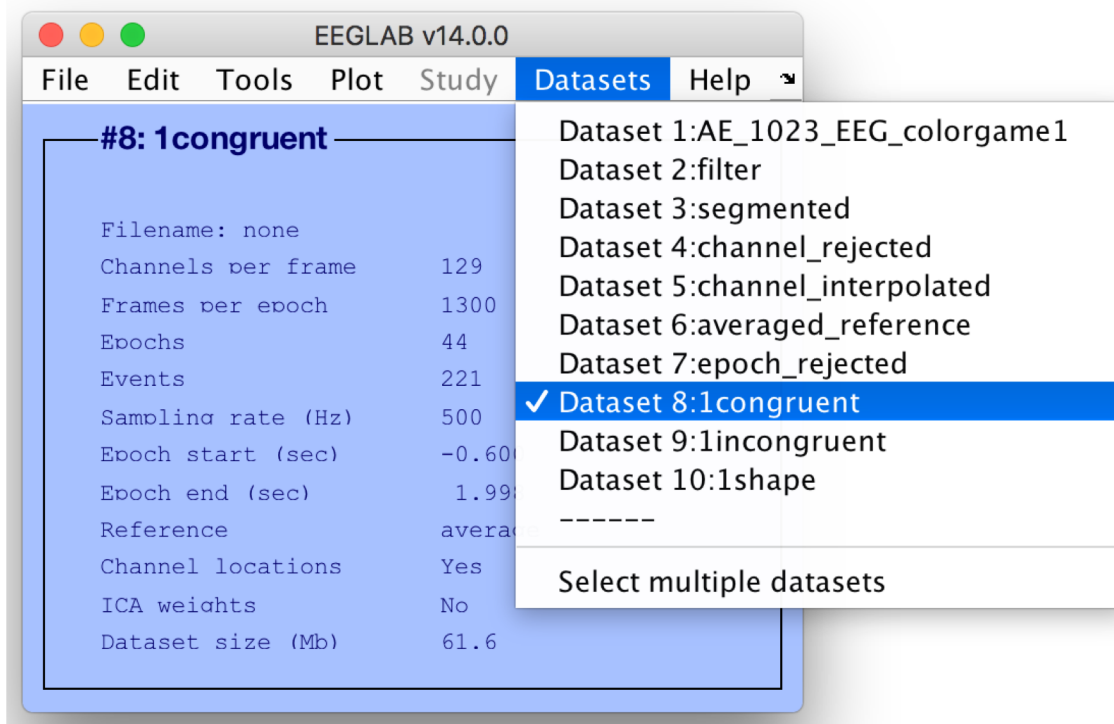
Click on any channel and it opens up a new window



- Shape is discrete and has an early sharp peak
- The congruent condition has an early peak, more blunted, because words are more complicated than shape.
- The incongruent condition has a late peak because it takes longer to process the conflict information

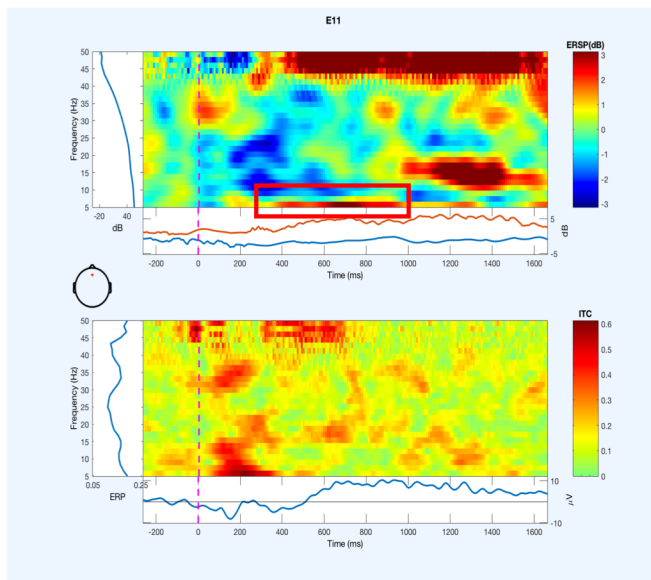
8. Time-frequency!

Make the same plot for dataset 8, 9 and 10
We are going to plot channel 11 because it is where we usually find lots of theta.



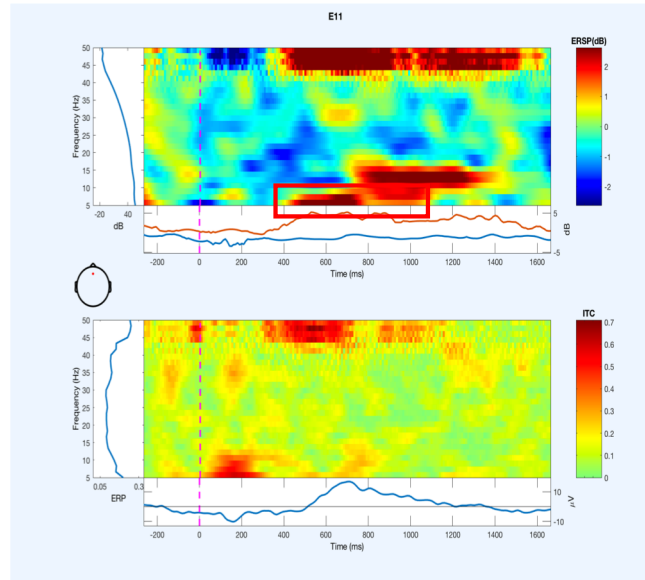
1shape

Short duration
of theta



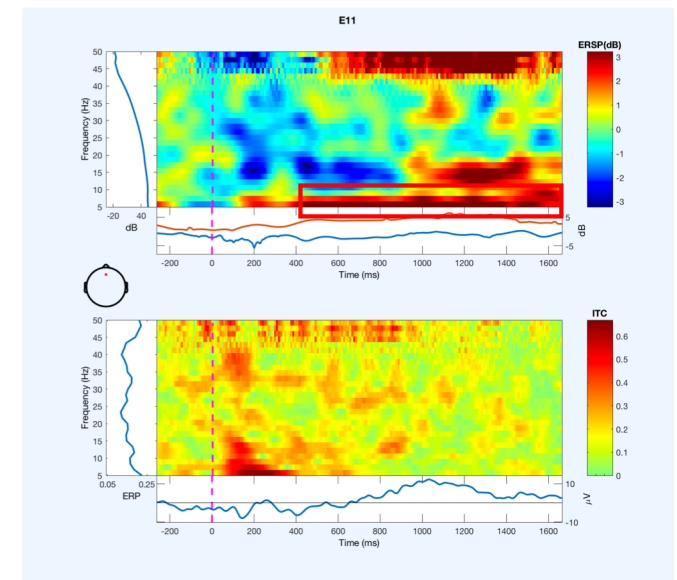
1congruent

Stronger and longer
duration of theta



1incongruent

Prolonged duration
of theta



Sorry I couldn't figure out how to limit the plotting frequency to be below 30 and still get the high resolution.
So ignore anything above 30 Hz.

Homework

- Keep in mind, we only processed 1 subject. For strong effects you could see in single subject.
- Work on the lettergame data, focusing on the comparisons between the following two conditions.
 - 1fgo– presnack, food as the background, go trials
 - 1fng-- presnack, food as the background, nogo trials
- And tell us what you find in terms of ERPs and oscillation!
 - Hint, go/nogo paradigm generates a central-parietal P300 for the nogo trials.
 - Since it is a fast paradigm, I would recommend segment it to -0.1 to 1 seconds.