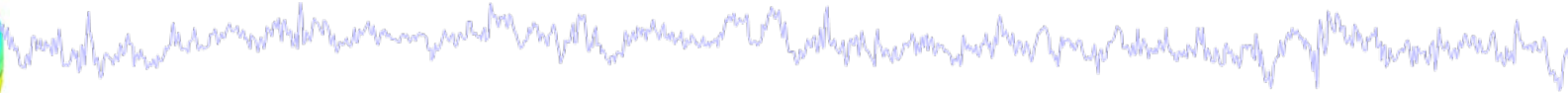


Evaluating ICA components



Plot 1

Component ERP

Plot 2

Component spectral power

Plot 3

Component ERP images

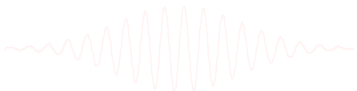
Plot 4

Component ERSP

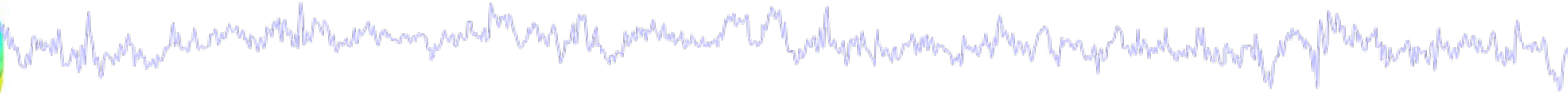
Plot 5

Component cross coherence

Exercise...



Evaluating ICA components



Plot 1

Component ERP

Plot 2

Component spectral power

Plot 3

Component ERP images

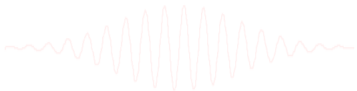
Plot 4

Component ERSP

Plot 5

Component cross coherence

Exercise...



Component ERPs

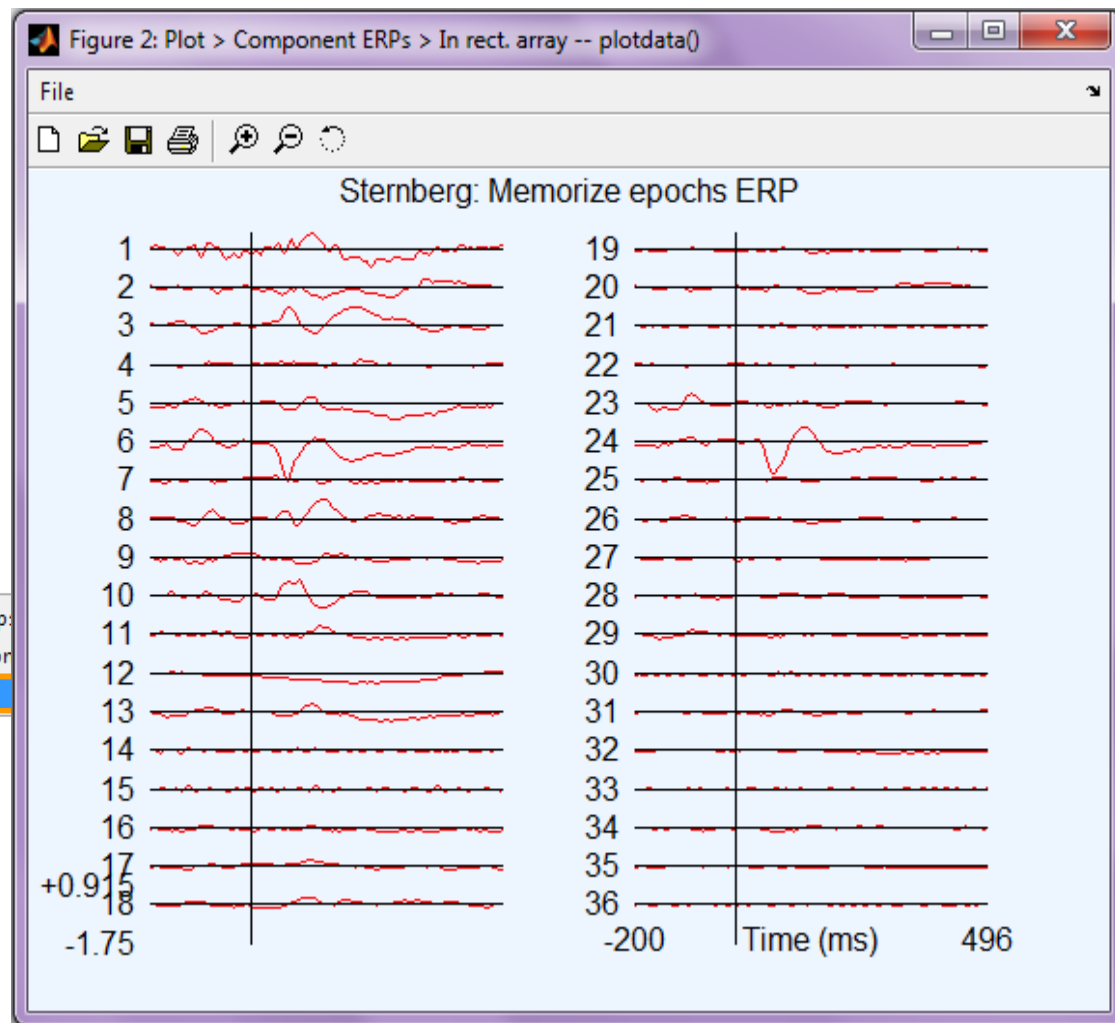


EEGLAB v7.1.7.18b

File Edit Tools Plot Study Datasets Help

#2: Ste chs

- 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**
 - With component maps
 - With comp. maps (cor)
 - In rectangular array**
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms
- Cluster dataset ICs



Component ERPs in rect. array -- pop_plotdata()

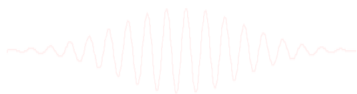
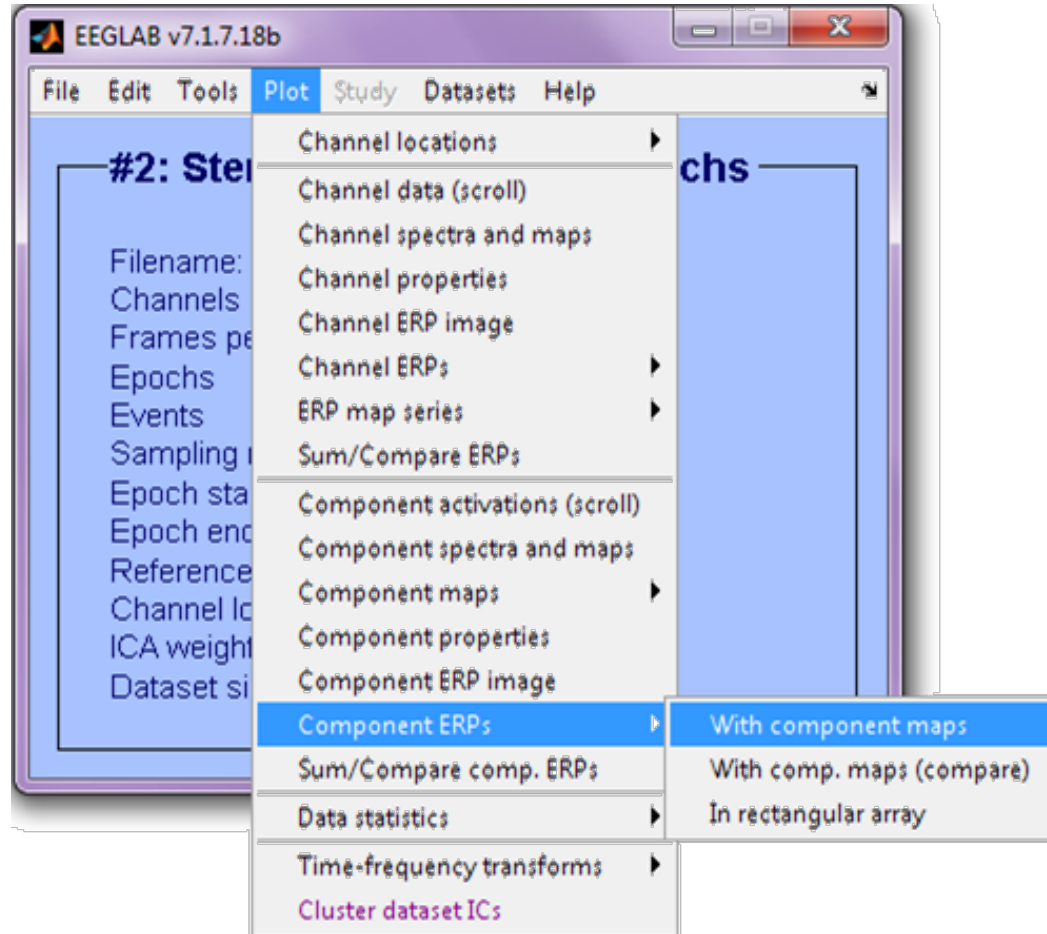
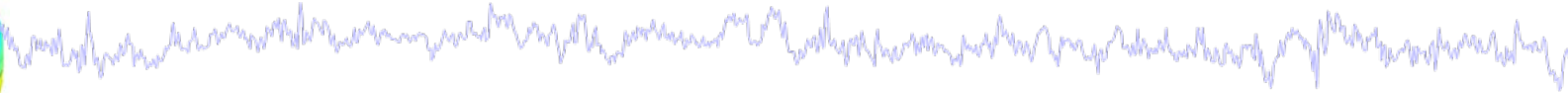
Component number(s): 1:71

Plot title: Sternberg: Memorize epochs ERP

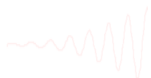
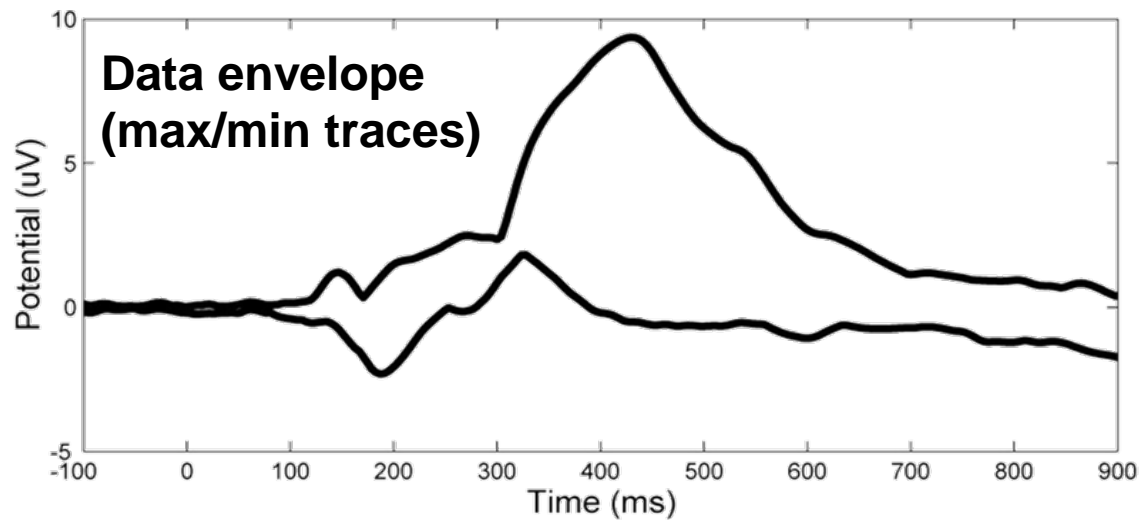
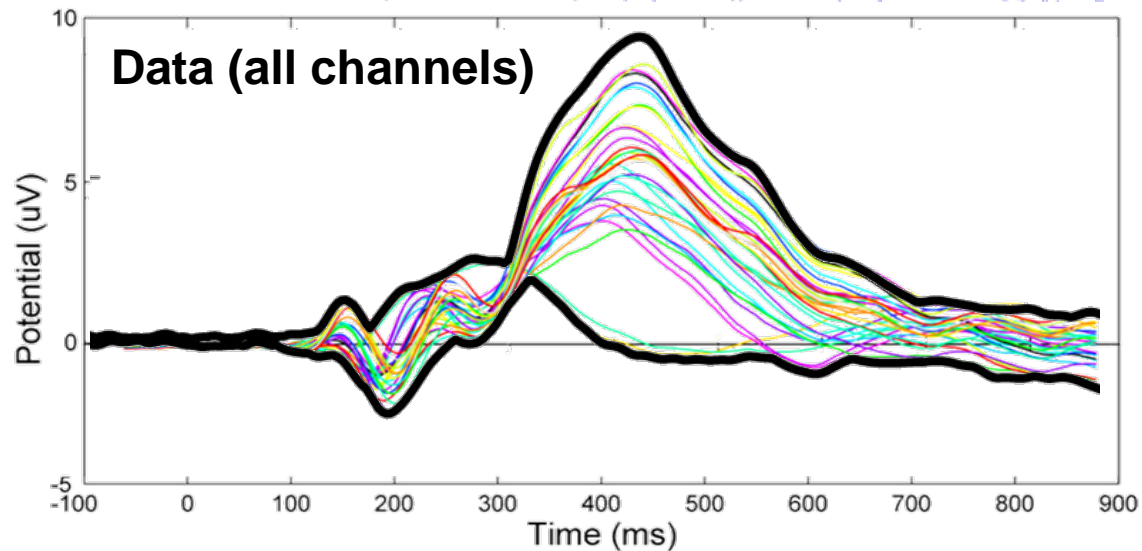
Vertical limits ([0 0]-> data range): 0 0

Cancel Help Ok

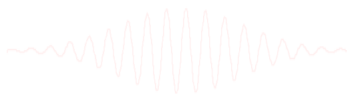
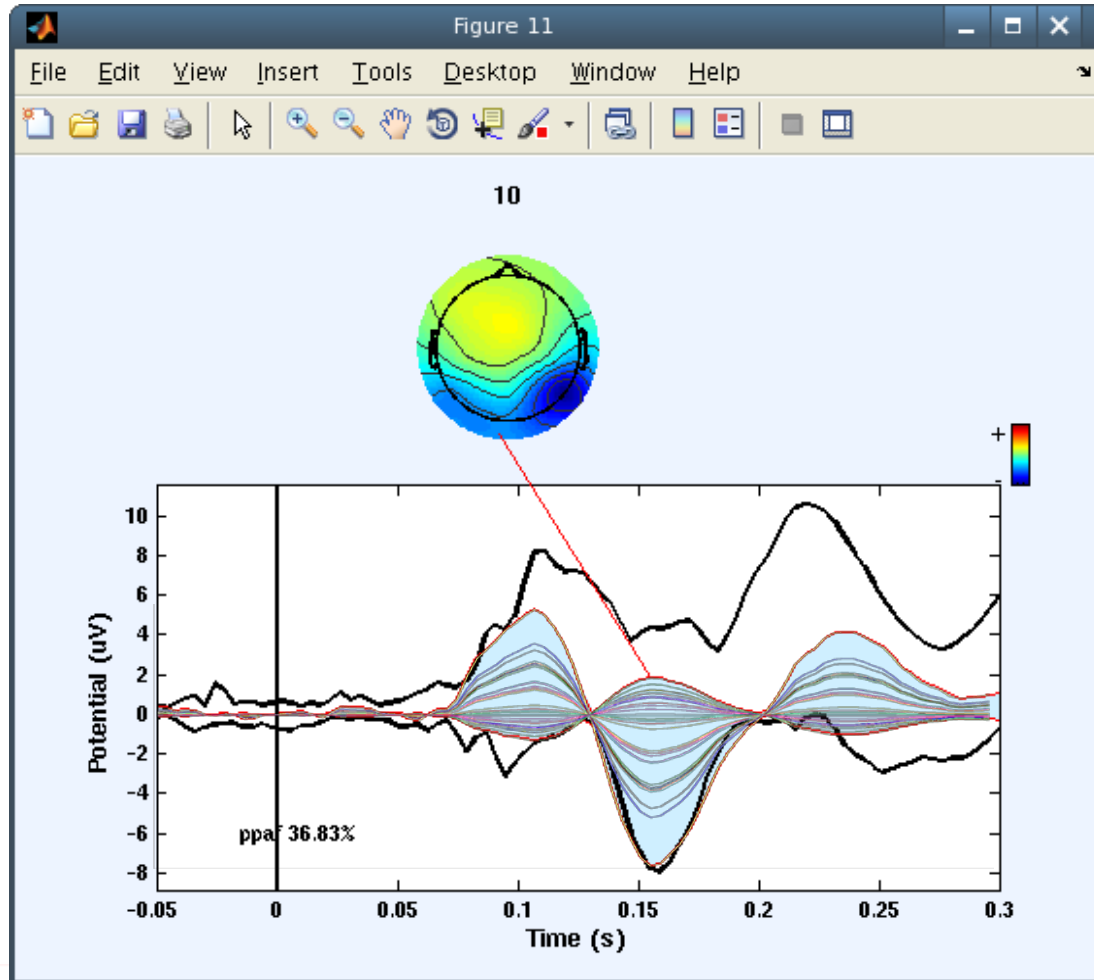
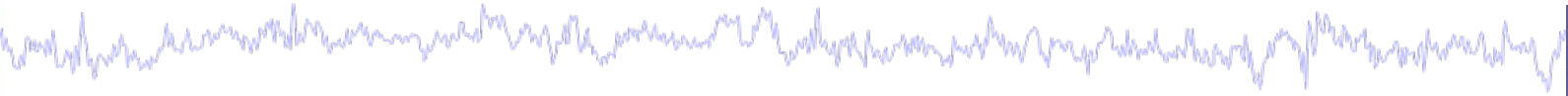
Component ERP envelope



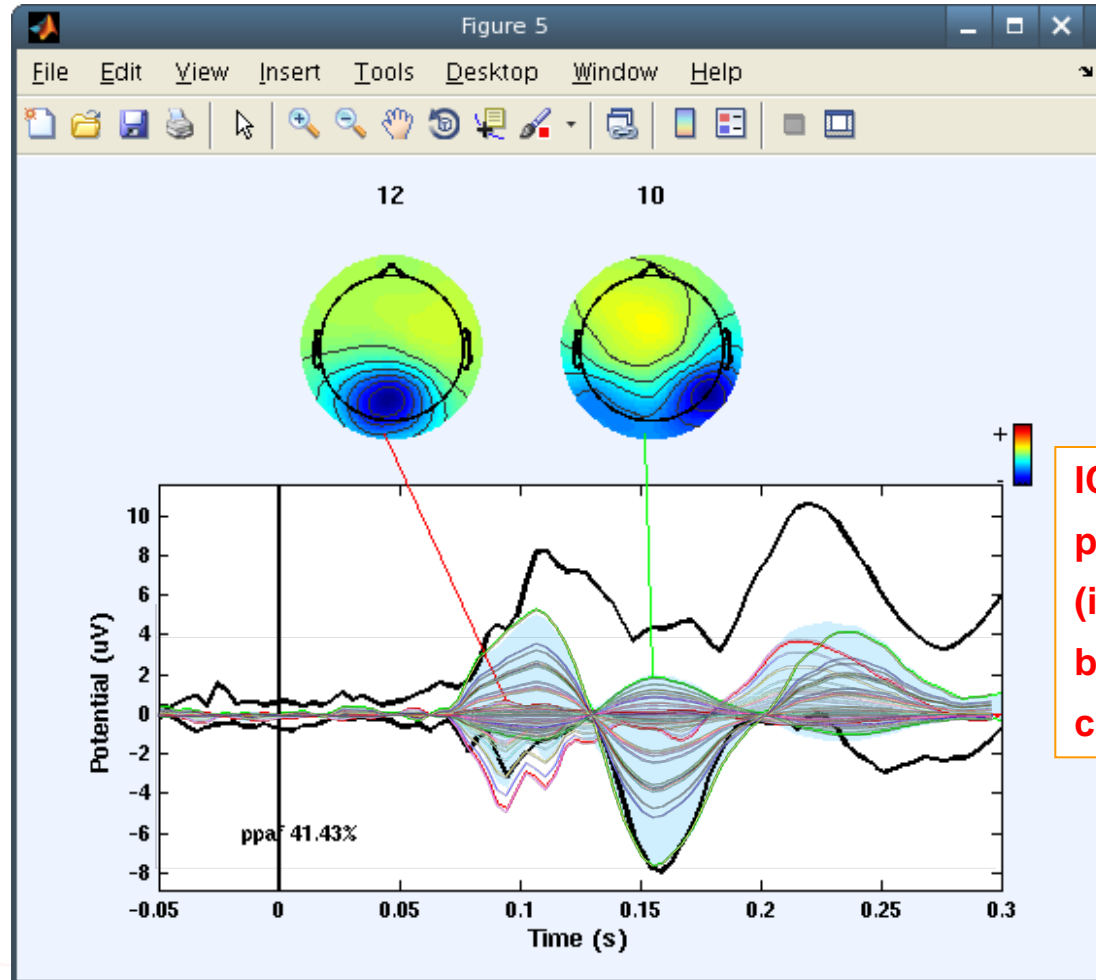
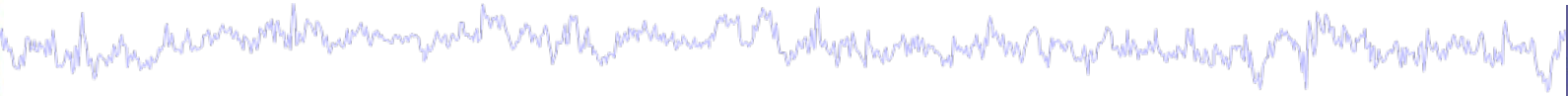
Definition: The data envelope



IC back-projection envelope

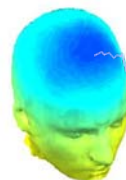


IC back-projection envelope



IC envelopes plotted for simplicity (instead of all back-projected channels)

IC contributions to ERP envelope



Plot component and ERP envelopes -- pop_envtopo()

Enter time range (in ms) to plot: -100 1000

Enter time range (in ms) to rank component contributions: 0 600

Number of largest contributing components to plot (1-20): 6

Else plot these component numbers only (<21) (Ex: 2;4,7):

Component numbers to remove from data before plotting:

Plot title: ERP components of faces_4 epochs

Optional topoplot() and spectopo() arguments: 'electrodes','off'

EEGLAB v7.1.7.18b

File Edit Tools Plot Study Datasets Help

#2: Step

Channel locations chs

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

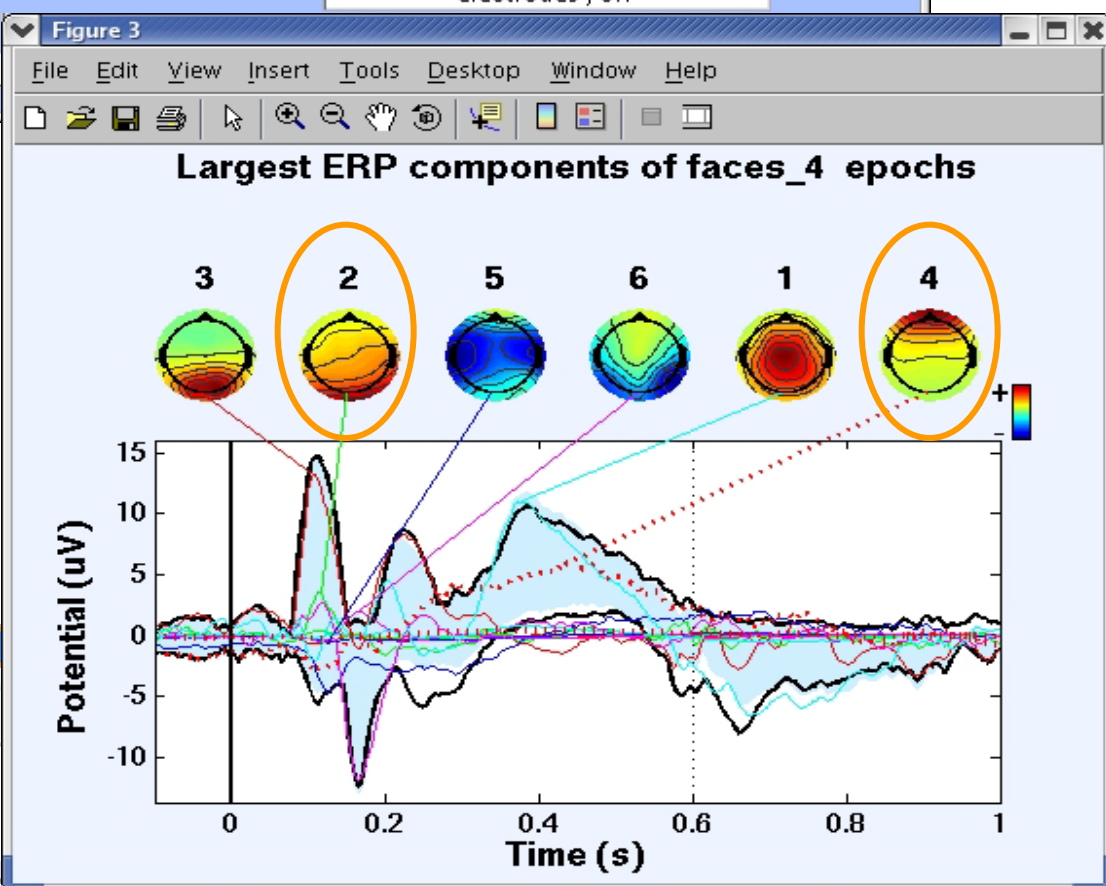
Component ERPs With component maps

Sum/Compare comp. ERPs With comp. maps (comp)

Data statistics In rectangular array

Time-frequency transforms

Cluster dataset ICs



Component contribution to the dataset ERP



Plot component and ERP envelopes -- pop_envtopo()

Enter time range (in ms) to plot: -100 1000

Enter time range (in ms) to rank component contributions: 0 600

Number of largest contributing components to plot (1-20): 6

Else plot these component numbers only (<21) (Ex: 2;4,7): **2, 4, 7, 9, 12, 17,18,25**

Component numbers to remove from data before plotting:

Plot title: ERP components of faces_4 epochs

Optional topoplot() and spectopo() arguments: 'electrodes','off'

Cancel

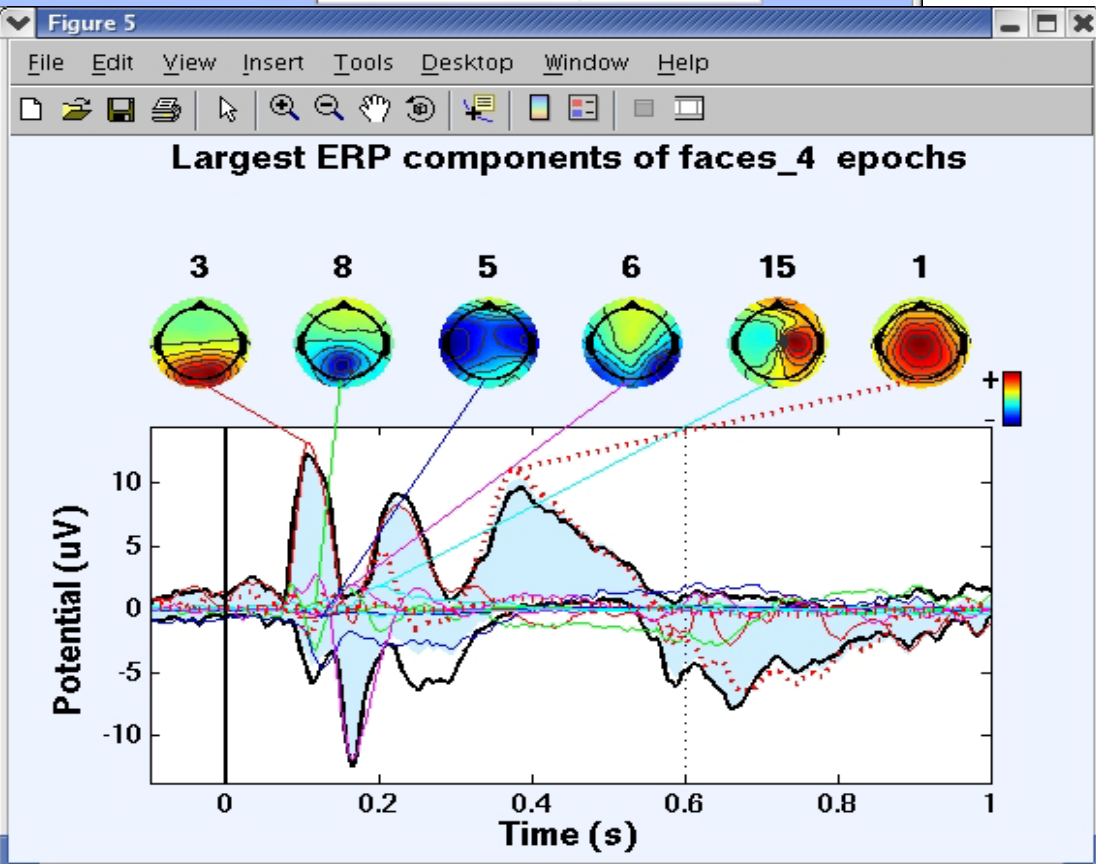
Artifact Components

EEGLAB v6.0b

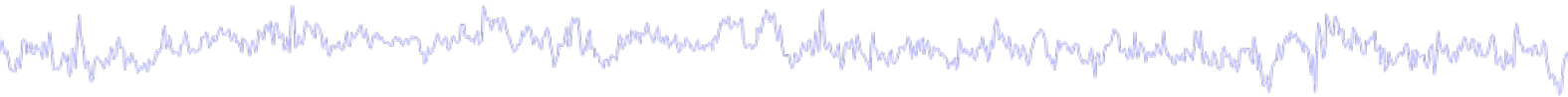
File Edit Tools Plot Study Datasets Help

#1: faces_4

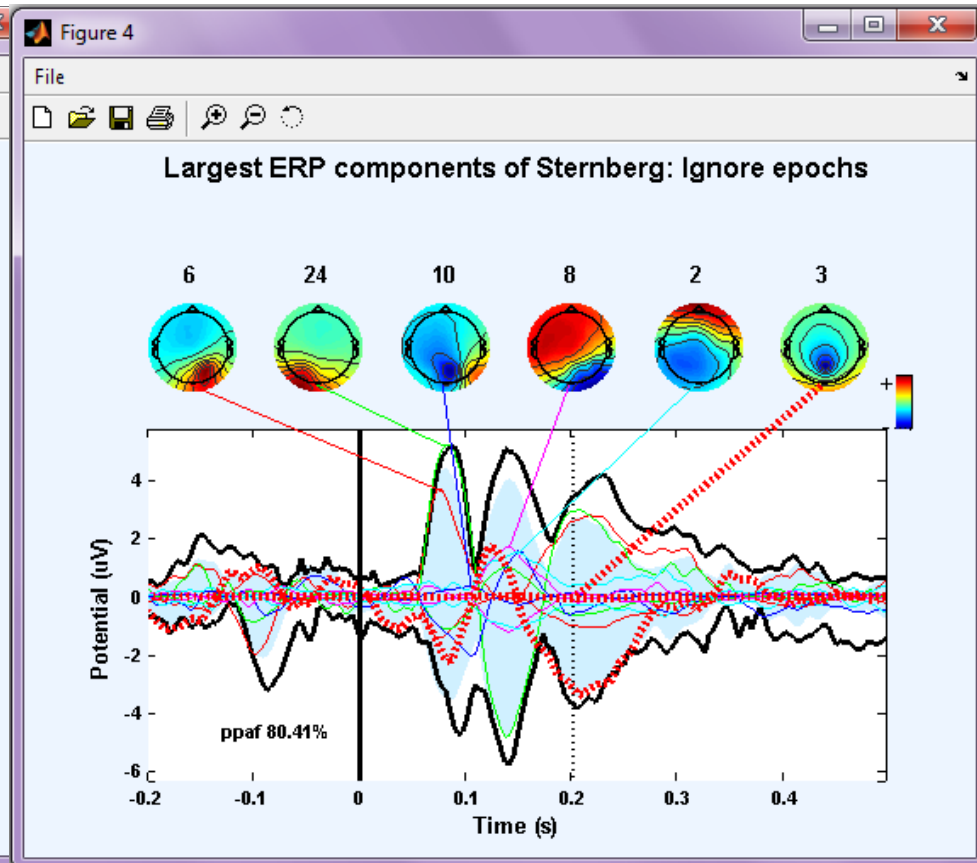
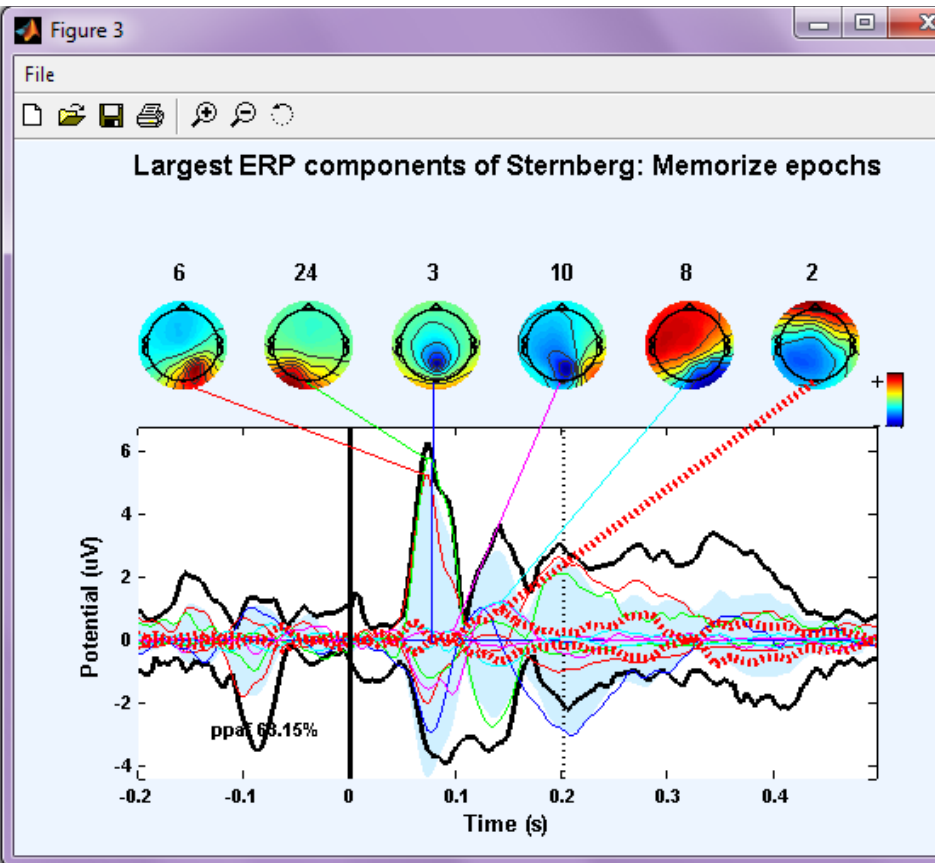
- Channel locations
- Channel data (scroll)
- Channel spectra and maps
- Channel properties
- Channel ERP image
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activations (scroll)
- Component spectra and maps
- Component maps
- Component properties
- Component ERP image
- Component ERPs**
 - With component maps
- Sum/Compare comp. ERPs
 - With comp. maps (comp)
- Data statistics
 - In rectangular array
- Time-frequency transforms
 - Average time-frequency
 - Cluster dataset ICs



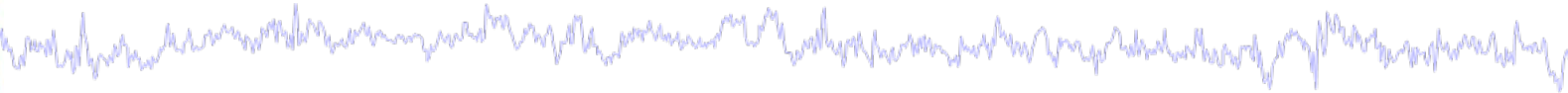
IC ERP difference



What is the IC ERP difference between these 2 conditions?



IC ERP difference



EEGLAB v7.1.7.18b

File Edit Tools **Plot** Study Datasets Help

#3: Step

- 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
- Cluster dataset ICs

Filename:
Channels
Frames per
Epochs
Events
Sampling
Epoch start
Epoch end
Reference
Channel loc
ICA weight
Dataset si

Component ERPs

- With component maps
- With comp. maps (compare)**
- In rectangular array

Sum/Compare comp. ERPs

- In rectangular array

Data statistics

- In rectangular array

Time-frequency transforms

Cluster dataset ICs

Plot component and ERP envelopes -- pop_envtopo()

Dataset indices to subtract (Ex: '1 2'-> 1-2): 2 3

Enter time range (in ms) to plot: -200 496

Enter time range (in ms) to rank component contributions: 0 200

Number of largest contributing components to plot (7): 6

Else plot these component numbers only (Ex: 2;4;7):

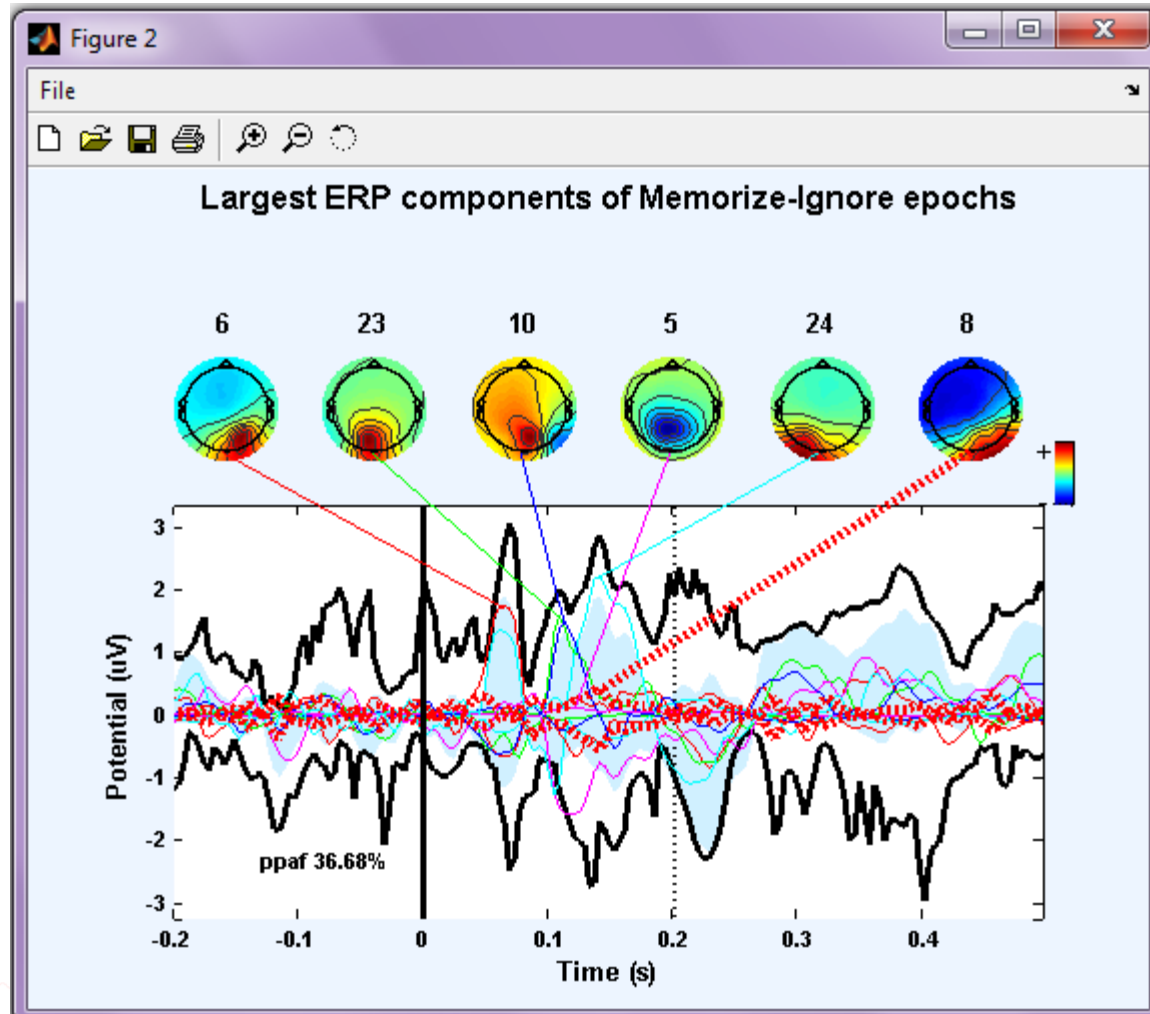
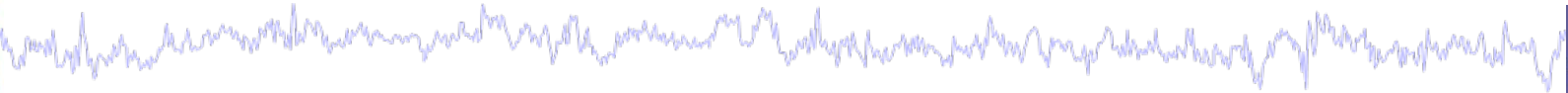
Component numbers to remove from data before plotting: 1

Plot title: Largest ERP components of Memoriz

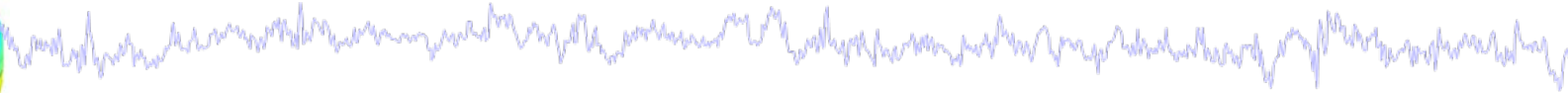
Optional topoplot() and envtopo() arguments: 'electrodes','off'

Cancel Help Ok

IC ERP difference



Evaluating ICA components



Plot 1

Component ERP

Plot 2

Component spectral power

Plot 3

Component ERP images

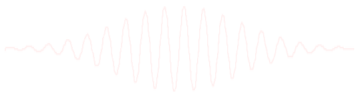
Plot 4

Component ERSP

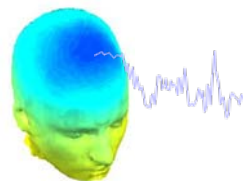
Plot 5

Component cross coherence

Exercise...



Plot component power



Component spectra and maps -- pop_spectopo()

Epoch time range to analyze [min_ms max_ms]: 0 2440528

Frequency (Hz) to analyze: 10 ←

Electrode number to analyze ([])=elec with max power; 0=whole scalp: 0

Percent data to sample (1 to 100): 20

Components to include in the analysis: 1:71

Number of largest-contributing components to map: 5 ←

Else, map only these component numbers:

[Checked] Compute comp spectra; [Unchecked] (data-comp) spectra:

Plotting frequency range ([min max] Hz): 2 25

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

Cancel Help

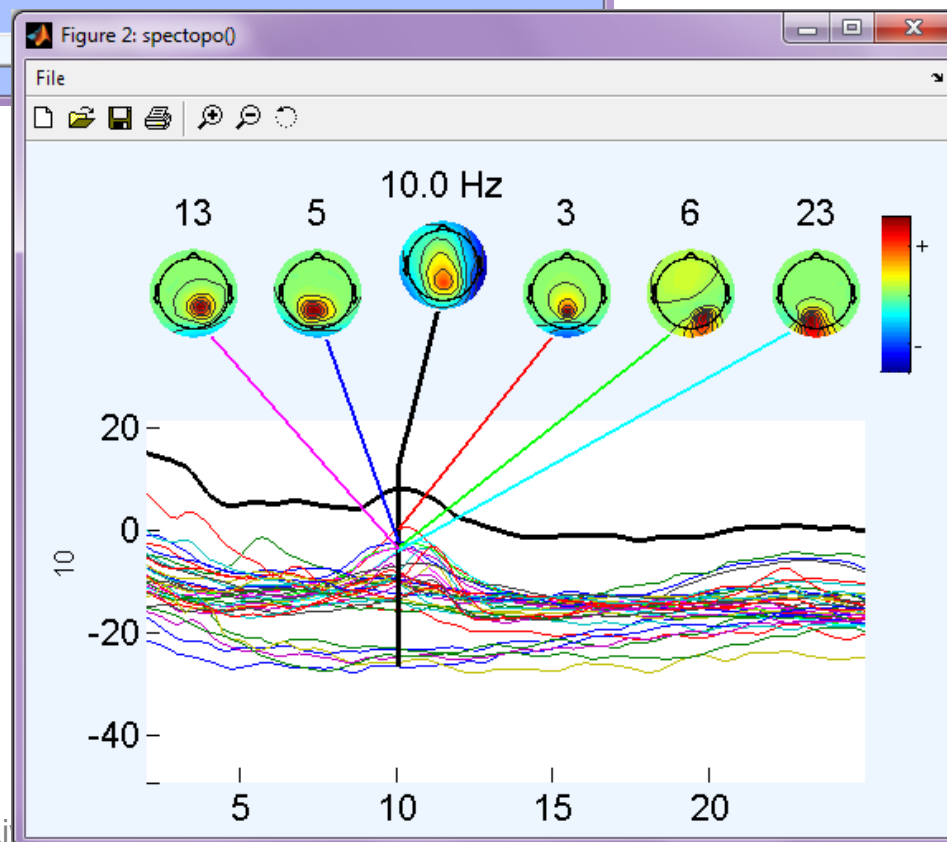
EEGLAB v7.1.7.18b

File Edit Tools Plot

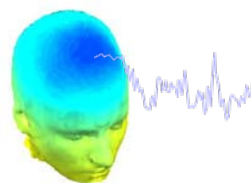
#1: Step

Filename:
Channels
Frames per
Epochs
Events
Sampling
Epoch start
Epoch end
Reference
Channel loc
ICA weight
Dataset si

- 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



Plot component power



Component spectra and maps -- pop_spectopo()

Epoch time range to analyze [min_ms max_ms]: 0 2440528

Frequency (Hz) to analyze: 6

Electrode number to analyze ([]=elec with max power; 0=whole scalp): 0

Percent data to sample (1 to 100): 20

Components to include in the analysis: 1:71

Number of largest-contributing components to map: 5

Else, map only these component numbers:

[Checked] Compute comp spectra; [Unchecked] (data-comp) spectra:

Plotting frequency range ([min max] Hz): 2 25

Spectral and scalp map options (see topoplot):

Cancel

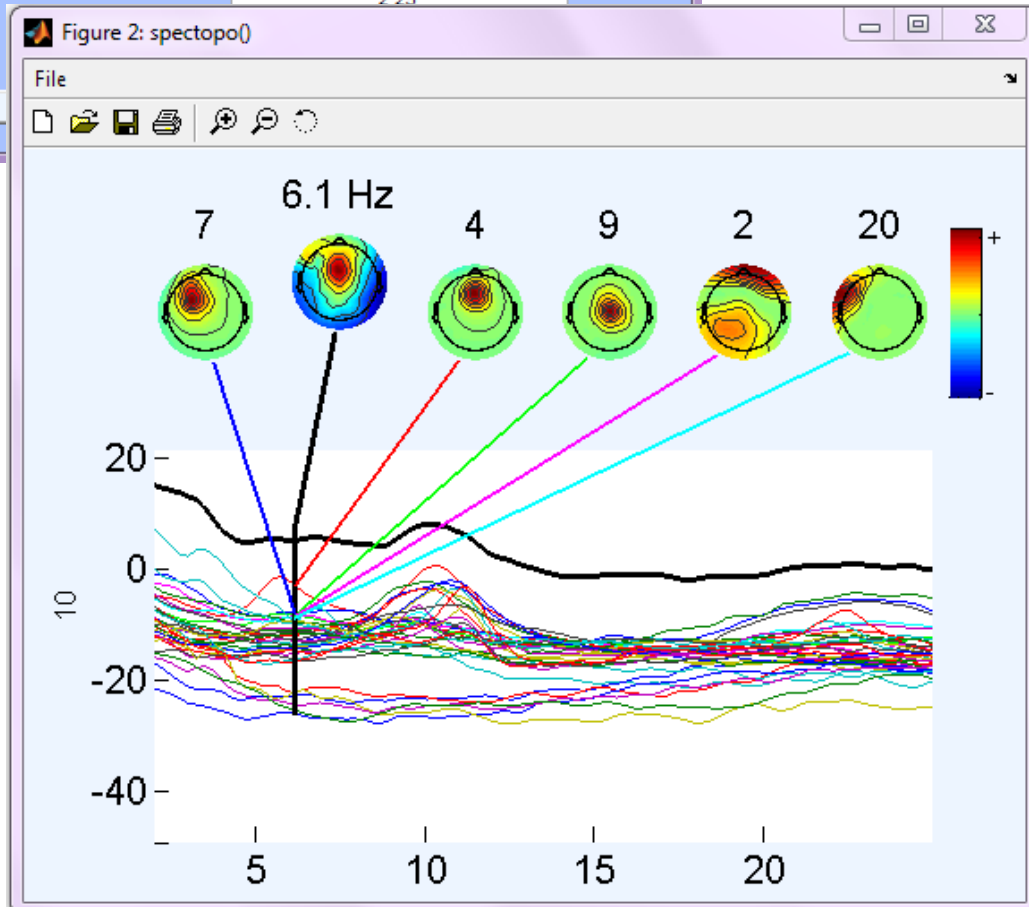
EEGLAB v7.1.7.18b

File Edit Tools Plot

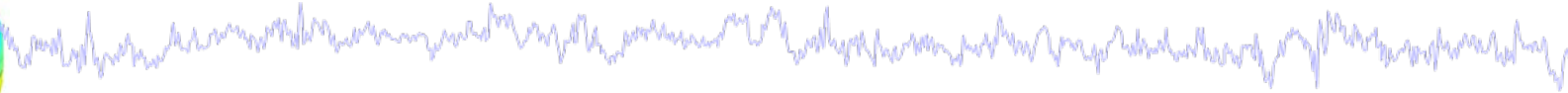
#1: Step

Filename:
Channels
Frames per
Epochs
Events
Sampling
Epoch sta
Epoch end
Reference
Channel lo
ICA weight
Dataset si

- 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



Evaluating ICA components



Plot 1

Component ERP

Plot 2

Component spectral power

Plot 3

Component ERP images

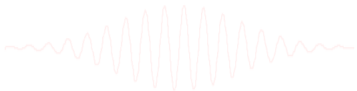
Plot 4

Component ERSP

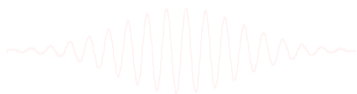
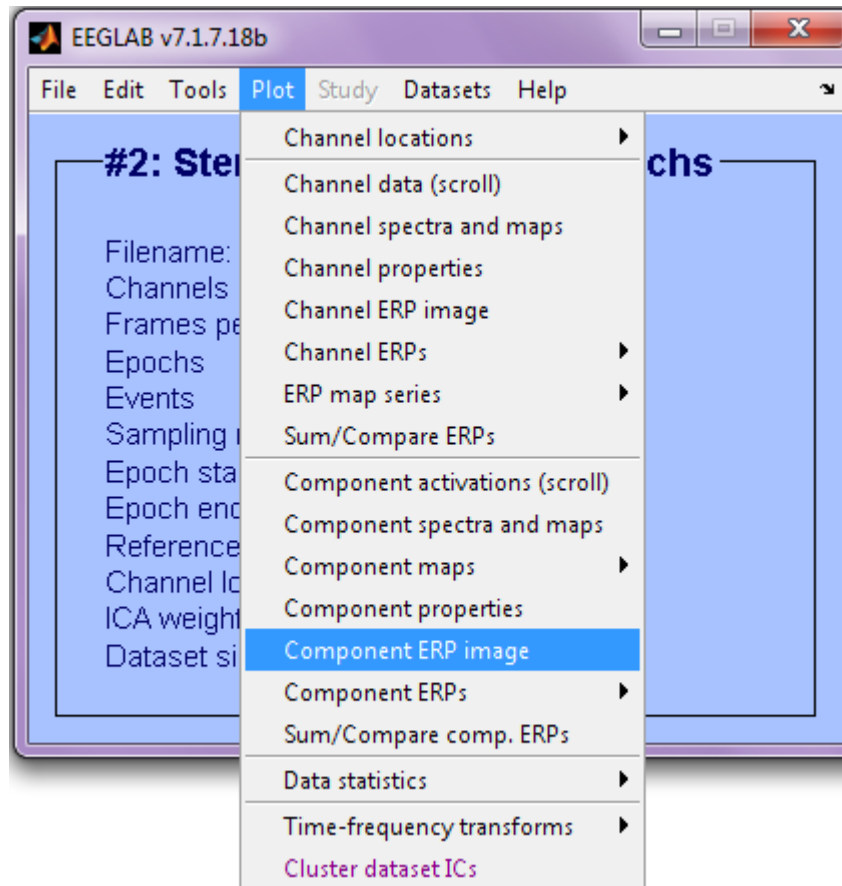
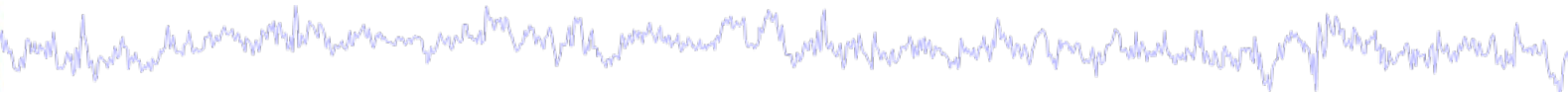
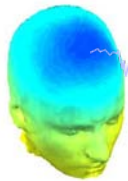
Plot 5

Component cross coherence

Exercise...



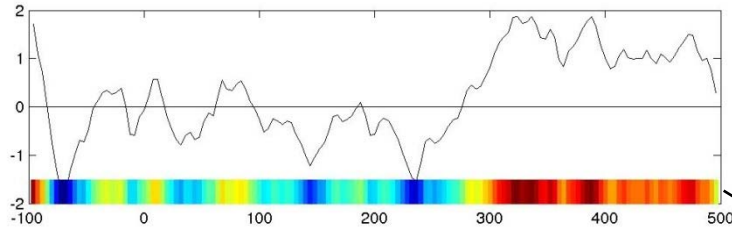
Component ERP image



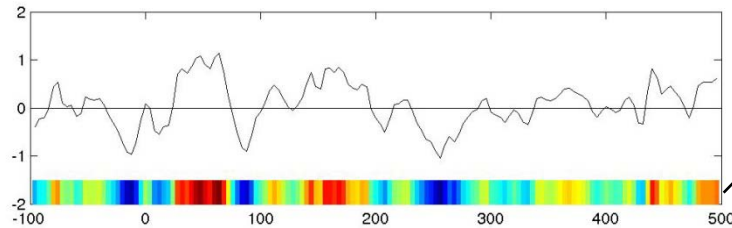
ERP Image basics



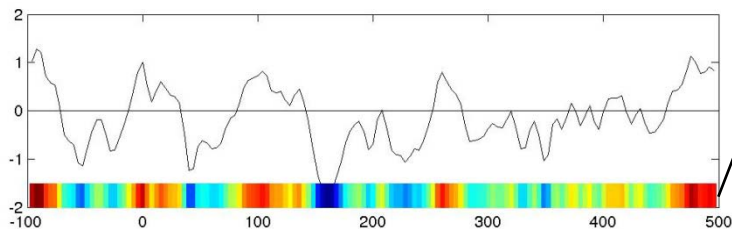
Trial 1



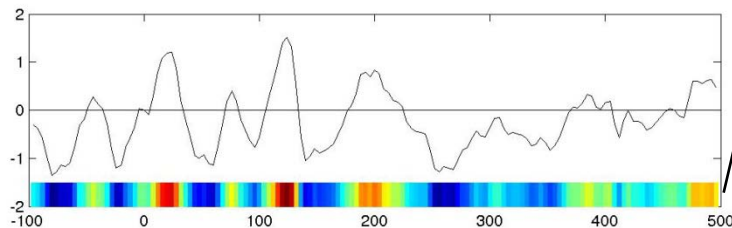
Trial 2



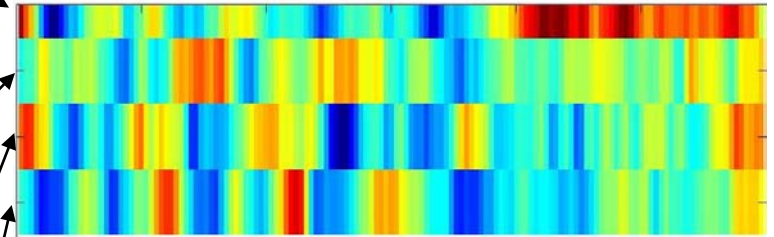
Trial 3



Trial 4

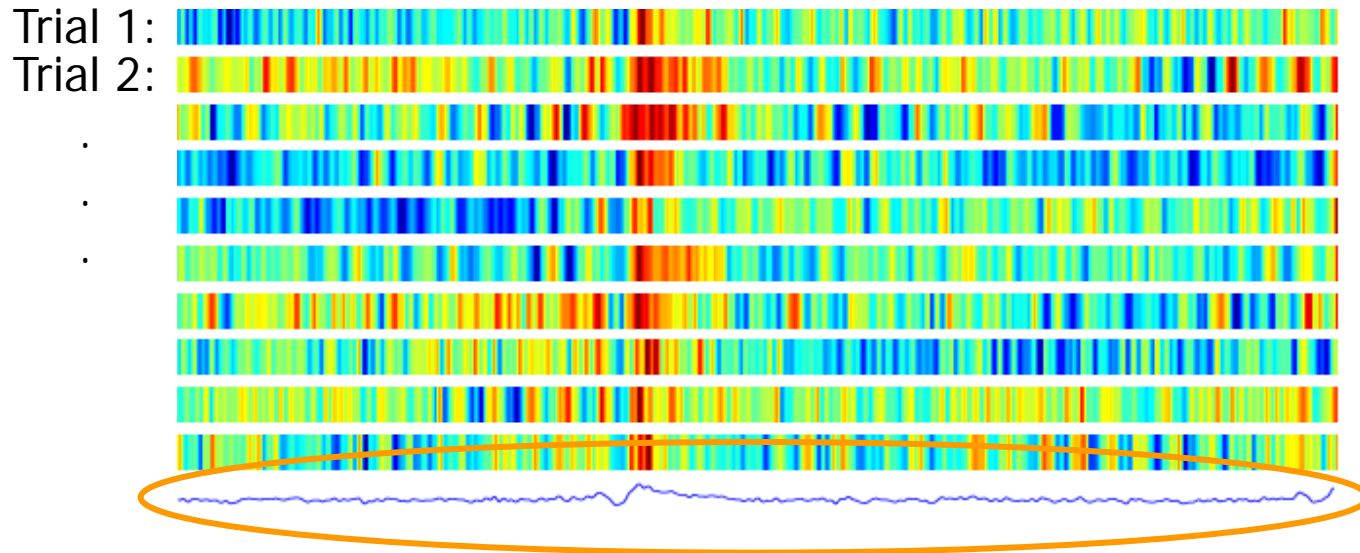


ERP Image

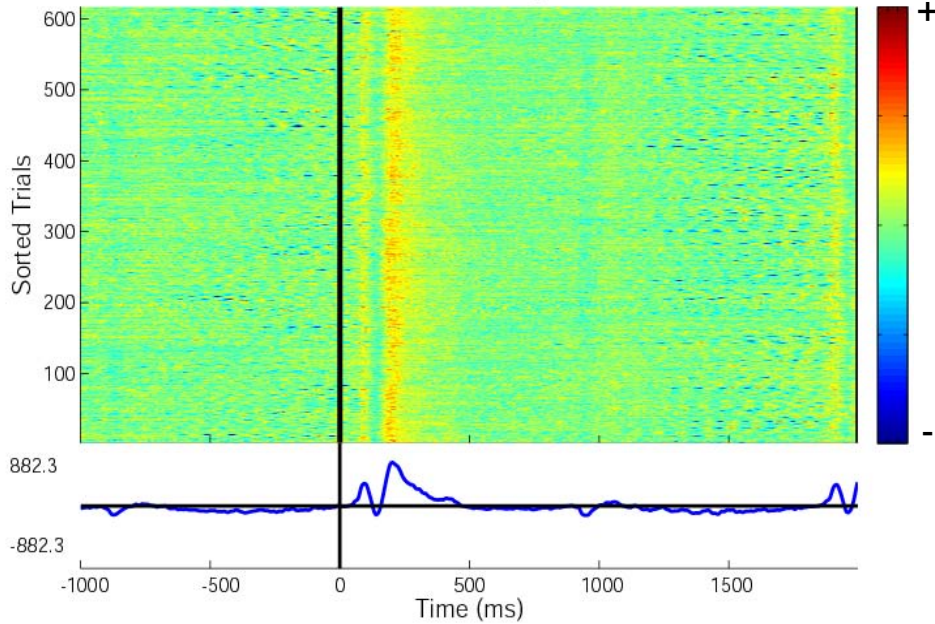


by default, sorted by
time-on-task
(1st trial, 2nd trial, ...)

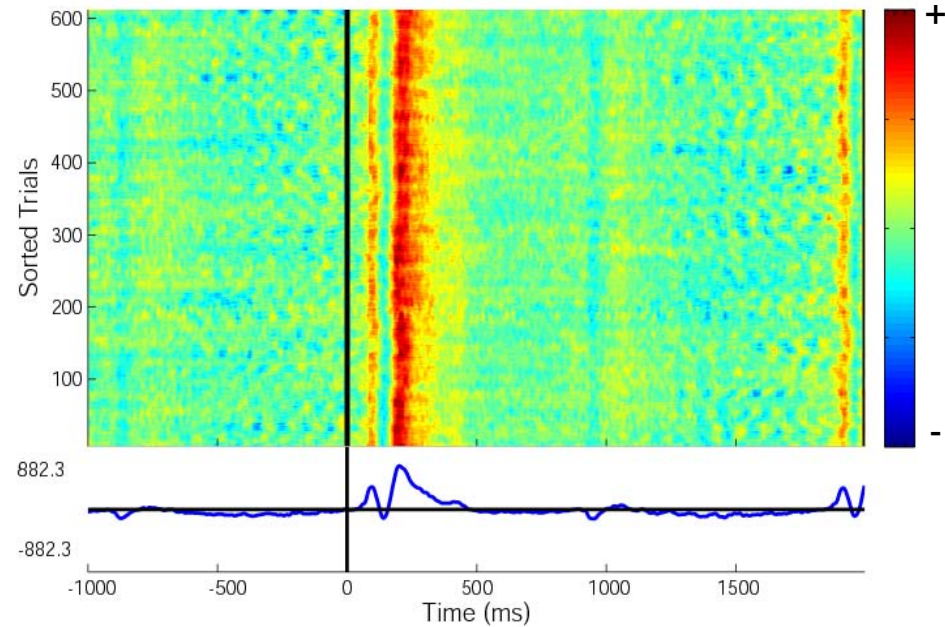
ERP Image basics



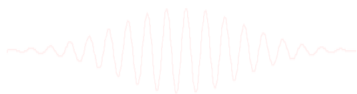
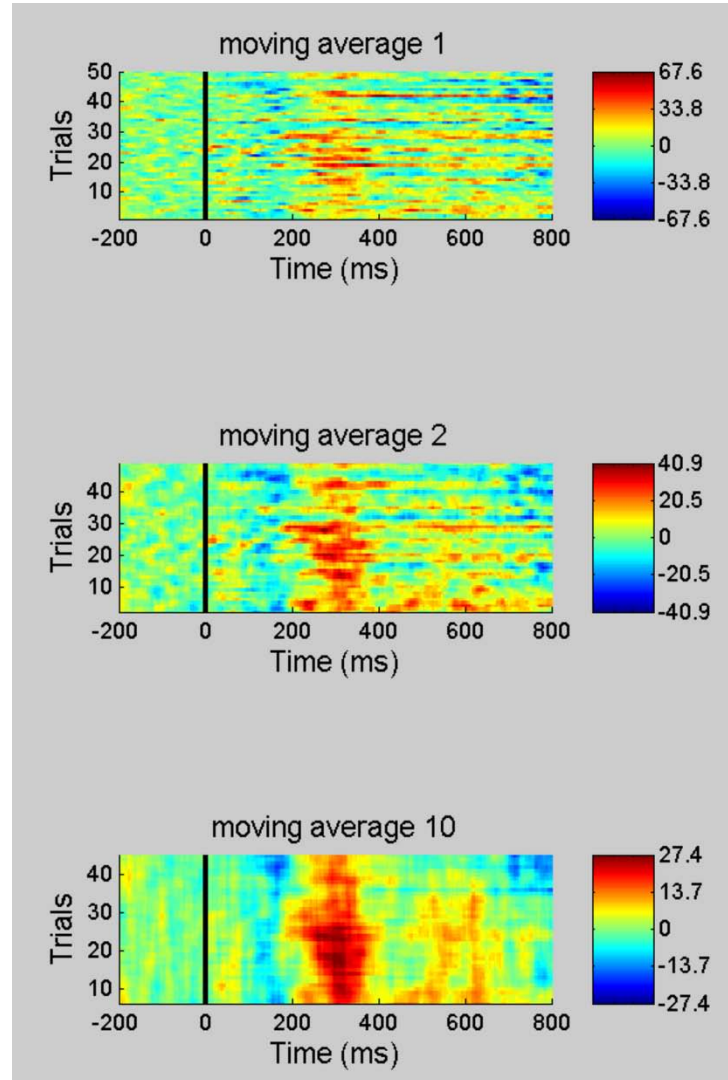
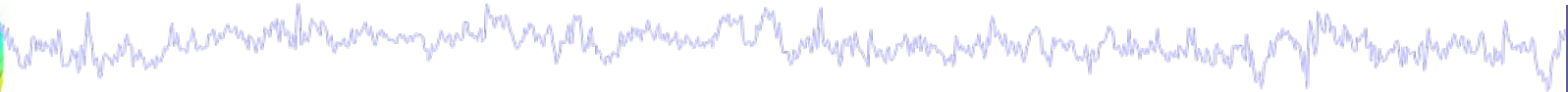
No Smoothing



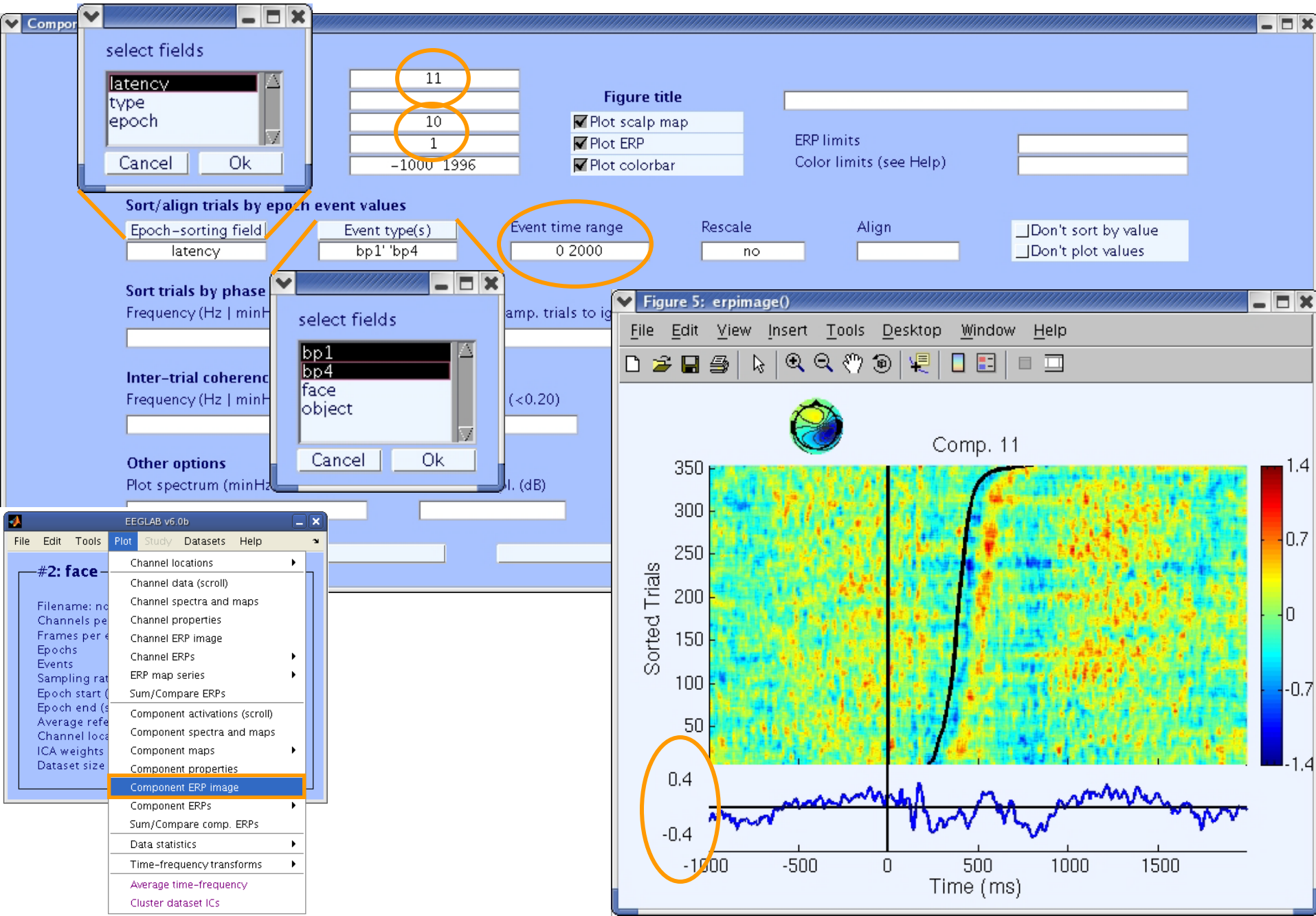
Smoothed across 10 Trials



ERP Images: smoothing across trials



Component ERP Images



Component ERP Images

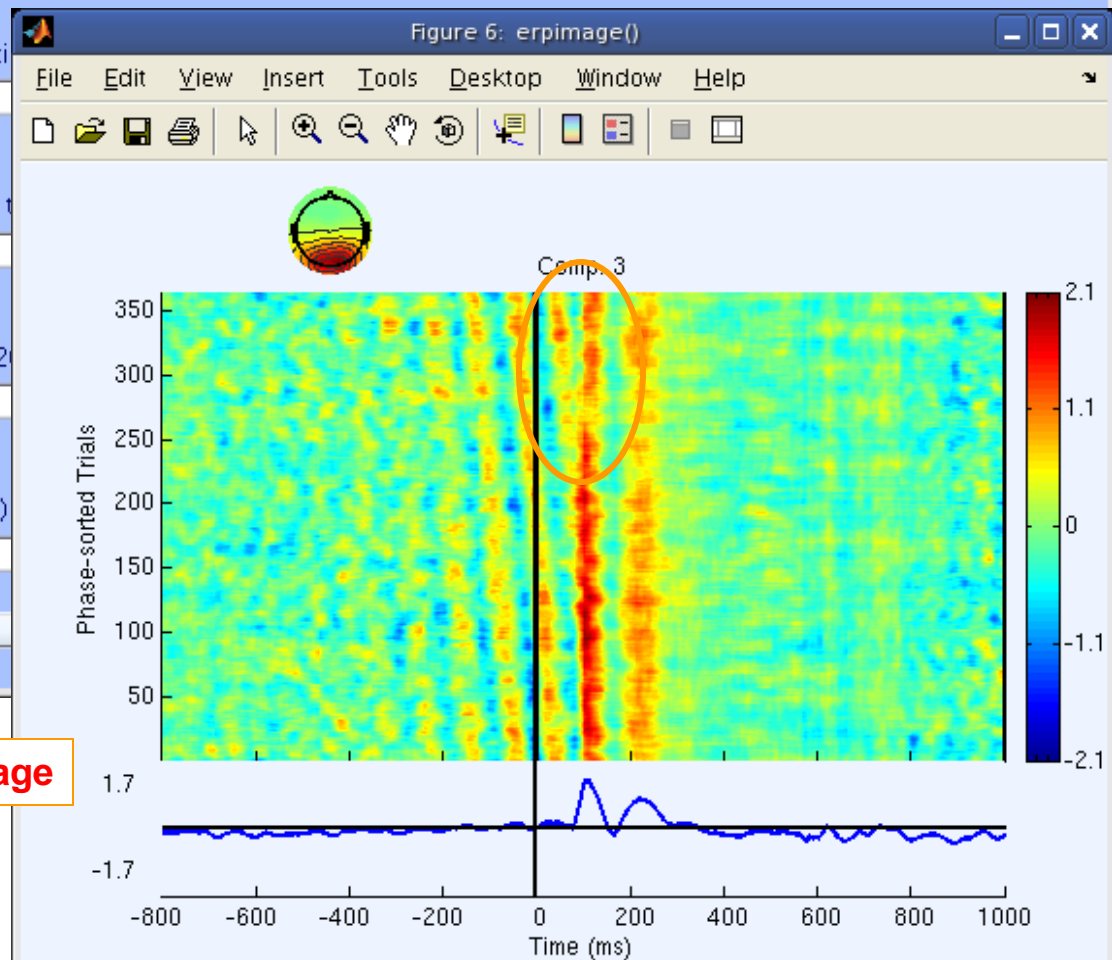
Component ERP image -- pop_erpimage()

Component(s)
Project to channel #
Smoothing
Downsampling
Time limits (ms)

Figure title
 Plot scalp map
 Plot ERP
 Plot colorbar
ERP limits
Color limits (see Help)

Sort/align trials by epoch event values
Epoch-sorting field Event type(s) Event time

Sort trials by phase
Frequency (Hz | minHz maxHz) Percent low-amp.
Inter-trial coherence options
Frequency (Hz | minHz maxHz) Signif. level (<0.2)
Other options
Plot spectrum (minHz maxHz) Baseline ampl. (dB)



Phase-sorted image

Component ERP Images

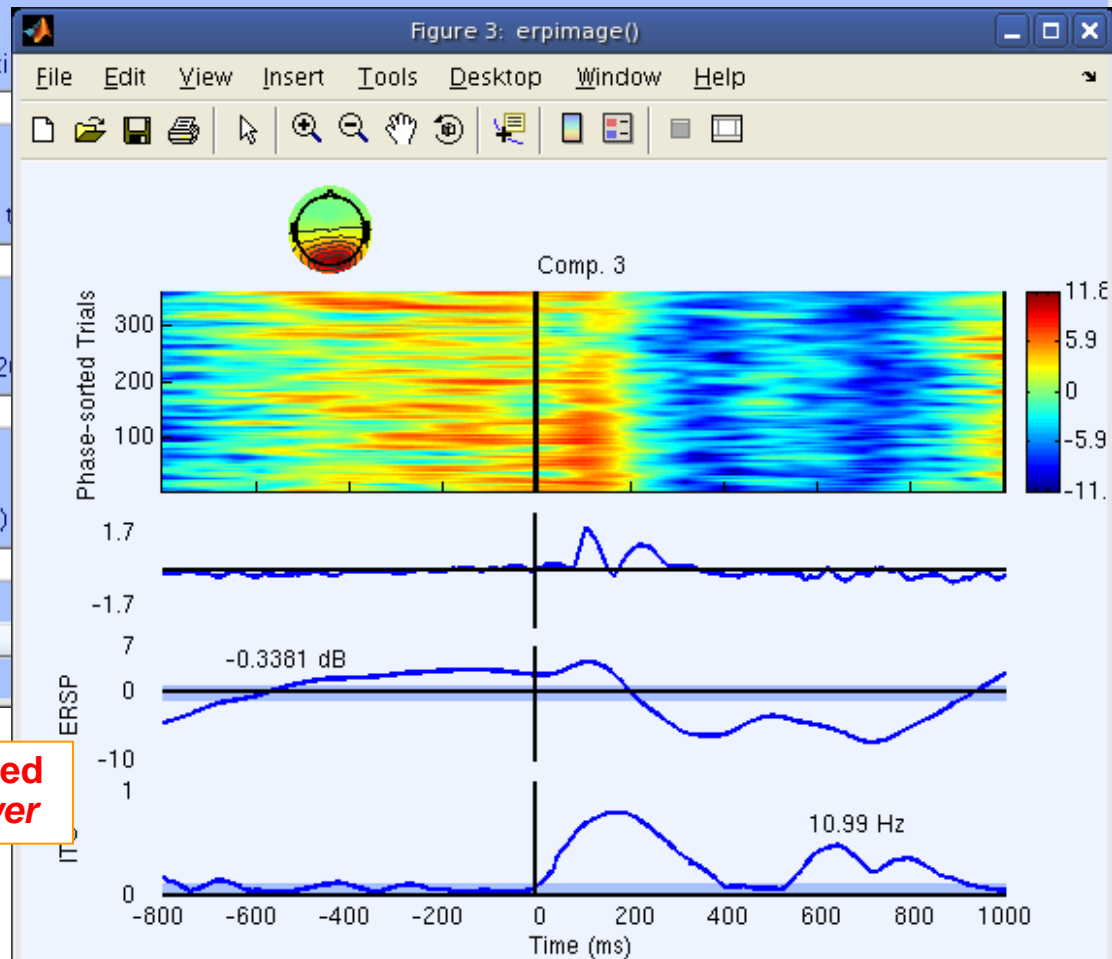
Component ERP image -- pop_erpimage()

Component(s)
Project to channel #
Smoothing
Downsampling
Time limits (ms)

Figure title
 Plot scalp map
 Plot ERP
 Plot colorbar
ERP limits
Color limits (see Help)

Sort/align trials by epoch event values
Epoch-sorting field Event type(s) Event time

Sort trials by phase
Frequency (Hz | minHz maxHz) Percent low-amp.
Inter-trial coherence options
Frequency (Hz | minHz maxHz) Signif. level (<0.2)
Other options
Plot spectrum (minHz maxHz) Baseline ampl. (dB)



Phase-sorted
alpha power

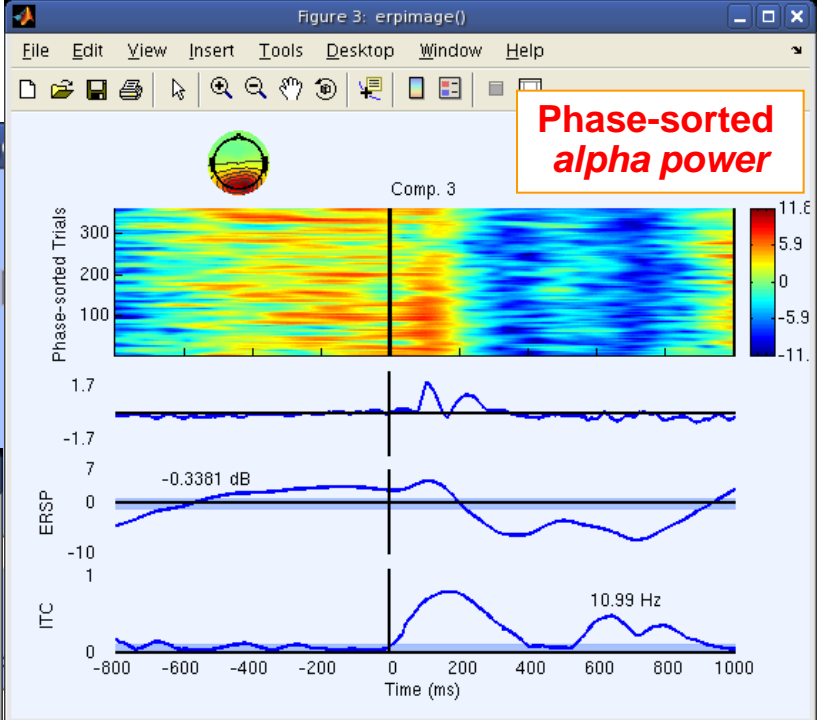
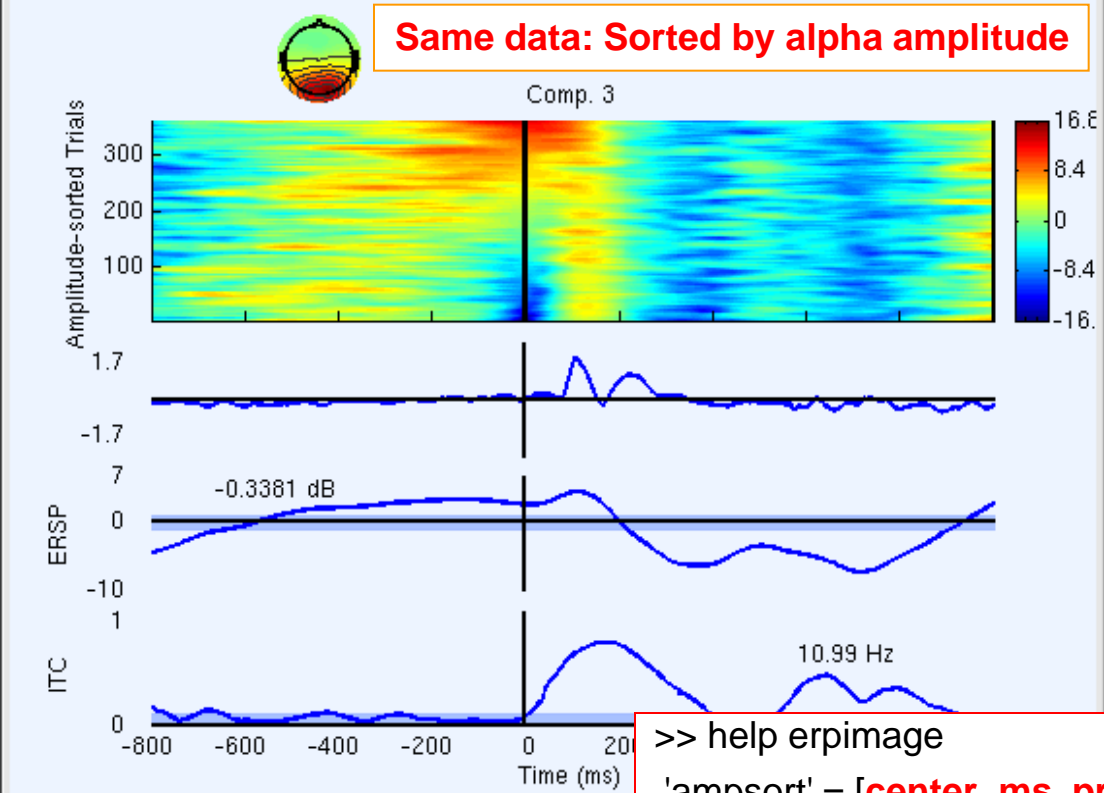
Component ERP

Component ERP image -- pop_erpimag

Component(s)	3	Figure title
Project to channel #		
Smoothing	10	
Downsampling	1	
Time limits (ms)	-800 1000	<input checked="" type="checkbox"/> Plot scalp map <input checked="" type="checkbox"/> Plot ERP <input checked="" type="checkbox"/> Plot colorbar

Figure 10: erpimage()

File Edit View Insert Tools Desktop Window Help



Coher limits (≤ 1) Image amps (Requires signif.)

More options (see >> help erpimage)

'ampsort', [0 0 10 12]

Ok

>> help erpimage
 'ampsort' = [center_ms, prcnt, freq, maxfreq] Sort epochs by amplitude.

Component ERP Images

Component ERP image -- pop_erpimage()

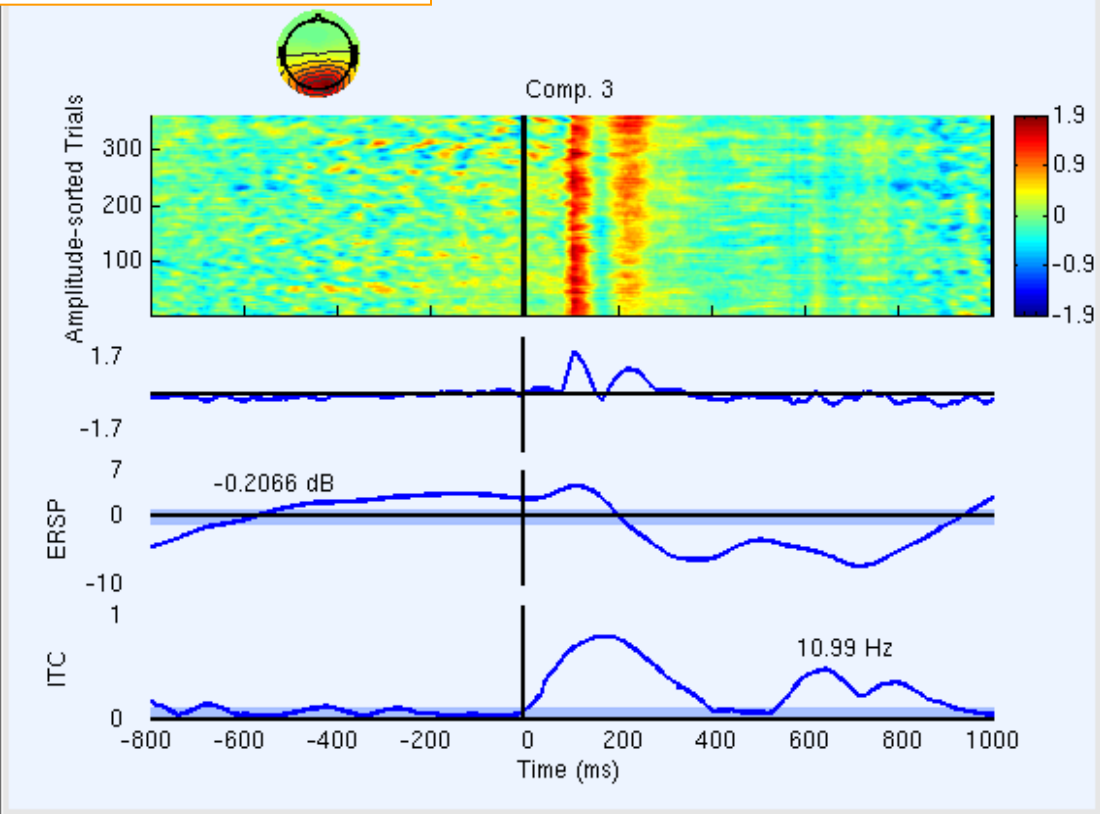
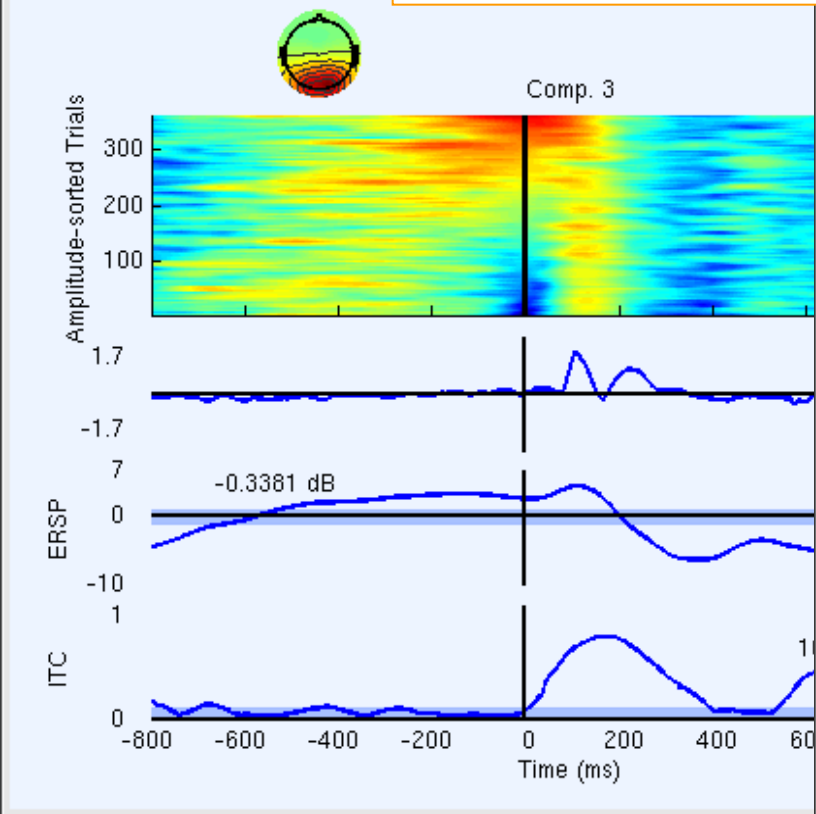
Component(s)	3	Figure title	
Project to channel #		<input checked="" type="checkbox"/> Plot scalp map	ERP limits
Smoothing	10	<input checked="" type="checkbox"/> Plot ERP	Color limits (see Help)
Downsampling	1	<input checked="" type="checkbox"/> Plot colorbar	
Time limits (ms)	-800 1000		

Figure 10: erpimage() | Figure 11: erpimage()

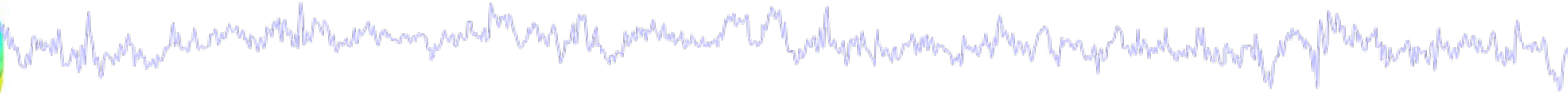
File Edit View Insert Tools Desktop Window Help

File Edit View Insert Tools Desktop Window Help

Same sorting order: Amplitude vs. activations



Evaluating ICA components



Plot 1

Component ERP

Plot 2

Component spectral power

Plot 3

Component ERP images

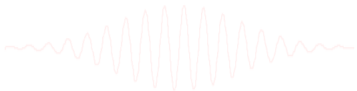
Plot 4

Component ERSP

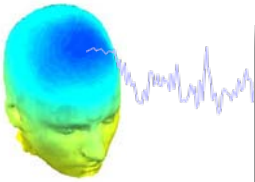
Plot 5

Component cross coherence

Exercise...



Plot IC ERSP



Plot component time frequency -- pop_newtimef()

Component number	3
Sub epoch time limits [min max] (msec)	-1000 1996
Frequency limits [min max] (Hz) or sequence	
Baseline limits [min max] (msec) (0->pre-stim.)	0
Wavelet cycles [min max/fact] or sequence	3 0.5
ERSP color limits [max] (min=)	
ITC color limits [max]	
Bootstrap significance level (1-)	
Optional newtimef() argument	

Use 200 time points
Use limits, padding 1
Use divisive baseline
Use limits

Log spaced
 No baseline
 Use FFT

Plot Event Related Spectral Power

Cancel

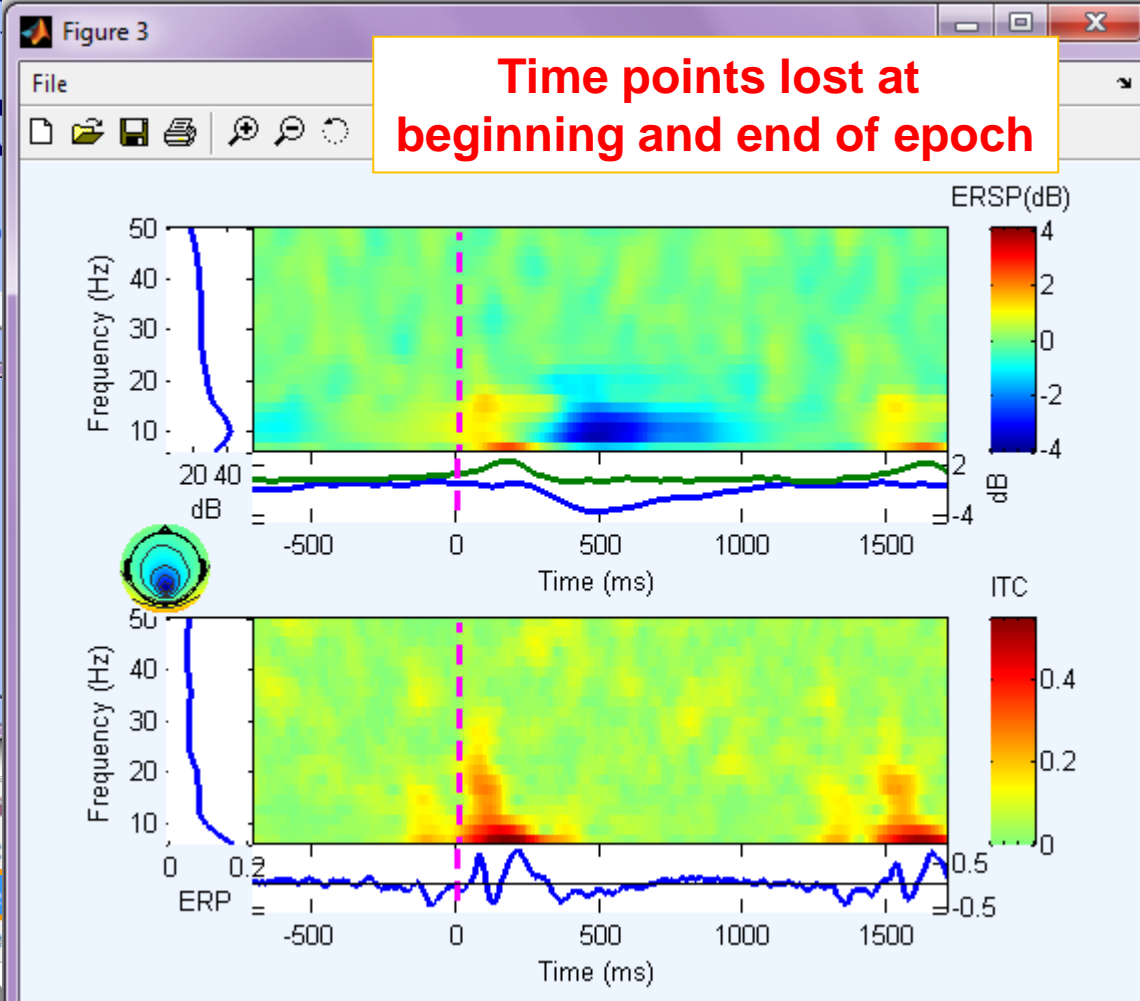
EEGLAB v7.1.7.18b

File Edit Tools Plot

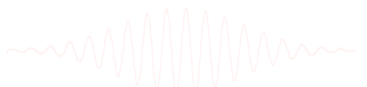
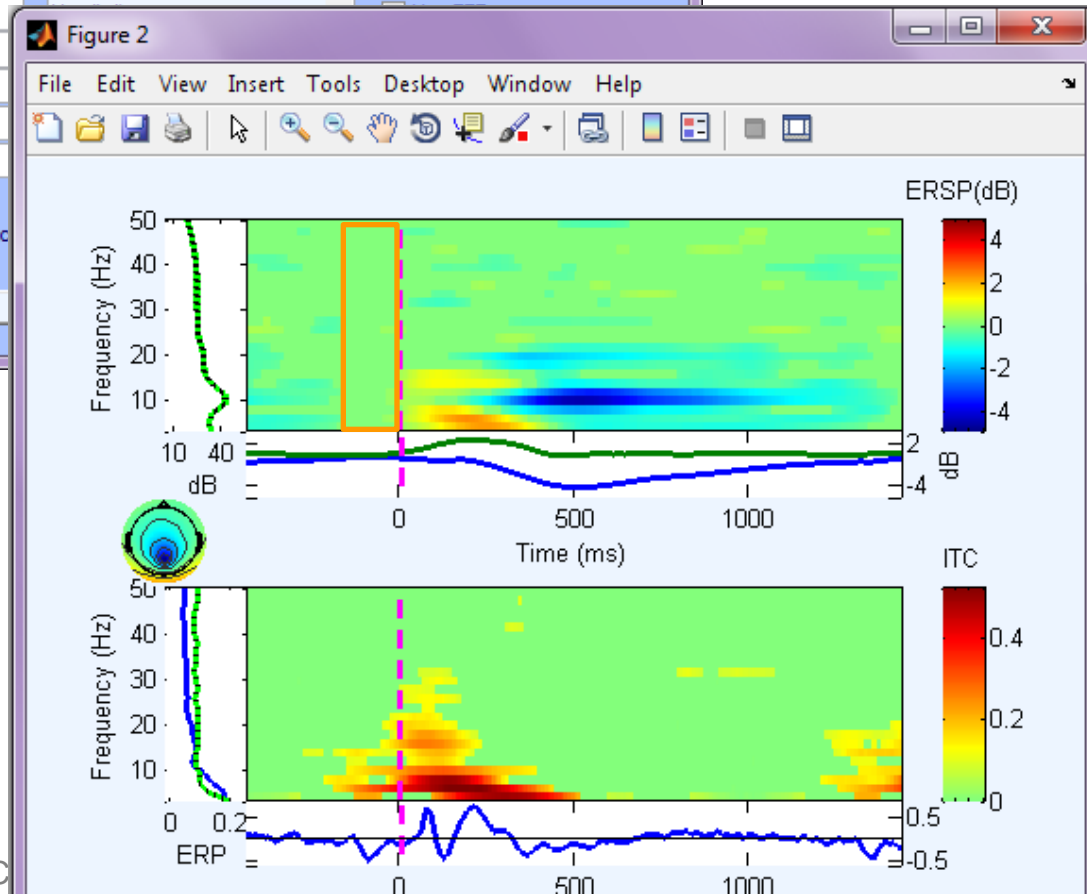
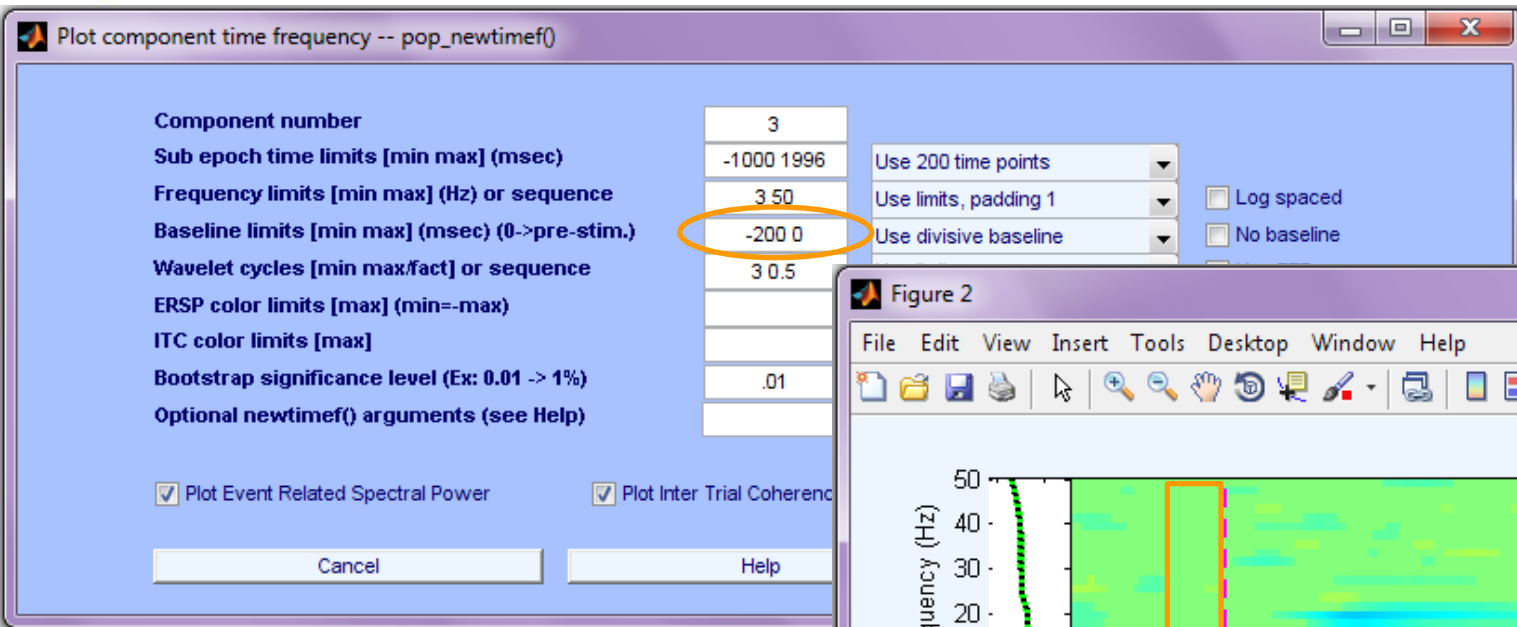
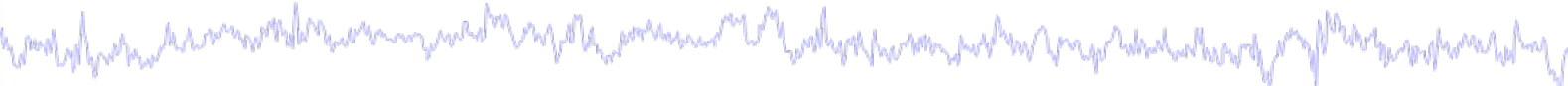
#2: Step

Filename:
Channels
Frames per
Epochs
Events
Sampling
Epoch start
Epoch end
Reference
Channel loc
ICA weight
Dataset si

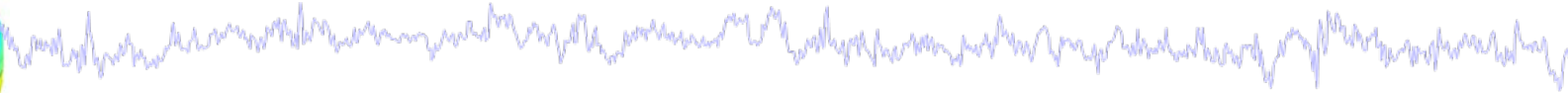
Sum/Compare ERPs
Component activations (scroll)
Component spectra and maps
Component maps
Component properties
Component ERP image
Component ERPs
Sum/Compare comp. ERPs
Data statistics
Time-frequency transforms
Cluster dataset ICs



Plot IC ERSP



Evaluating ICA components



Plot 1

Component ERP

Plot 2

Component spectral power

Plot 3

Component ERP images

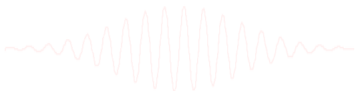
Plot 4

Component ERSP

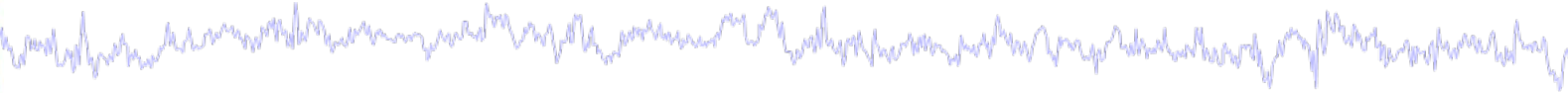
Plot 5

Component cross coherence

Exercise...



IC cross coherence



EEGLAB v7.1.7.18b

File Edit Tools Plot Study Dataset

#2: Step

Filename:
Channels:
Frames per
Epochs:
Events:
Sampling rate:
Epoch start:
Epoch end:
Reference:
Channel locations:
ICA weights:
Dataset size:

- Channel locations
- Channel data (scans)
- Channel spectra and maps
- Channel properties
- Channel ERP images
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activation
- Component spectra and maps
- Component maps
- Component properties
- Component ERP images
- Component ERPs
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms
- Cluster dataset ICs

Plot component cross-coherence -- pop_newcrossf()

First component number: 4

Second component number: 9

Epoch time range [min max] (msec): -1000 1996

Wavelet cycles (0->FFT, see >> help timef): 3 0.5

[set]->log. scale for frequencies (match STUDY):

[set]->Linear coher / [unset]->Phase coher:

Bootstrap significance level (Ex: 0.01 -> 1%): **.001**

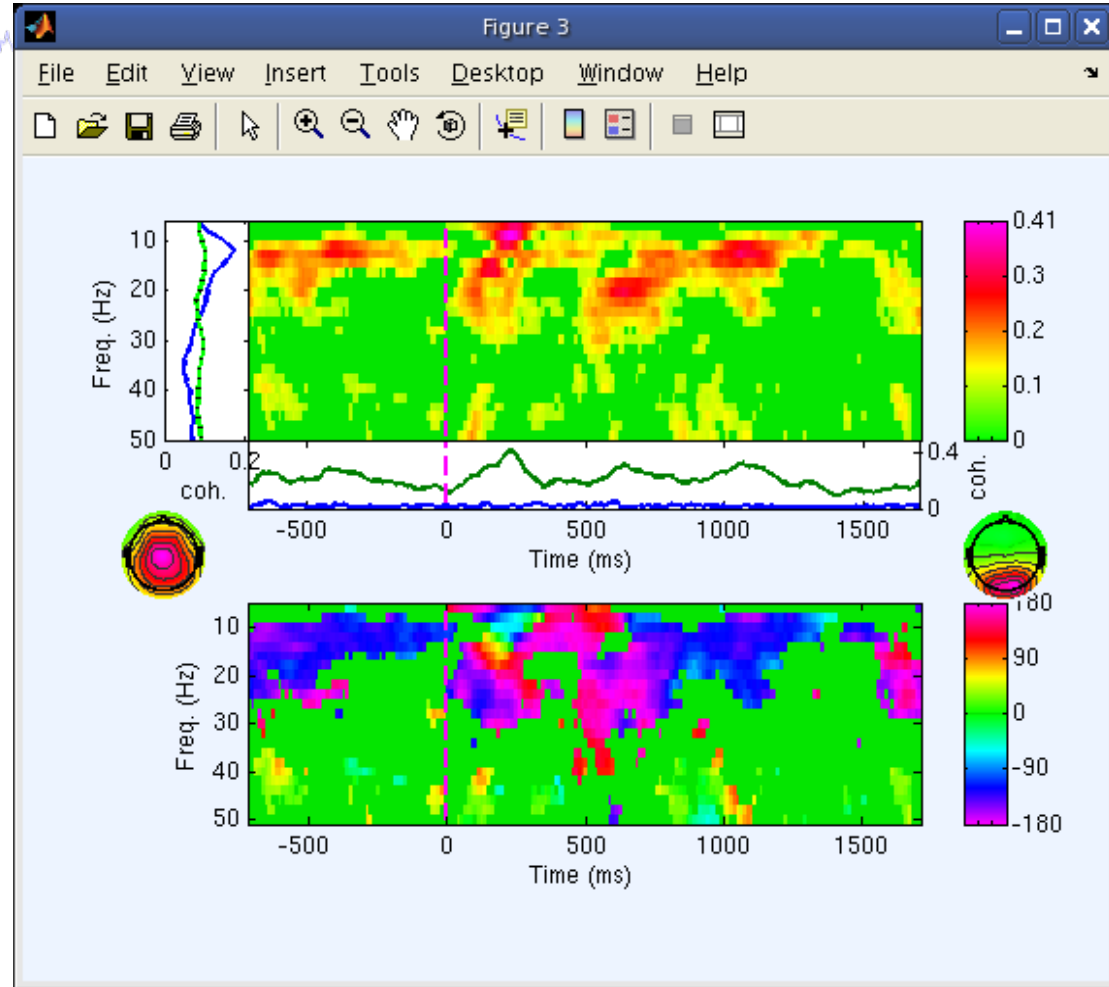
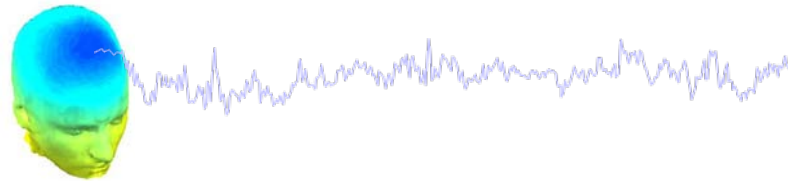
Optional timef() arguments (see Help): 'padratio', 1

Plot coherence amplitude Plot coherence phase

Cancel Help Ok

Be sure to mask by bootstrap significance limits

IC cross coherence



EEGLAB v6.0b

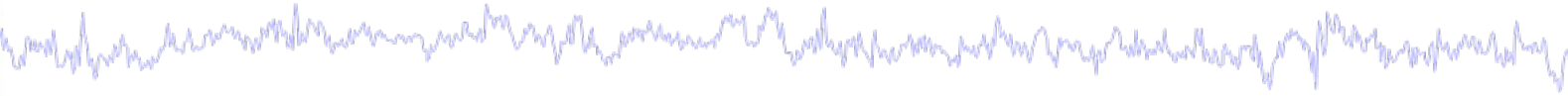
File Edit Tools **Plot** Study Datasets Help

#6: faces

- Filename: no
- Channels pe
- Frames per e
- Epochs
- Events
- Sampling rat
- Epoch start (
- Epoch end (s
- Average refe
- Channel loca
- ICA weights
- Dataset size

- 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 time-frequency
 - Channel cross-coherence
 - Component time-frequency
 - Component cross-coherence**
- Average time-frequency
- Cluster dataset ICs

Exercise



- **ALL**
 - Load stern.set, epoch on Memorize letters, reject noise
- **Novice**
 - From the GUI, plot component ERPs with maps
 - Pick an interesting IC and plot an ERP image of it
 - Try sorting by RT or phase, is there any relationship to the IC activation pattern? What about power in a frequency band of choice?
- **Intermediate**
 - Plot ERSPs for selected ICs
 - ~ Compare FFT, wavelet(s), and multi-taper methods for ERSP
 - Plot cross coherence between two selected ICs
 - ~ Compare this result with cross coherence between two channels that are highly weighted in the respective ICs

