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...
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Exercise...
Component ERPs
Component ERP envelope

EEGLAB Workshop X, June 14-17, 2010, Jyväskylä, Finland: Julie Onton – Evaluating ICA components
Definition: The data envelope

Data (all channels)

Data envelope (max/min traces)
IC back-projection envelope
IC back-projection envelope

IC envelopes plotted for simplicity (instead of all back-projected channels)
IC contributions to ERP envelope

Enter time range (in ms) to plot:
Enter time range (in ms) to rank component contributions:
Number of largest contributing components to plot (1-20):
Else plot these component numbers only (<21) (Ex: 2,4,7):
Component numbers to remove from data before plotting:
Plot title:
Optional topoplot() and spectopo() arguments:

Largest ERP components of faces_4 epochs

Potential (uV)

Time (s)
Component contribution to the dataset ERP

Artifact Components

Largest ERP components of faces_4 epochs

Potential (uV)

Time (s)
What is the IC ERP difference between these 2 conditions?
IC ERP difference
IC ERP difference

Largest ERP components of Memorize-Ignore epochs

Potential (kV)

Time (s)

ppaf 36.68%
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Exercise...
Plot component power
Plot component power
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Exercise...
ERP Image basics

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

Trial 1
Trial 2
Trial 3
Trial 4
ERP Image basics

Trial 1:

Trial 2:

No Smoothing

Smoothed across 10 Trials
ERP Images: smoothing across trials
Component ERP Images

Select fields:
- latency
- type
- epoch

Figure title:

Sort/align trials by epoch event values:
Epoch-sorting field:
- latency

Event time range:
- 0.2000

Select fields:
- bp1
- bp4

Other options:
- Plot scalp map
- Plot ERP
- Plot colorbar

Event type(s):
- bp1''bp4

ERP limits:
Color limits (see Help):

Figure 5: erpimage()
### Component ERP Images

**Component(s):** 3
**Project to channel #:**
**Smoothing:** 10
**Downsampling:** 1
**Time limits (ms):** -800 1000

**Phase-sorted events**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Percent low-amp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

**Inter-trial coherence options**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Signif. level (&lt;0.2)</th>
</tr>
</thead>
</table>

**Other options**

<table>
<thead>
<tr>
<th>Plot spectrum (minHz maxHz)</th>
<th>Baseline ampl. (dB)</th>
</tr>
</thead>
</table>

**Figure title**

**Figure 6: erpimage()**

![Phase-sorted image](image_url)
Component ERP Images

Component(s): 3
Project to channel #: 10
Smoothing:
Downsampling: 1
Time limits (ms): -800 1000

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. trials
   10 12

Inter-trial coherence options:
   Frequency (Hz | minHz maxHz)
   Signif. level (<0.05)
   10 12 .01

Other options:
   Plot spectrum (minHz maxHz)
   Baseline ampl. (dB)

Figure title

Plot scalp map
Plot ERP
Plot colorbar

ERP limits:
Color limits (see Help):

Phase-sorted alpha power
Component ERP

Component(s) 3
Project to channel #
Smoothing 10
Downsampling 1
Time limits (ms) -800 1000

Figure title
Plot scalp map
Plot ERP
Plot colorbar

Phase-sorted alpha power

Same data: Sorted by alpha amplitude

>> help erpimage

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

Component ERP image -- pop_erpimage

Phase-sorted Trials

0 300

-1.7

0.3381 dB

10.99 Hz

ERSP

ITC

-10

0

0

0

0

-800 -600 -400 -200 0 200 400 600 800 1000

Time (ms)

10.99 Hz

-1.7

0.3381 dB

0
Component ERP Images

Same sorting order: Amplitude vs. activations
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Exercise...
Plot IC ERSP
Longer window for lower frequencies means more time points lost at beginning and end of epoch.
Pad frequencies
For a smoother appearance
Use bootstrap significance level to mask insignificant time/freq points.
Plot IC ERSP

Component number
Sub epoch time limits [min max] (msec)
Frequency limits [min max] (Hz) or sequence
Baseline limits [min max] (msec) (0->pre-stim.)
Wavelet cycles [min max fact] or sequence
ERSP color limits [max] (min=max)
ITC color limits [max]
Bootstrap significance level (Ex: 0.01 -> 1%)
Optional newtimef() arguments (see Help)

Use 200 time points
Use limits, padding 1
Use divisive baseline
No baseline

Plot Event Related Spectral Power
Plot Inter Trial Coherence

Figure 2

ERSP (dB)

ITC

Time (ms)

Frequency (Hz)
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Exercise...
IC cross coherence

Be sure to mask by bootstrap significance limits
IC cross coherence

![IC cross coherence](image.png)
Exercise

- **ALL**
  - Load stern.set or stern_small.set, epoch, reject noise

- **Novice**
  - From the GUI, plot component ERPs with maps
  - Pick an interesting IC/ERP 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**
  - From the commandline, use newtimef() to tailor your time/frequency output to your liking.
  - Compare FFT, wavelet(s), and multi-taper methods

- **Advanced**
  - Plot cross coherence between two selected ICs
  - Compare this result with cross coherence between two channels that are highly weighted in the respective ICs