STUDY analysis

Task 1

Load/plot/use STUDY ERSP data

Task 2

Cluster ERP image (IC polarity)

Task 3

Cluster ERP analysis

Exercise...

STUDY analysis

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Exercise...

Task 1: Load data from commandline

```
** Where is the raw data stored?
Data for each subject is stored in the file path
of that subject (STUDY.datasetinfo(subj).filepath)
** What is it called?
File name format:  'setname.extension'
extension = '.ica*' or '.dat*' (for channel data)
for example:
S01_attend1_pos1.icaerp  % ERP data
S01_attend1_pos1.icaersp % ERSP data
S01_attend1_pos1.icaitc  % ITC data
S01_attend1_pos1.icaspec % Power spectrum data
S01_attend1_pos1.icatopo % Scalp map data

% Example of channel data file name:
S01_attend1_pos1.daterp  % ERP data
```

Task 1: Load individual ERSPs

```
% load ERSP data for all ICs in a single cluster:

clust = 5; % choose a cluster
cond = 1; % choose experimental condition
tmlims = [0 1000];  % time limits (ms)
frqlims = [0 40];   % frequency limits (Hz)


for ic = 1:size(STUDY.cluster(clust).sets,2) % all cluster members
   setidx = STUDY.cluster(clust).sets(cond,ic);
   comp = STUDY.cluster(clust).comps(ic);
   [logersp(:,:,ic), logfreqs, timevals, params, baseersp] = …
          std_readersp(ALLEEG, setidx, comp, tmlims, frqlims);
end;
```

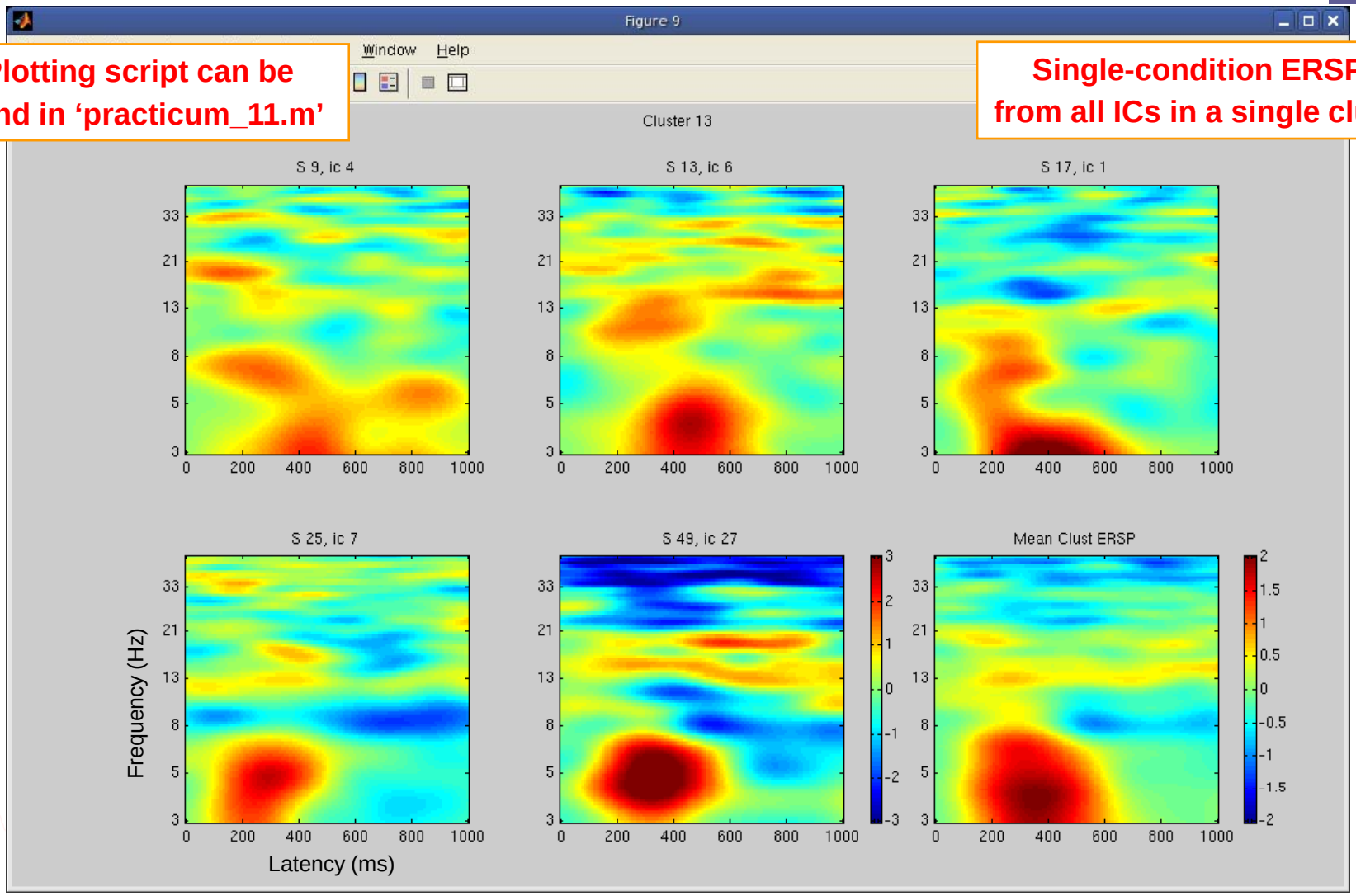
Task 1: Load individual ERSPs

```
% Check imported variables in workspace:

>> whos logersp logfreqs timevals params baseersp

  Name           Size                 Bytes  Class

  baseersp      91x1                   728  double
  logersp       91x106x7            540176  double
  logfreqs       1x91                   728  double
  params         1x1                   4432  struct
  timevals       1x106                  848  double
```

Task 3: PLOT individual ERSPs

Plotting script can be found in 'practicum_11.m'

Single-condition ERSPs from all ICs in a single cluster



Task 1: Raw data files

```
% Load *raw* ERSP data

load_string = 'C:\EEGLAB_WORKSHOP\STUDY\S01\attend1_pos1.icaersp';

ERSPdata = load('-mat',load_string); % .mat format!
```

Task 1: Raw data structure

```
>> ERSPdata

comp1_ersp: [126 x 200 single]
comp1_erspbase: [1 x 126 single]
comp1_erspboot: [126 x 2 single]
comp2_ersp: [126 x 200 single]
comp2_erspbase: [1 x 126 single]
comp2_erspboot: [126 x 2 single]
freqs: [1 x 126 double]
times: [1 x 200 double]
datatype: 'ERSP'
parameters: {1 x 26 cell}
datafile: [1 x 57 char]

>>
```

ERSP dB data → comp1_ersp

dB baseline → comp1_erspbase

bootstrap limits → comp1_erspboot

126 frequency bins → freqs

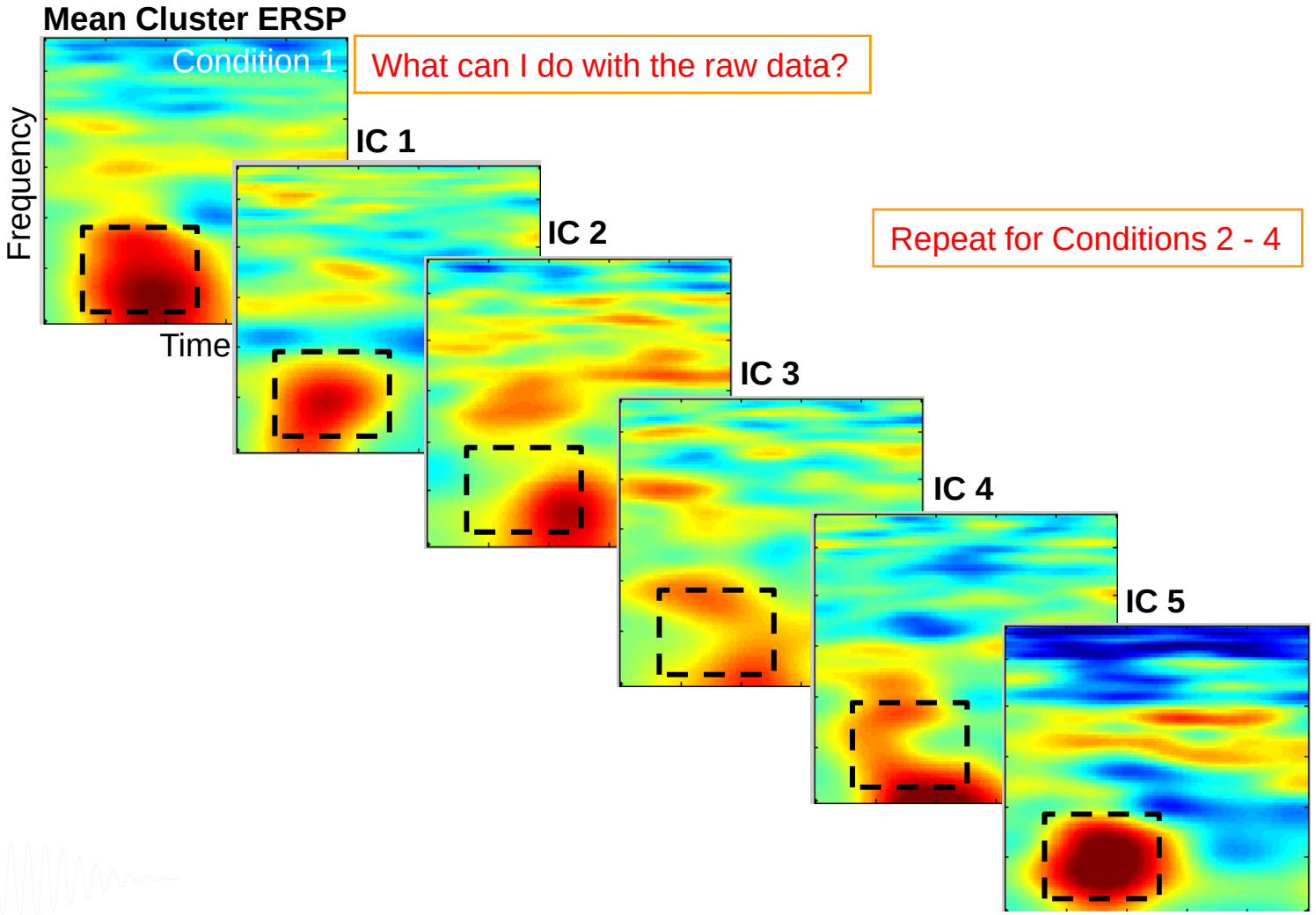
200 time points → times

200 time points

upper and lower bootstrap limits

126 frequency bins

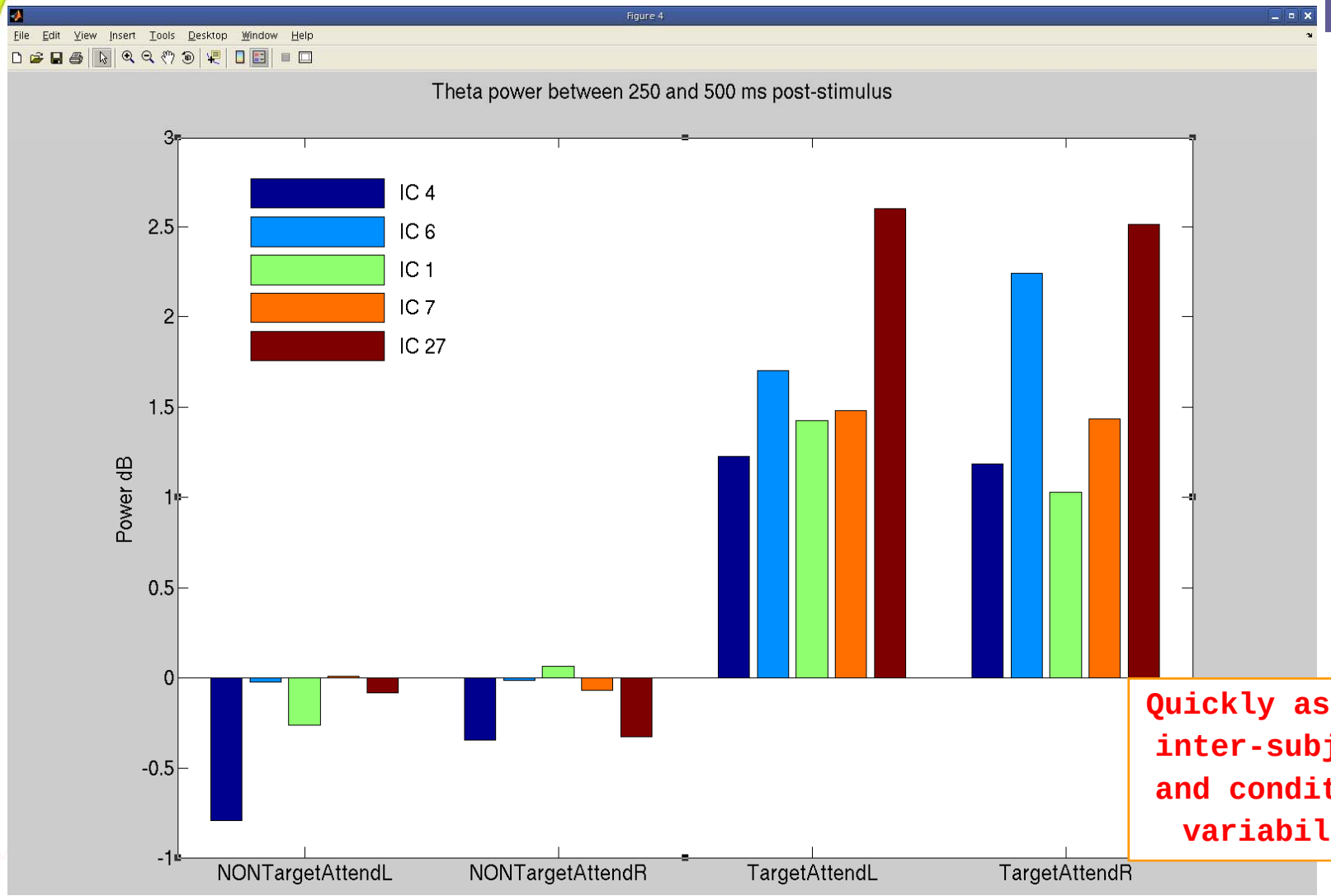
Task 1: Use STUDY ERSP data for analysis



What can I do with the raw data?

Repeat for Conditions 2 - 4

Task 1: Mean theta power across conditions



Quickly assess inter-subject and condition variability

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Exercise...

Task 2: Cluster ERP image

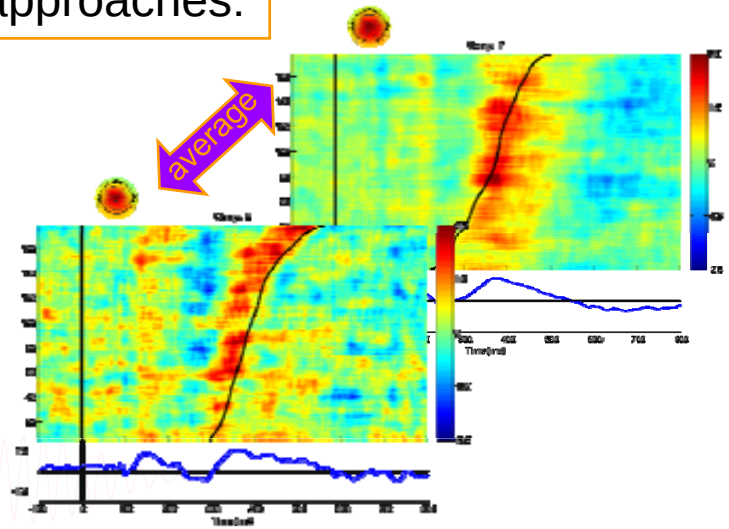
Purpose of ERP image:

- Observe single-trial dynamics of an IC activation (or power)

Purpose of *CLUSTER* ERP image:

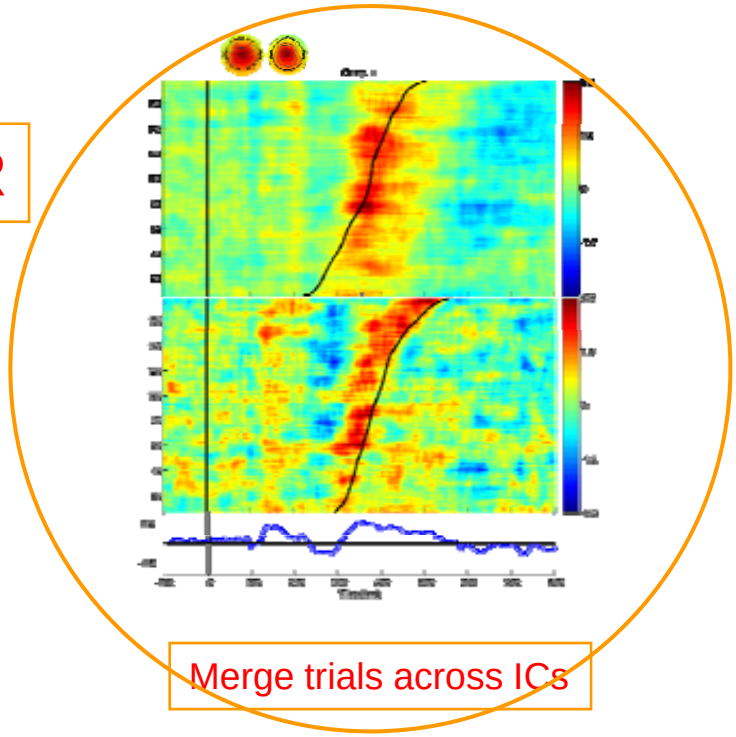
- Observe single-trial dynamics of multiple *matched* ICs from several subjects

Two approaches:



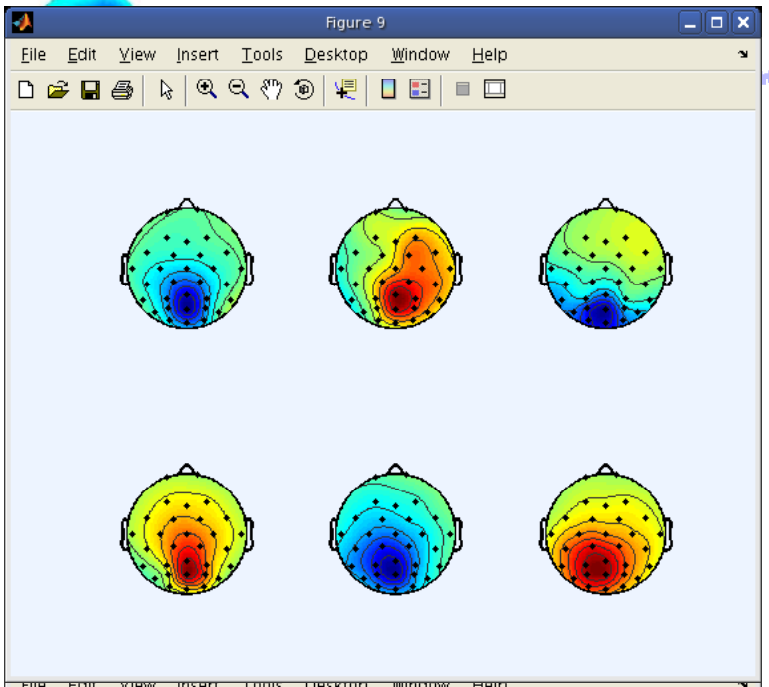
Average ERP images across ICs

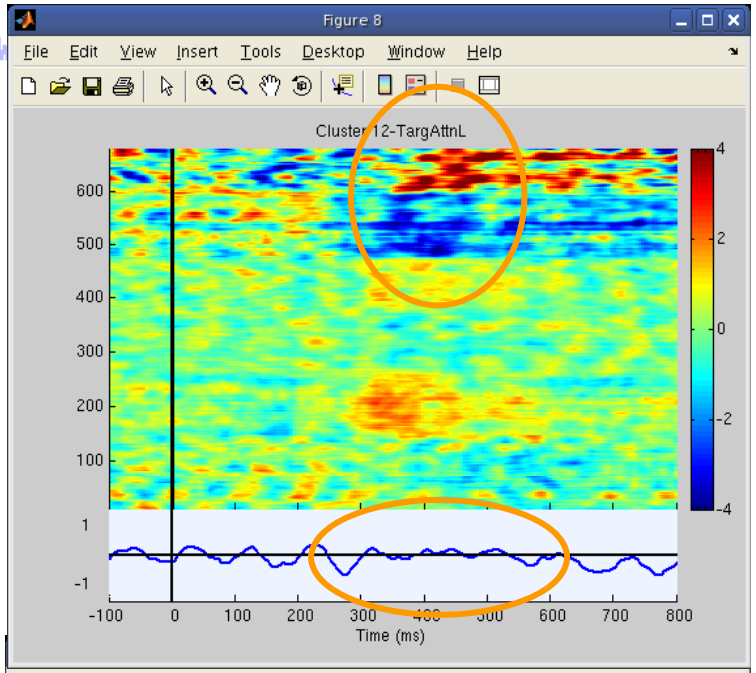
OR



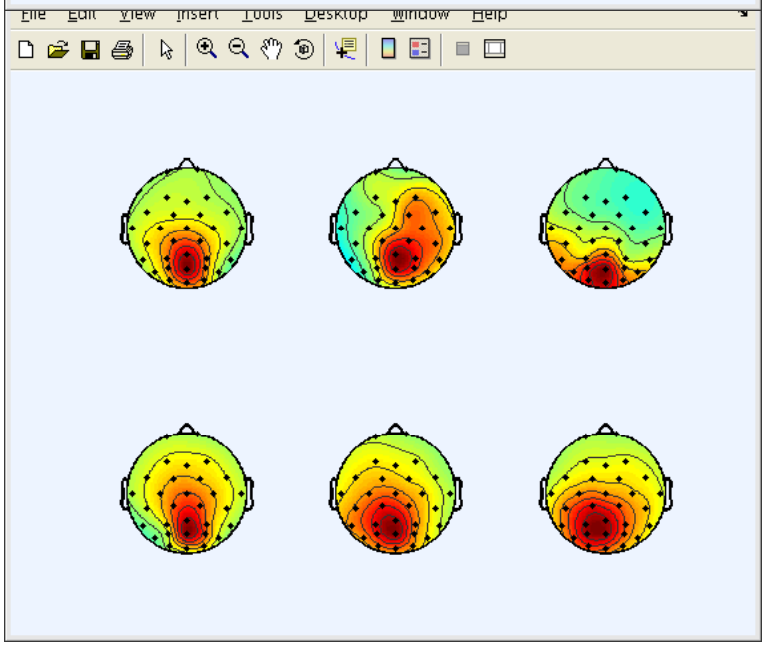
Merge trials across ICs

Task 2: Cluster ERP image: match polarity

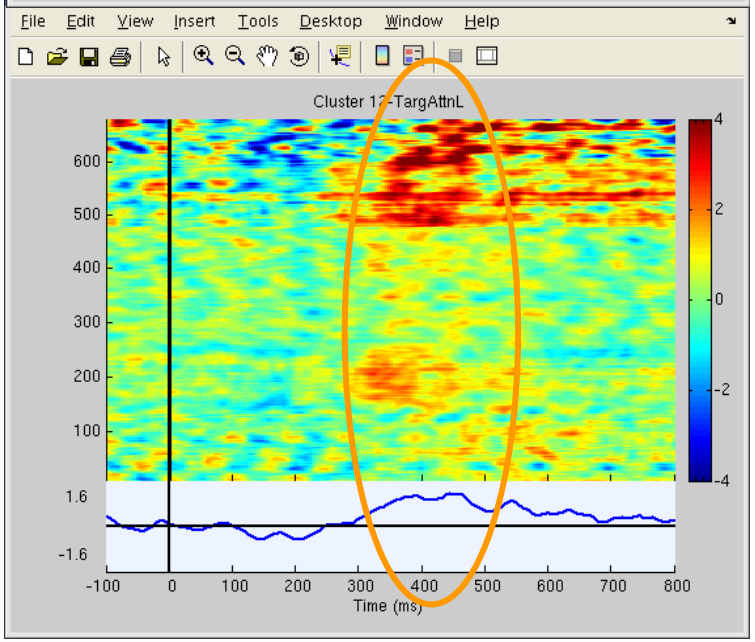




reversed polarities reflect mismatched scalp maps



reorienting maps and activations gives a more coherent picture



Task 2: Matching activation polarity

View and edit current component clusters -- pop_clustedit()

Study 'Attention': 181 of 181 components clustered

Select cluster to plot

Cls 22 (4 ICs)
Cls 23 (5 ICs)
Cls 24 (4 ICs)
Cls 25 (7 ICs)

Select component(s) to plot

All components
S03 IC7
S06 IC5
S10 IC6

Plot scalp maps | Plot scalp map(
Plot dipoles | Plot dipole(s)
Plot ERPs | Params | Plot ERP(s)
Plot spectra | Params | Plot spectra
Plot ERSPs | Params | Plot ERSP(s)
Plot ITCs | Plot ITC(s)
Plot cluster properties | Plot component pro

Create new cluster | Reassign selected com
Rename selected cluster | Remove selected outlie
Merge clusters | Auto-reject outlier cor

Save STUDY set to disk /home/julie/WorkshopSD2007/STUD

Cancel | Help | Ok

Figure 8

File Edit View Insert Tools Desktop Window Help

Cls 23 (5 ICs, 4 Ss)

ic7/S03

ic5/S06

ic6/S10

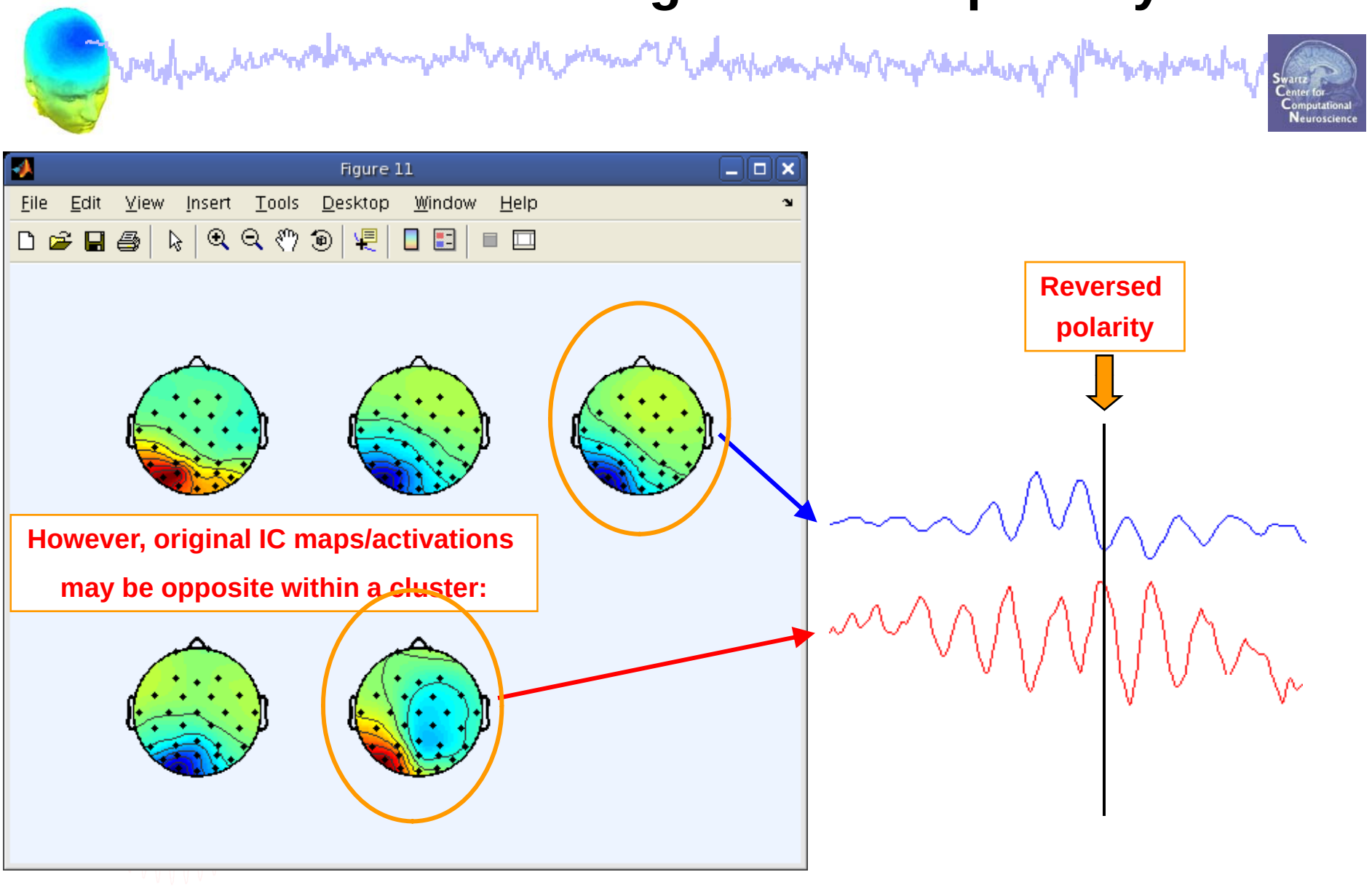
ic10/S10

ic16/S14

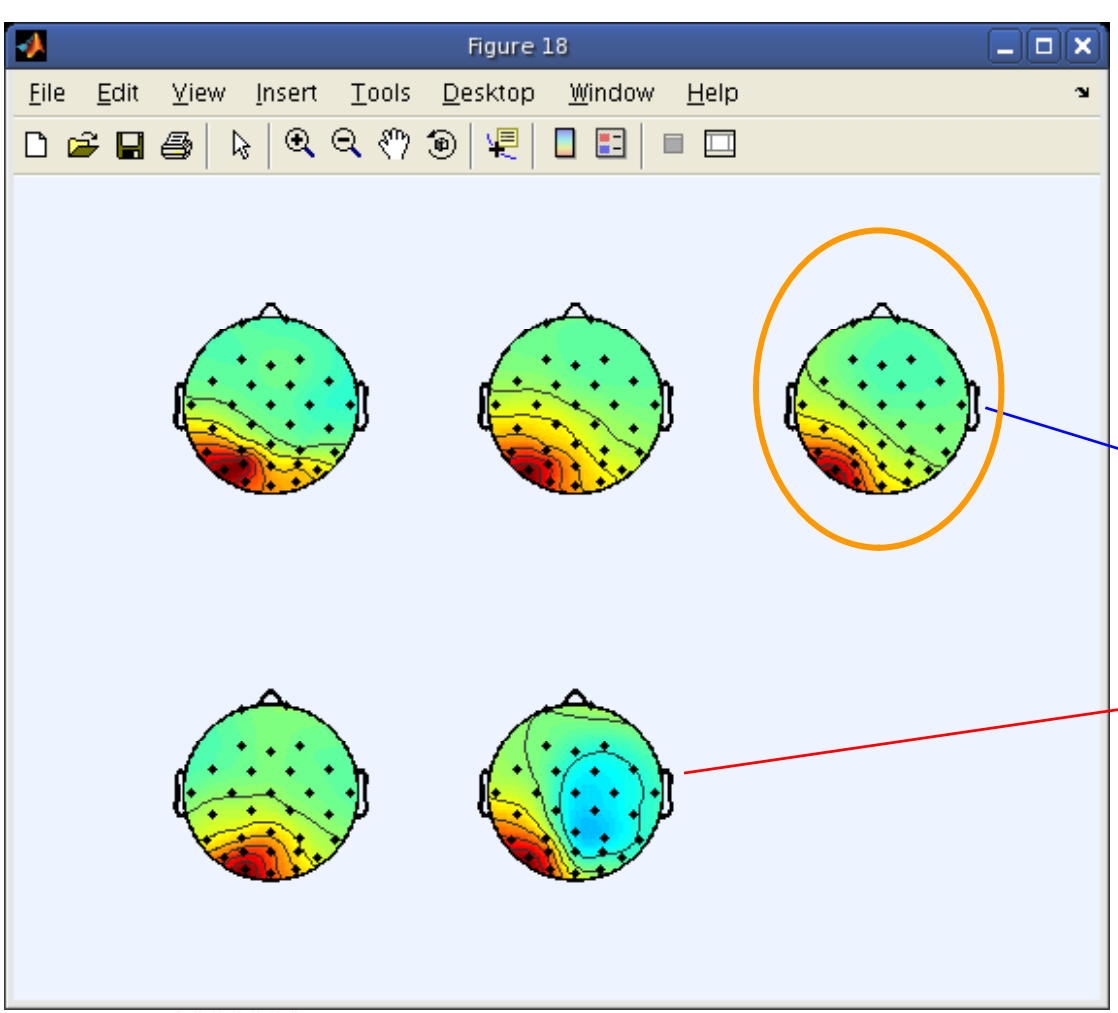
EEGLAB STUDY

matches polarities for you

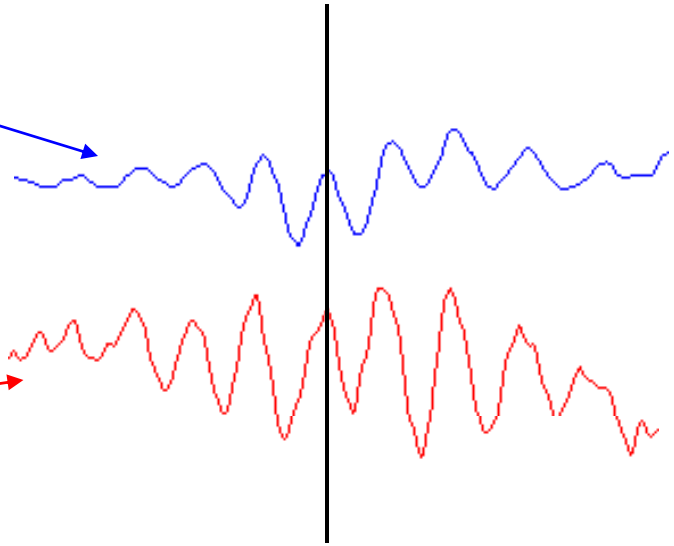
Task 2: Matching activation polarity



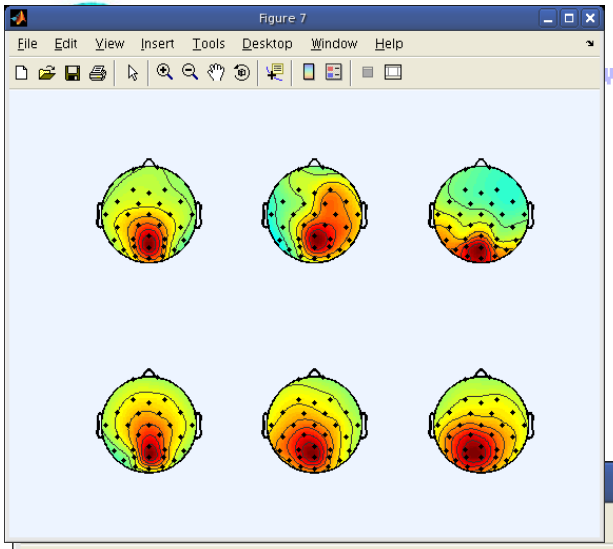
Task 2: Matching activation polarity

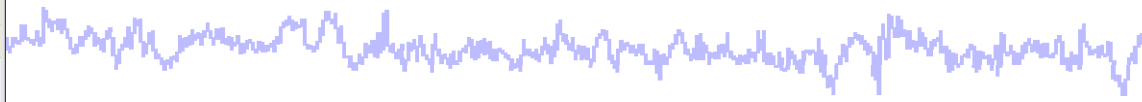


Reorient map AND activation of one IC to align



Task 2: Cluster ERP image: RT sort





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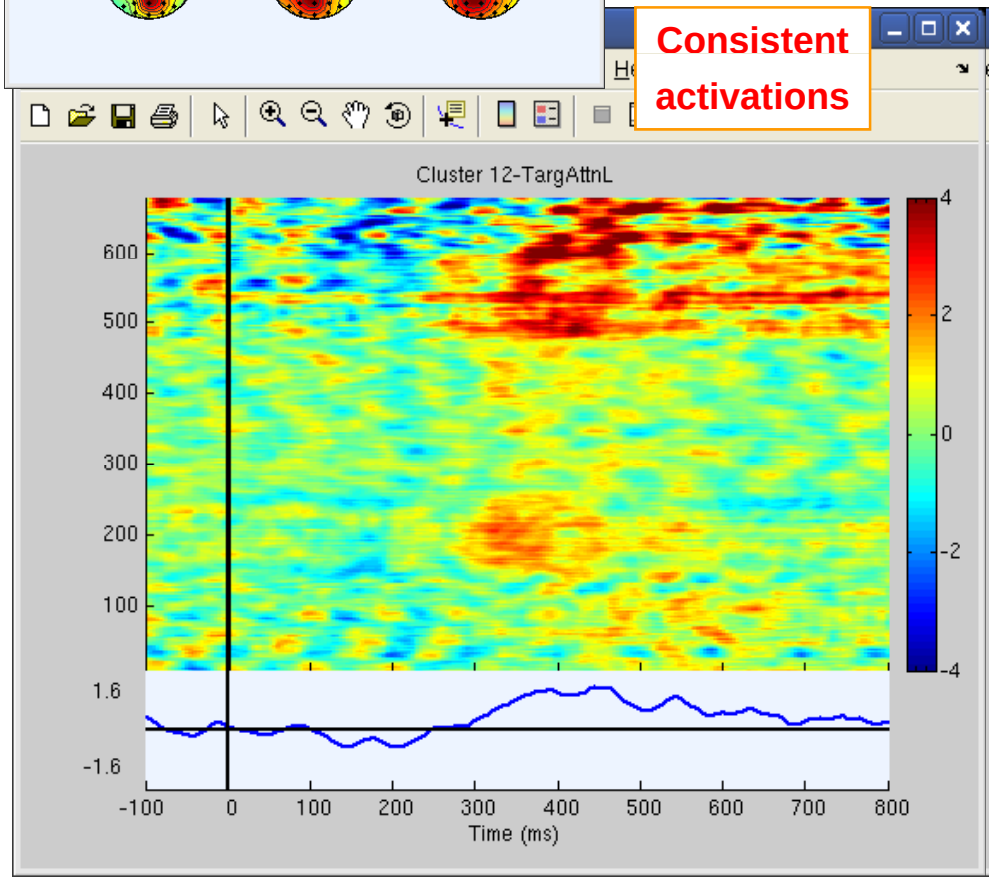
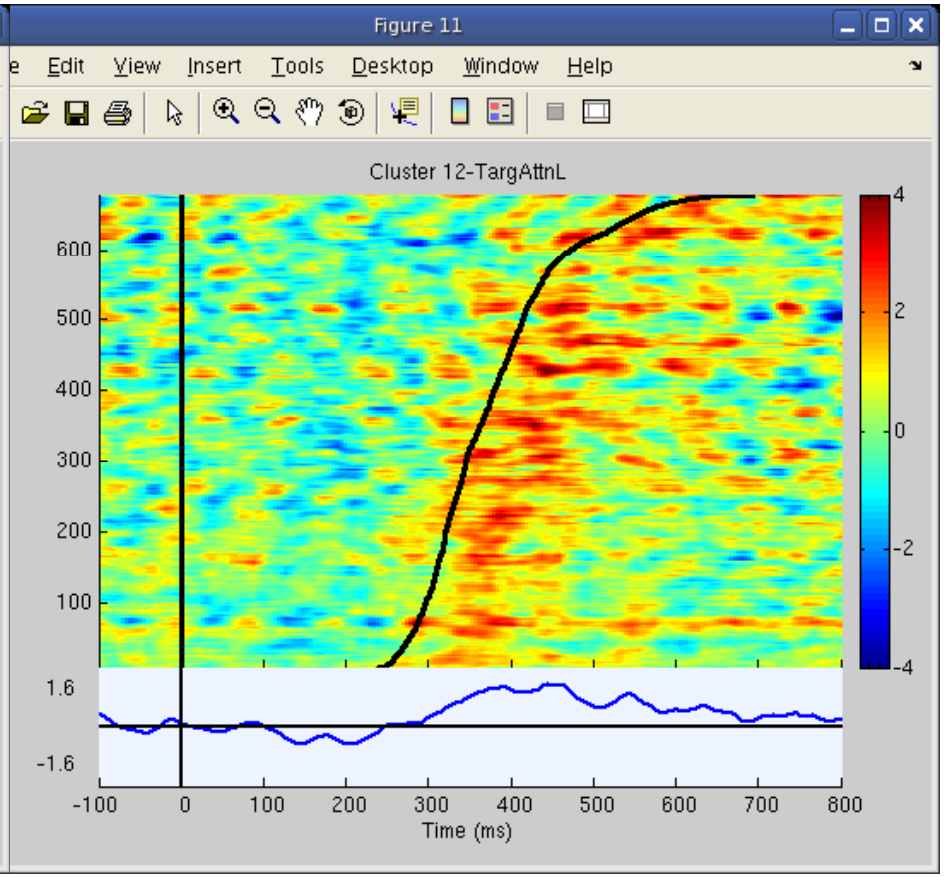
Consistent scalp maps

Consistent activations

Sort cluster ERP image by response time





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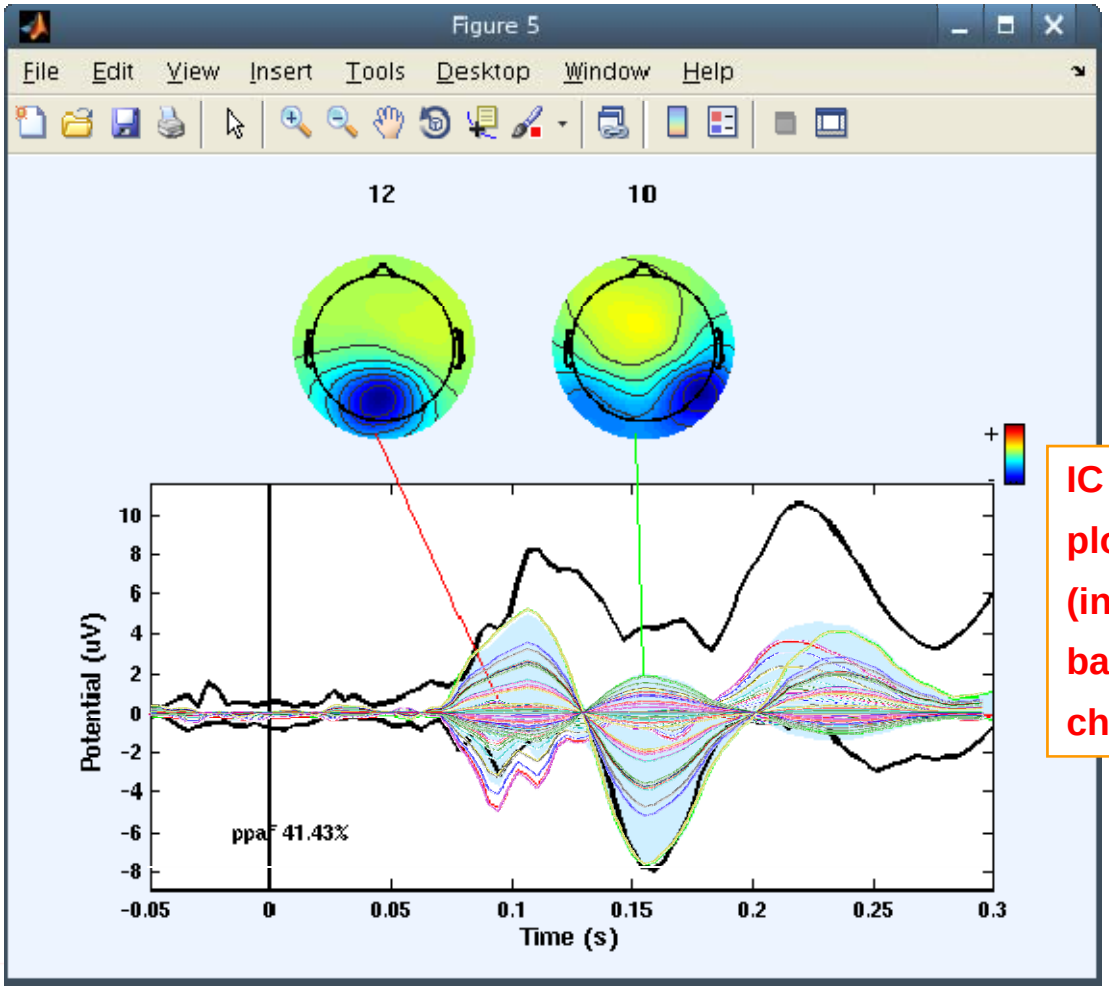
Cluster ERP analysis

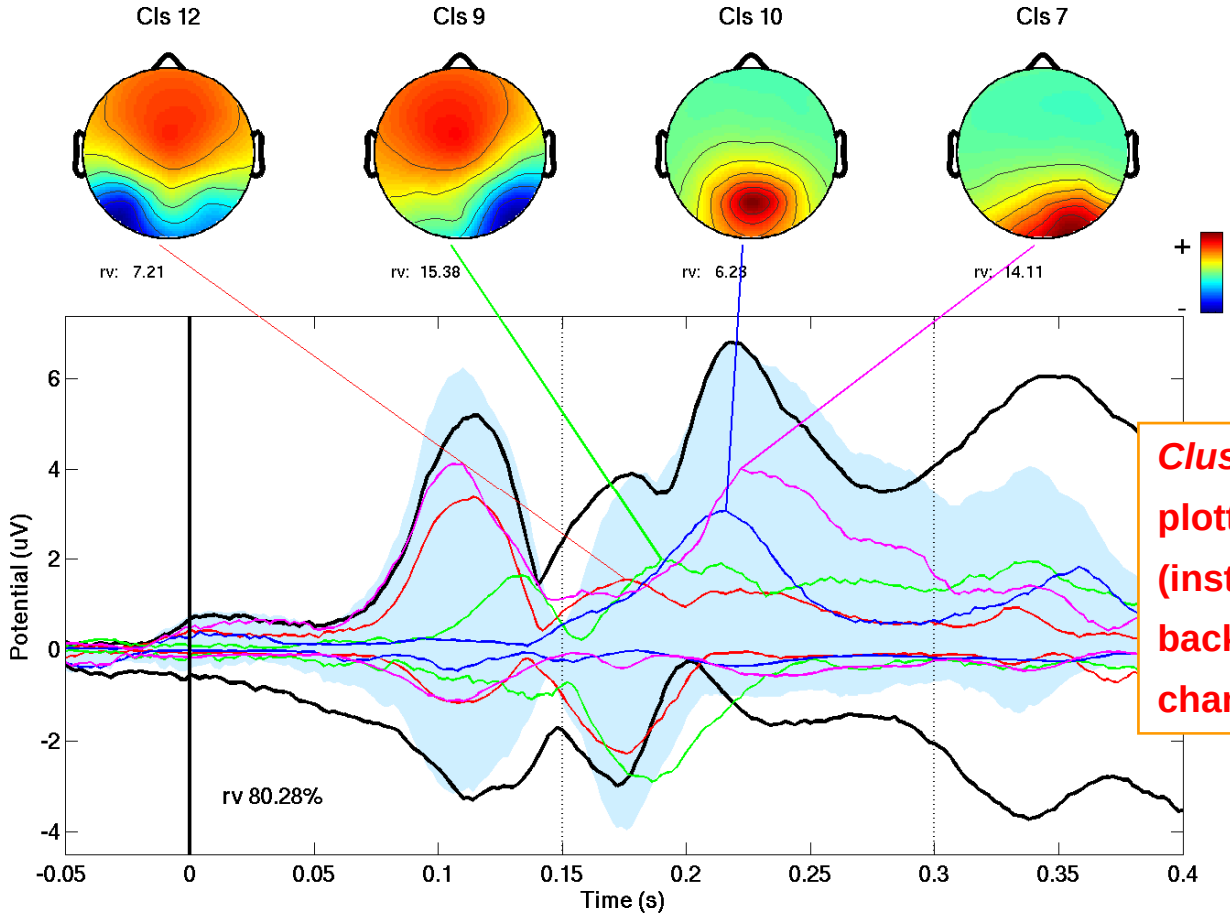
Exercise...

REVIEW: Single-subject IC ERP envelope



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

Task 3: STUDY Cluster ERP analysis

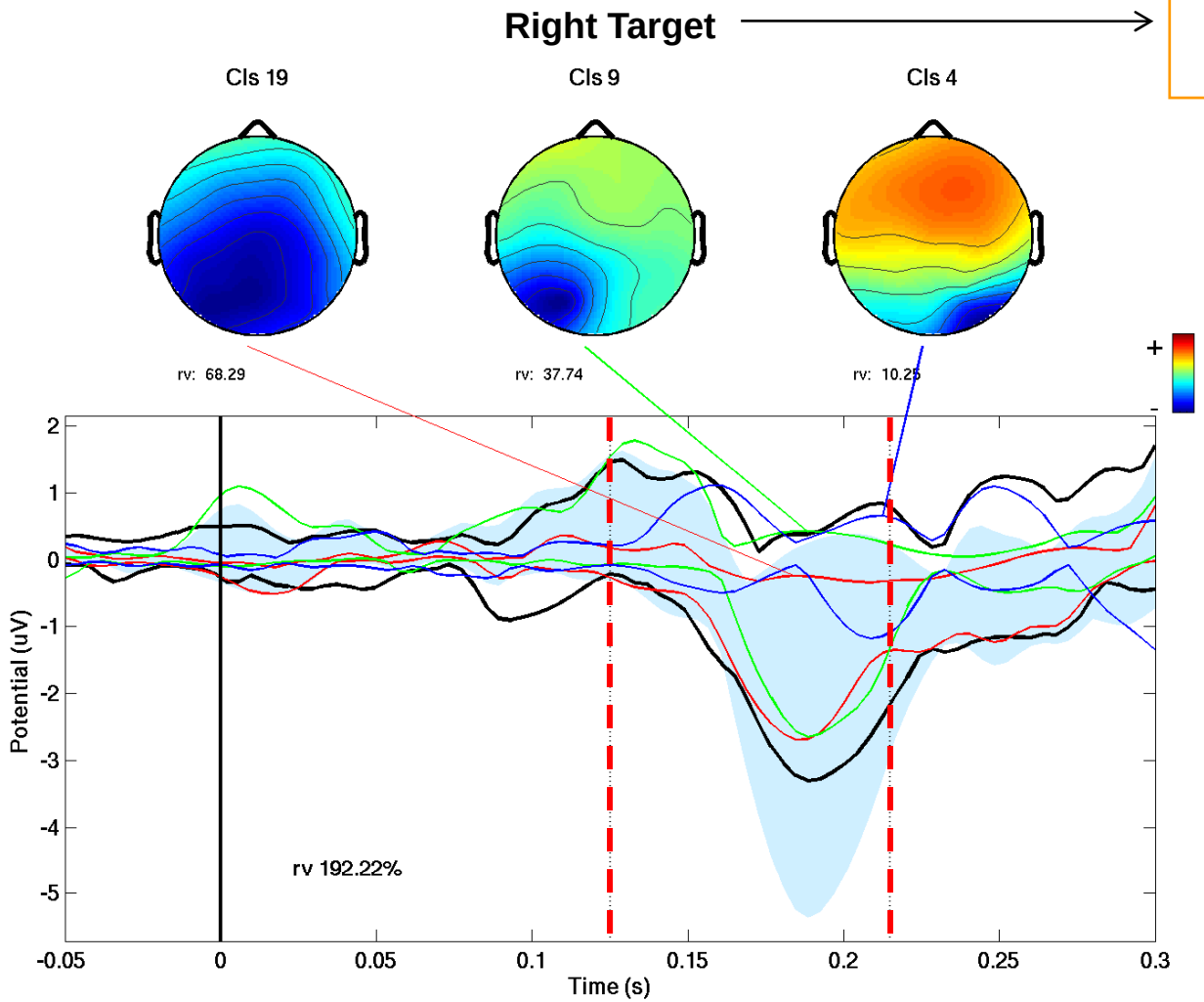


Cluster **envelopes plotted for simplicity (instead of all back-projected channels)**

Task 3: STUDY Cluster ERP analysis

Which clusters make the largest contribution to the P1/N1?

Right-side targets only

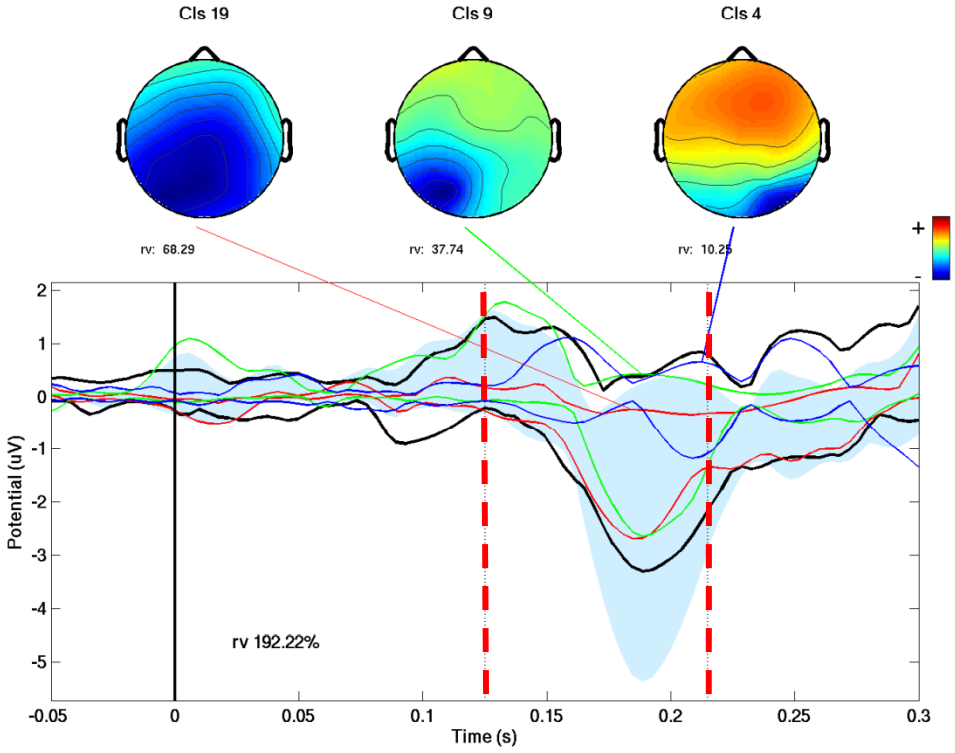


Expt'l note:
Fixation: center
Attention: to right
OR left

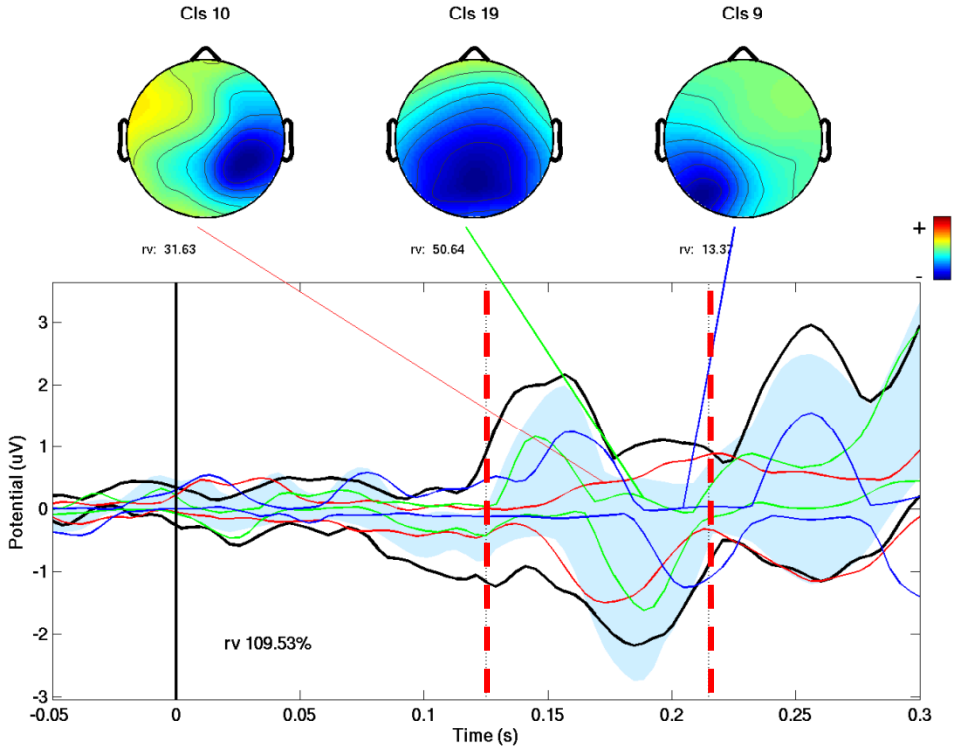
Task 3: STUDY Cluster ERP analysis

Fixation: Center

Attention Right/Right Target

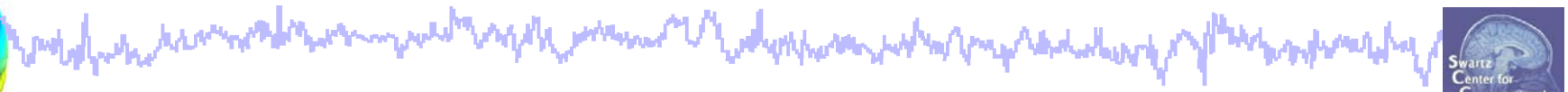


Attention Left/Left Target



Which clusters differentiate the P1/N1 in *Left* and *Right* targets?

Task 3: STUDY Cluster ERP analysis



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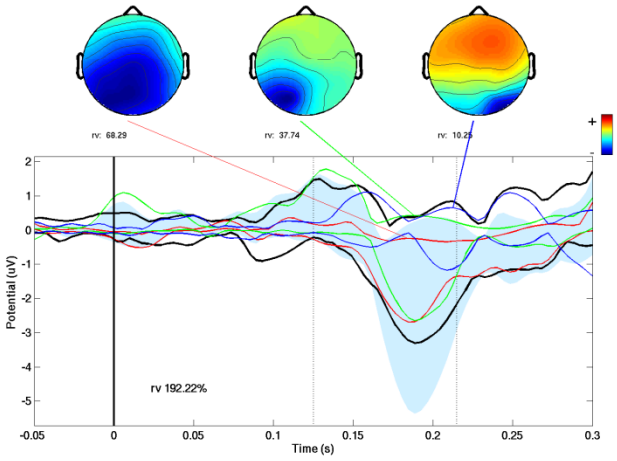
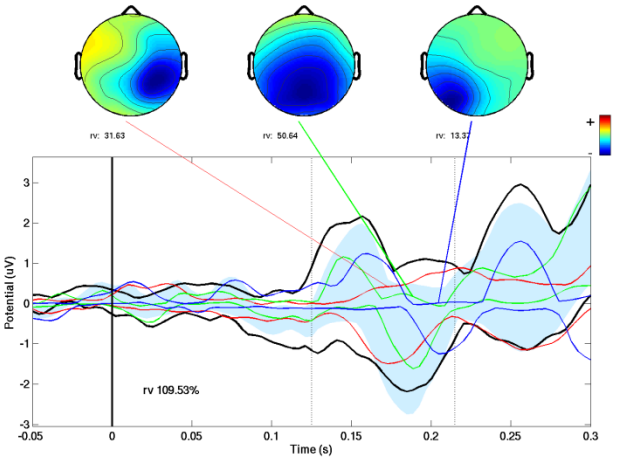
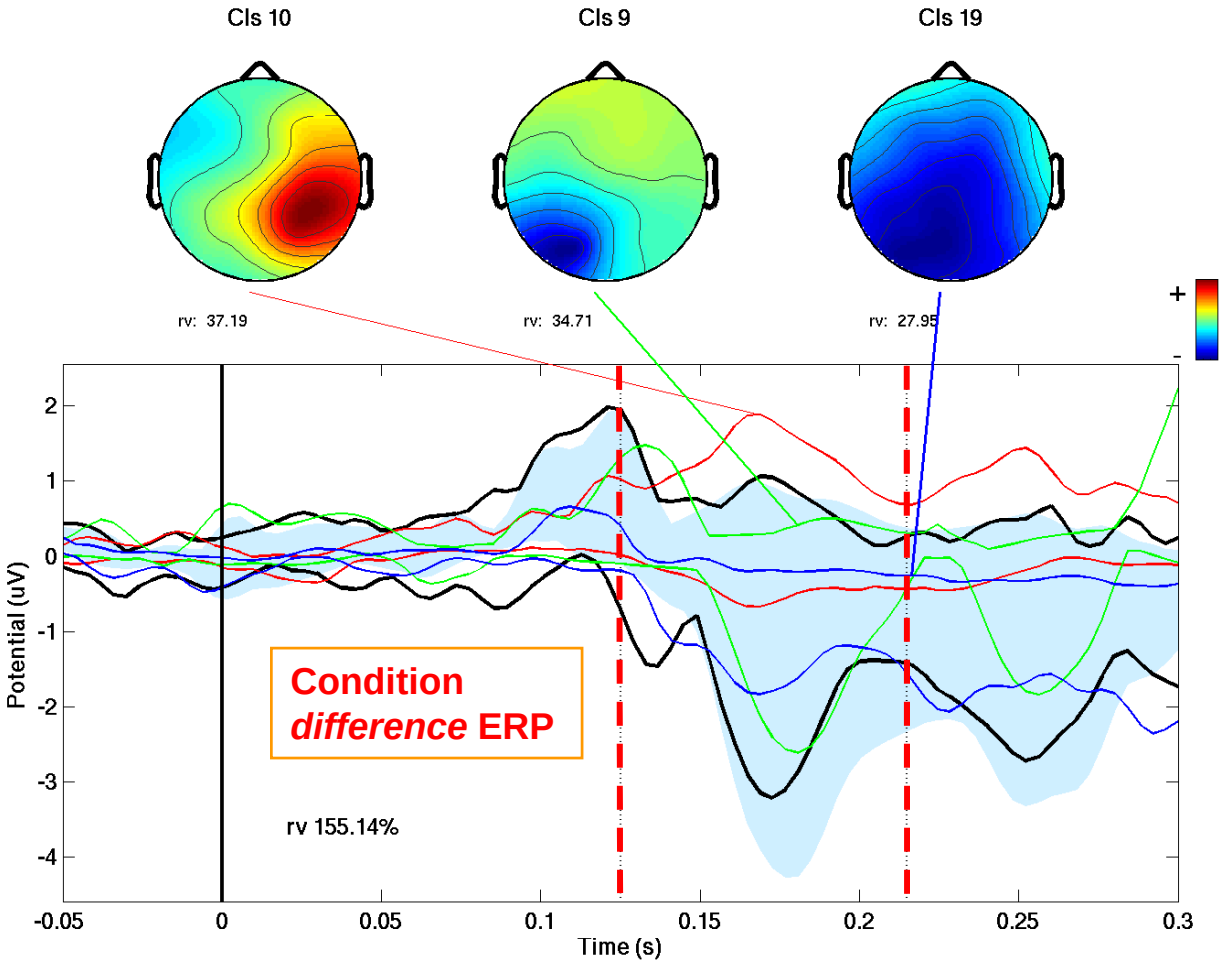
Attention Right/Right Target



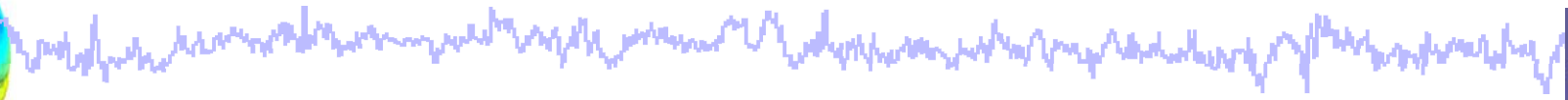
Attention Left/Left Target



Right _minus_ Left Targets

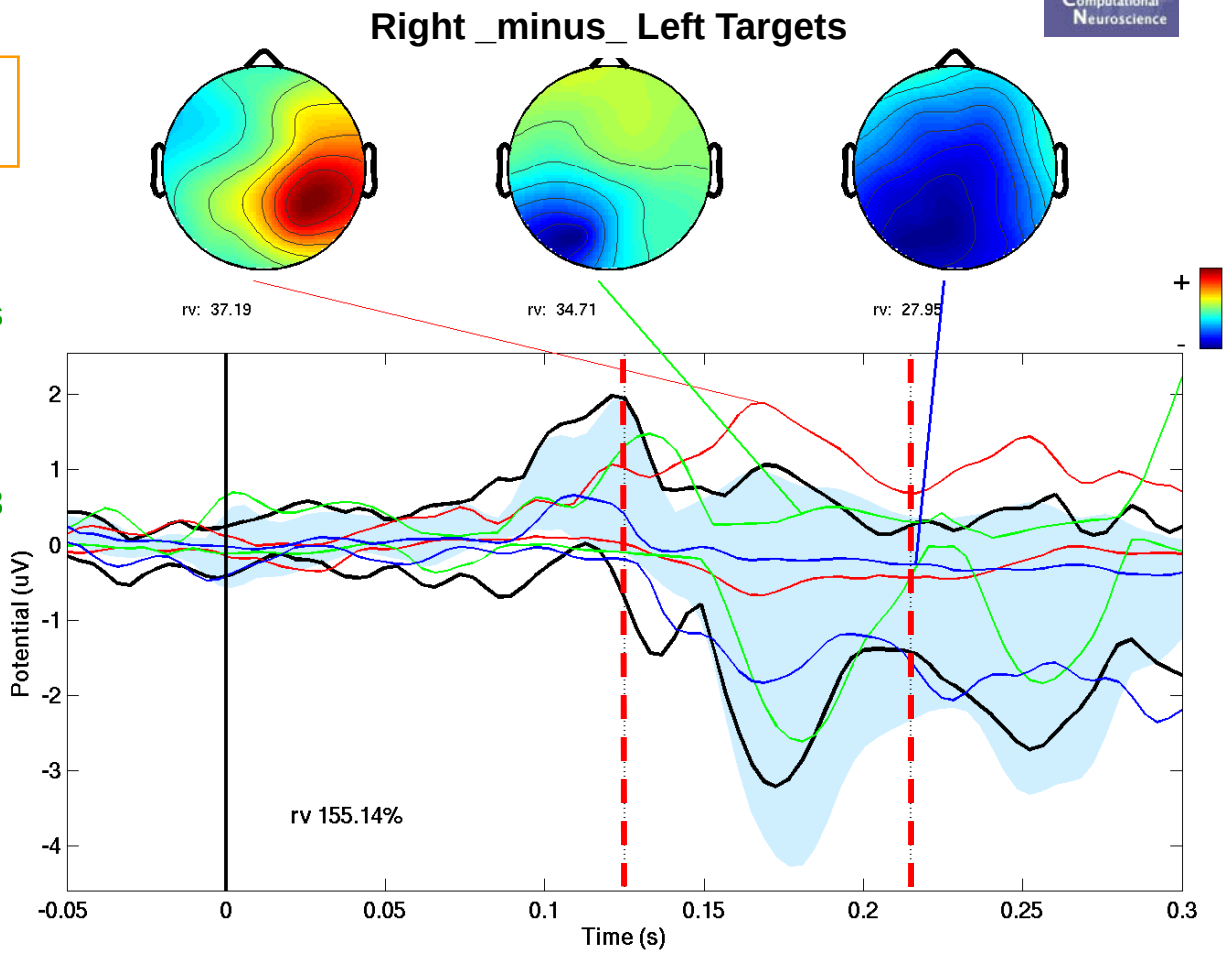


Task 3: STUDY Cluster ERP analysis



std_envtopo() script can be found in practicum_11.m

```
% std_envtopo variables:
plotlims = [-50 300];% x-axis
tmlims = [125 215];% P1 win
bsln = [-100 0];
conddiffs = [4 3];% 4 minus 3
artifact_cls = [3,15,18];
clusters = -3; % 3 largest
```




```
% std_envtopo function call:
std_envtopo(STUDY,ALLEEG,…
'clustnums', clusters ,…
'env_erp','contrib',…
'only_clust','on','timerange', plotlims, 'subclus', artifact_cls,'…
limcontrib', tmlims,'baseline', bsln,'diff', conddiffs);
```

Exercise

- **ALL**
  - Load workshop STUDY

- **Novice**
  - Load and plot individual ERSPs for one or more clusters.
  - How consistent are the ERSPs in these clusters?

- **Intermediate**
  - Pick a cluster to investigate
  - Plot mean power in a small time/frequency window across all ICs and conditions for this cluster

- **Advanced**
  - Plot ERP image for a single cluster sorting for response time.
  - Plot cluster ERP (std_envtopo) and compare with ERP image

** All scripts for Intermediate/Advanced exercises can be found in …/EEGLAB_WORKSHOP/Scripts/practicum_11.m