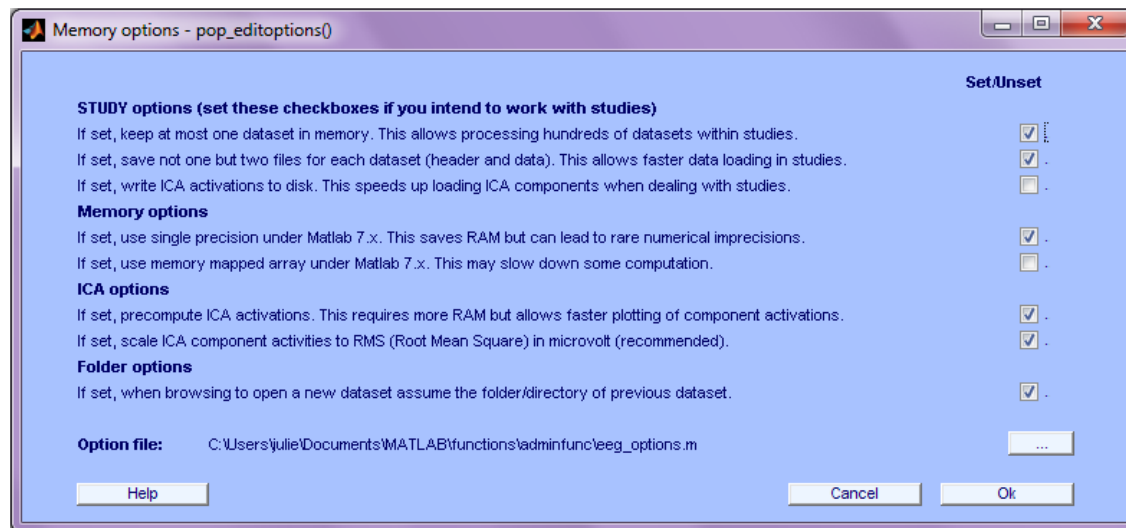
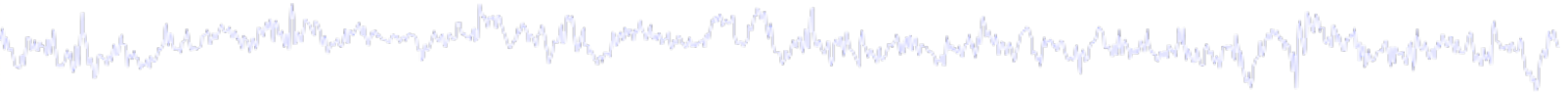
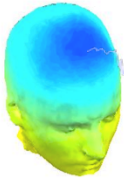


STUDY scripts



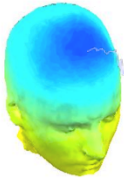
Most important option:

- Allows only one dataset to be loaded at once.
- Most STUDYs are too big to have all data loaded at once.

% Set memory options:

`pop_edioptions( 'option_storedisk', 1);`

Edit dataset info



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:

	dataset filename	browse	subject	session	condition	group	Select by r.v.	
1	C:\Users\julie\Documents\Wor	...	S01		memorize		Comp.: 3 5 ...	Clear
2	C:\Users\julie\Documents\Wor	...	S01		ignore		Comp.: 3 5 ...	Clear
3	C:\Users\julie\Documents\Wor	...	S01		probe		Comp.: 3 5 ...	Clear
4	C:\Users\julie\Documents\Wor	...	S02		memorize		Comp.: 5 6 ...	Clear
5	C:\Users\julie\Documents\Wor	...	S02		ignore		Comp.: 5 6 ...	Clear
6	C:\Users\julie\Documents\Wor	...	S02		probe		Comp.: 5 6 ...	Clear
7	C:\Users\julie\Documents\Wor	...	S03		memorize		Comp.: 6 7 ...	Clear
8	C:\Users\julie\Documents\Wor	...	S03		ignore		Comp.: 6 7 ...	Clear
9	C:\Users\julie\Documents\Wor	...	S03		probe		Comp.: 6 7 ...	Clear
10	C:\Users\julie\Documents\Wor	...	S04		memorize		Comp.: 1 2 ...	Clear

Important note: Removed datasets will not be saved before being deleted from EEGLAB memory

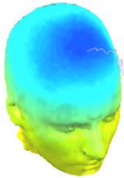
< Page 1 >

☐ 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.)

Help Cancel Ok

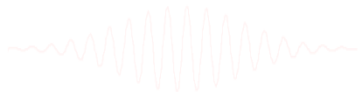
Load dataset info from commandline



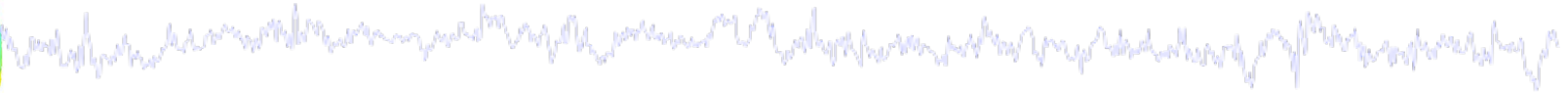
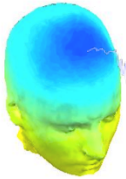
```
% create the STERN STUDY
eeglab
basedir = pwd;
subjs = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' ...
         'S08' 'S09' 'S10' 'S11' 'S12' 'S13'};
commands = {}; % initialize STUDY dataset list

% Now loop through subjects and add to the STUDY
for subj = 1:length(subjs) % for each subject
    fileIgnore = fullfile(basedir, subjs{subj}, 'Ignore.set');
    fileMemorize = fullfile(basedir, subjs{subj}, 'Memorize.set');
    fileProbe = fullfile(basedir, subjs{subj}, 'Probe.set');
    commands = { commands{:} ...
                {'index' 3*subj-2 'load' fileIgnore 'subject' subjs{subj} 'condition' 'Ignore' } ...
                {'index' 3*subj-1 'load' fileMemorize 'subject' subjs{subj} 'condition' 'Memorize' } ...
                {'index' 3*subj 'load' fileProbe 'subject' subjs{subj} 'condition' 'Probe' } };
end;
commands = { commands{:} { 'dipselect', 0.15 } };
[STUDY ALLEEG] = std_editset( STUDY, ALLEEG, 'name', 'Sternberg', ...
    'task', 'Sternberg', 'commands', commands, ...
    'updatedat','off', 'filename', fullfile(basedir, 'stern_autogenerated.study'));

% update workspace variables and redraw EEGLAB
CURRENTSTUDY = 1; EEG = ALLEEG; CURRENTSET = [1:length(EEG)];
[STUDY, ALLEEG] = std_checkset(STUDY, ALLEEG);
eeglab redraw
```

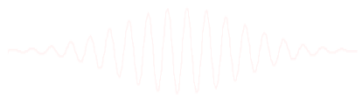


STUDY structure

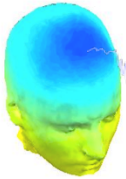


STUDY =

```
    name: 'Sternberg'
    task: 'Sternberg'
datasetinfo: [1x39 struct]
    notes: ''
    filename: 'stern.study'
    filepath: 'C:\Users\julie\Documents\Workshops\Finland\STUDY'
    history: [1x7332 char]
    subject: {1x13 cell}
    group: {''}
    session: []
condition: {'ignore' 'memorize' 'probe'}
    setind: [3x13 double]
    etc: [1x1 struct]
preclust: [1x1 struct]
    cluster: [1x1 struct]
    changrp: [1x71 struct]
    saved: 'yes'
```



Understanding STUDY structure



```
>> STUDY.datasetinfo(11) % access dataset 11  
ans =
```

```
    filepath: [1x61 char]
```

```
    filename: 'S04.set'
```

```
    subject: 'S04'
```

Subject 4!

```
    session: []
```

```
    condition: ''
```

```
    group: ''
```

```
    trialinfo: 1x350 struct
```

```
        index: 11
```

```
        comps: [1x24 double]
```

```
>> trialinfo(163) % access trial 163
```

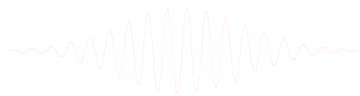
```
ans =
```

```
    stimtype: 'Memorize'
```

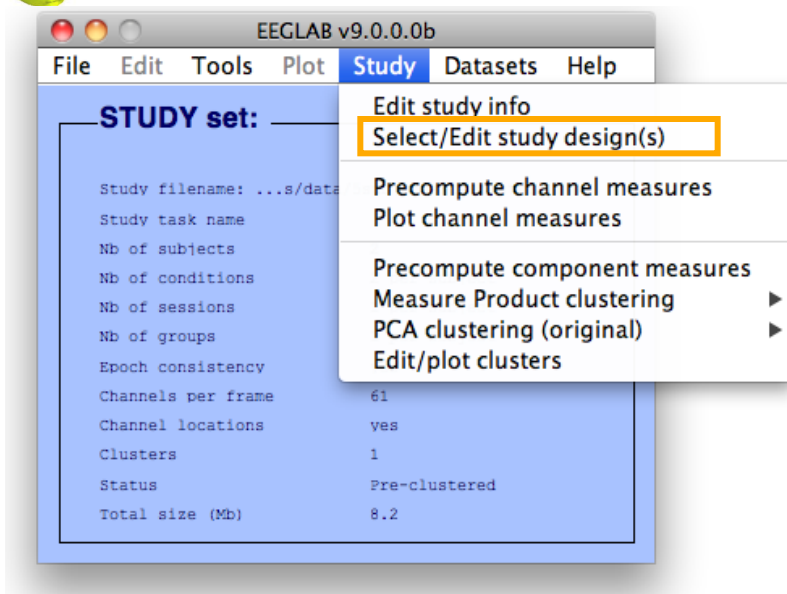
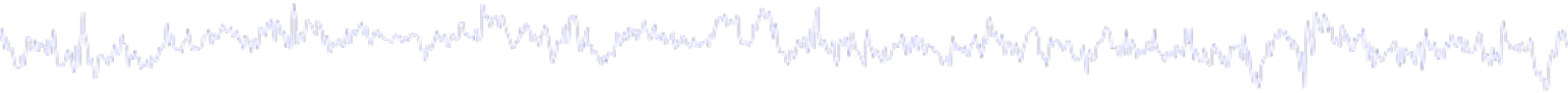
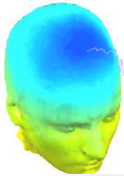
```
    latency: 13201
```

```
    duration: 0
```

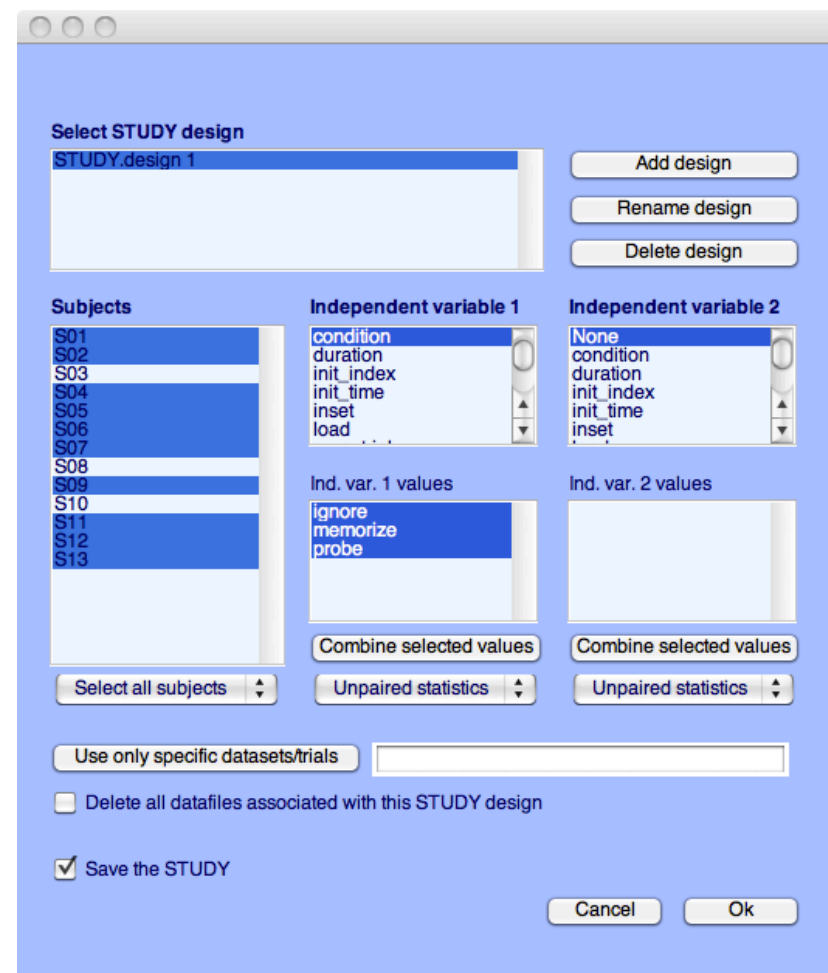
```
    ...
```



```
STUDY = std_makedesign(STUDY, ALLEEG, 3, 'variable1','condition','variable2',"','name','Design
3','values1',{ 'ignore' 'memorize' 'probe'}, 'subselect',{'S02' 'S03'}, 'dataselect',{'condition' {'probe'}});
```

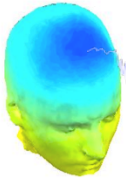


Select subjects



```
STUDY = std_makedesign(STUDY, ALLEEG, 3,
'variable1','condition',
'variable2',"',
'name','Design 3',
'values1',{ 'ignore' 'memorize' 'probe'},
'subselect',{'S02' 'S03'},
'dataselect',{'condition' {'probe'}});
```

STUDY design structure



```
STUDY.design(1)

ans =

    name: 'Design 1 - compare letter types'
variable: [1x2 struct]
  cases: [1x1 struct]
include: {}
  cells: [1x39 struct]
```

Exploding the contents of each of these sub-structures, we obtain

```
    name: 'Design 1 - light and audio all subjects'

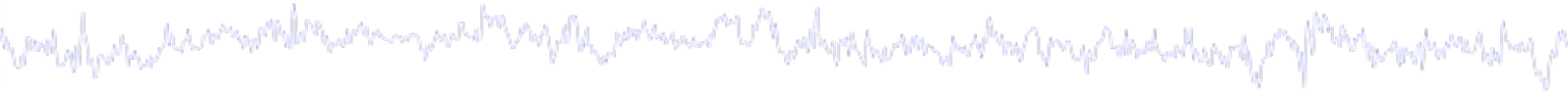
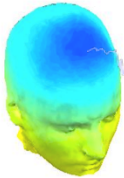
variable: [1x2 struct]
  (1).label : 'condition'
  (1).pairing: 'on'
  (1).value : {'ignore' 'memorize' 'probe'}
  (2).label : ''
  (2).pairing: 'off'
  (2).value : {}

cases: [1x1 struct]
  label: 'subject'
  value: {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' }

include: {}

cells: [1x39 struct]
  dataset : 2
  trials : {[1x267 double]}
  value : {'ignore' ''}
  case : 'S01'
  filebase: '/Volumes/donnees/data/STUDYstern/S01/Ignore'
```

Precompute data measures



TIP: Compute all measures so you can test different combinations for clustering

Select and compute component measures for later clustering -- pop_precomp()

Pre-compute component measures for STUDY 'Sternberg'

☒ Compute ERP/spectrum/ERSP only for components selected by RV (set) or for all components (unset)

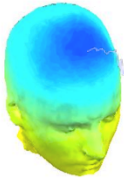
List of measures to precompute

☒ ERPs	Baseline ([min max] in ms)	[-200 0]	
☒ Power spectrum	Spectopo parameters		Test
☒ ERSPs	Time/freq. parameters	'cycles', [3 0.5], 'nfreqs', 100	Test
☒ ITCs			
☒ Scalp maps			

☐ Recompute even if present on disk

```
[STUDY ALLEEG] = std_precomp(STUDY, ALLEEG, 'components', 'erp', ...  
'on', 'rmbase', [-200 0], 'scalp', 'on', 'spec', 'on', ...  
'specparams', {}, 'ersp', 'on', 'erspparams', {'cycles' [3 0.5] ...  
'nfreqs', 100, 'freqs', [3 70]}, 'itc', 'on');
```

Precluster the data



Select and compute component measures for later clustering -- pop_precl...

Build pre-clustering matrix for STUDY set: Sternberg

Select the cluster to refine by sub-clustering (any existing sub-hierarchy will be overwritten)

ParentCluster 1 (336 ICs)

Note: Only measures that have been precomputed may be used for clustering.

Measures	Dims.	Norm.	Rel. Wt.
☒ spectra	10	☒ 1	
☐ ERPs	10	☒ 1	
☒ dipoles	3	☒ 10	
☐ scalp maps	10	☒ 1	
☒ ERSPs	10	☒ 1	
☐ ITCs	10	☒ 1	
☐ Final dimensions	10		

Help

☐ Use Measure Product clustering

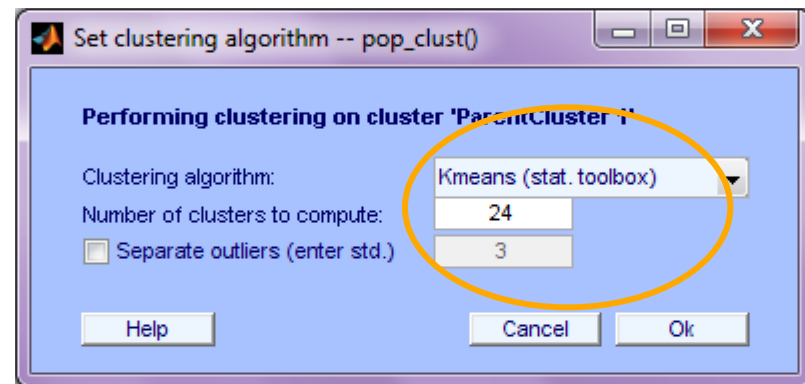
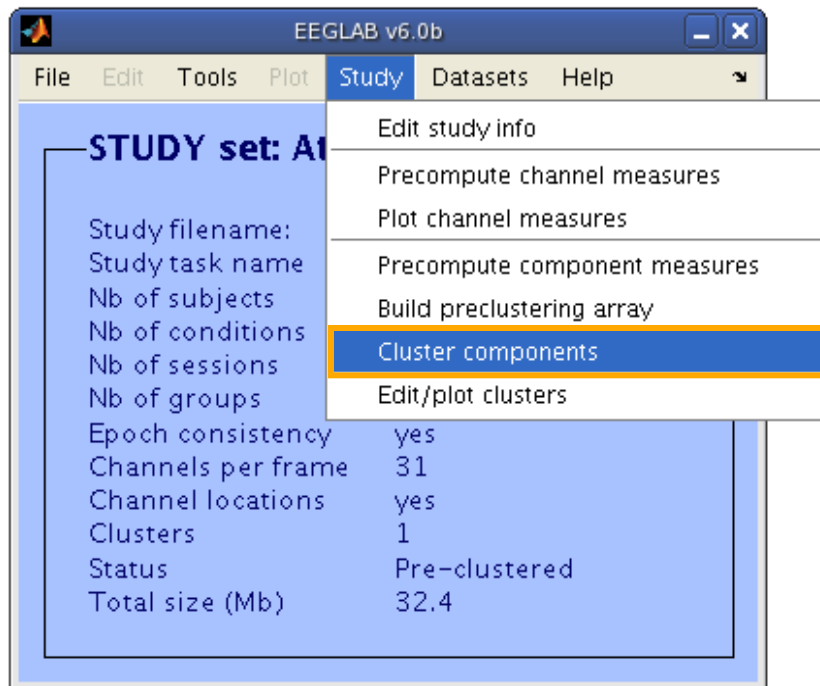
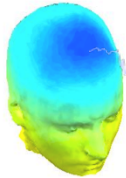
Help Cancel Ok

Additional settings for selected measures:

- Freq. range [Hz]: 3 25
- Time range [ms]:
- Use channel values: ☐ Absolute values
- Time range [ms]: 0 600
- Freq. range [Hz]: 3 30
- Time range [ms]:
- Freq. range [Hz]:

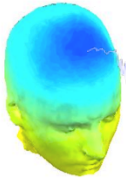
```
parentclust = 1;
[STUDY ALLEEG] = std_preclust(STUDY, ALLEEG, parentclust, {'spec', 'npca', 5, ...
    'norm', 1, 'weight', 1, 'freqrang', [3 25]}, {'erp', 'npca', 6, 'norm', 1, ...
    'weight', 1, 'timewindow', [0 400]}, {'scalp', 'npca', 10, 'norm', 1, 'weight', 1, ...
    'abso', 1}, {'dipoles', 'norm', 1, 'weight', 10}, {'ersp', 'npca', 20, ...
    'freqrang', [3 30], 'timewindow', [0 600], 'norm', 1, 'weight', 1}, {'itc', ...
    'npca', 6, 'freqrang', [3 30], 'timewindow', [0 400], 'norm', 1, 'weight', 1});
```

Cluster components



```
nclusts = 25; % choose # of clusters to create
[STUDY] = pop_clust(STUDY, ALLEEG, 'algorithm', 'kmeans', 'clus_num', nclusts);
```

Understanding STUDY structure



26 = # of clusters

```
>> STUDY.cluster  
1x26 struct array with fields:
```

```
parent  
name  
child  
comps  
sets  
algorithm  
preclust  
dipole  
allinds  
setinds
```

One cluster:

```
>> STUDY.cluster(6)  
ans =
```

```
parent: {'ParentCluster 1'}  
name: 'Cls 6'  
child: []  
comps: [35 7 12 35 10 23 7 30 4 ...]  
sets: [1 2 3 4 5 6 7 8 9 10 1 2 ...]  
algorithm: {'Kmeans' [24]}  
preclust: [1x1 struct]  
dipole: [1x1 struct]  
allinds: { [...] [...]; [...] [...]}  
setinds: { [...] [...]; [...] [...]}
```

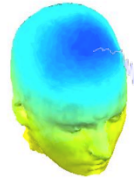
IC indices

dataset indices for ICs

Design IC indices

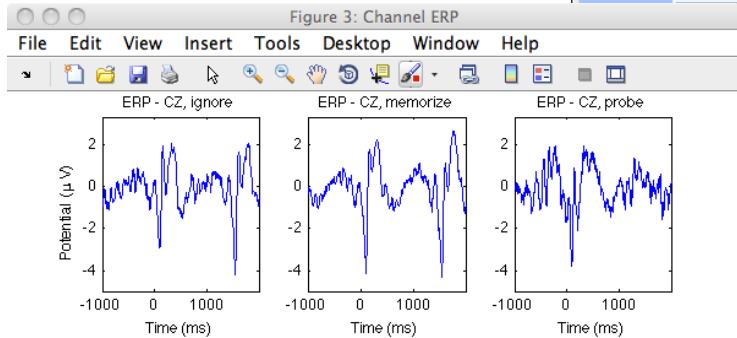
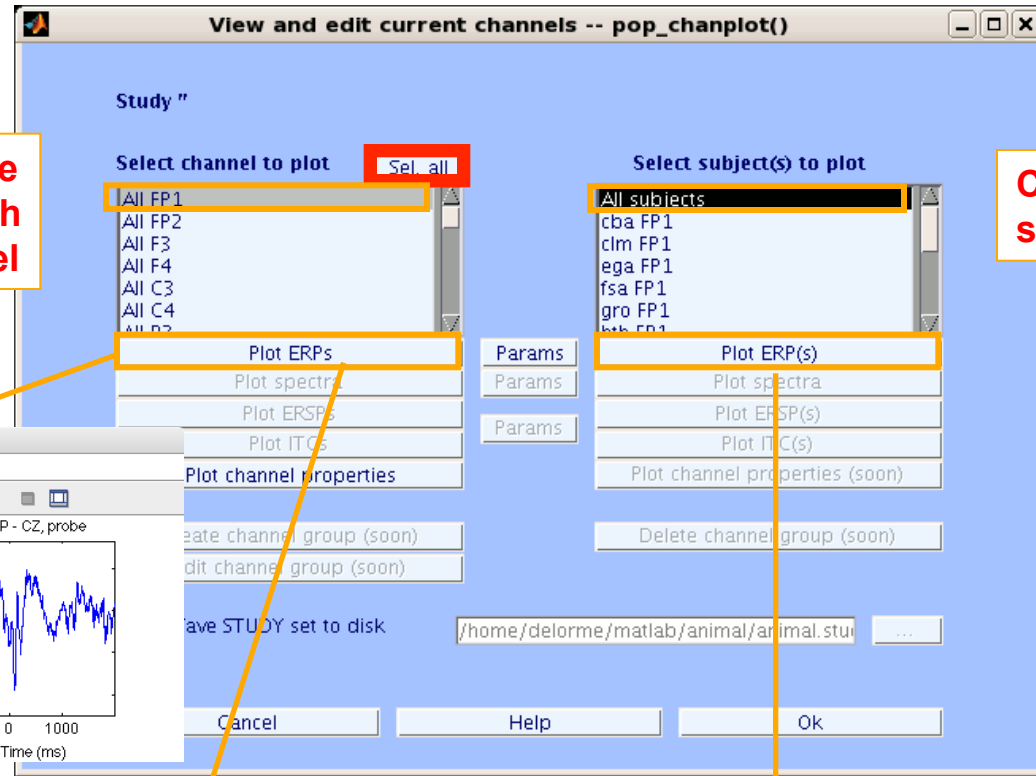
Design indices

6 = cluster index

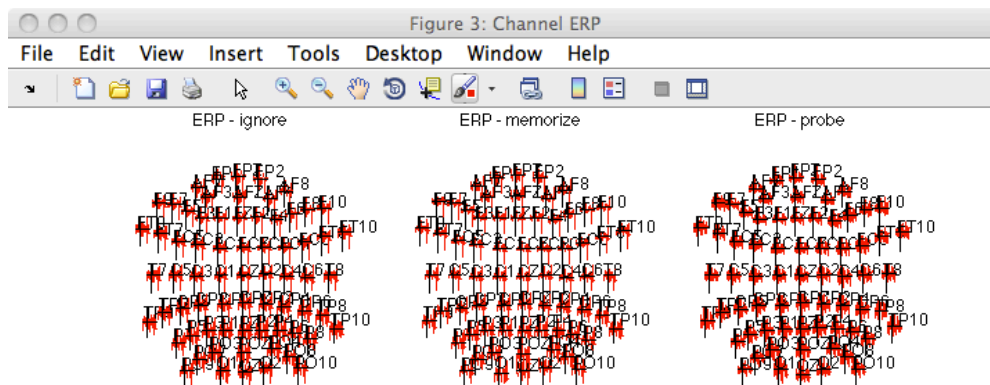


Choose which channel

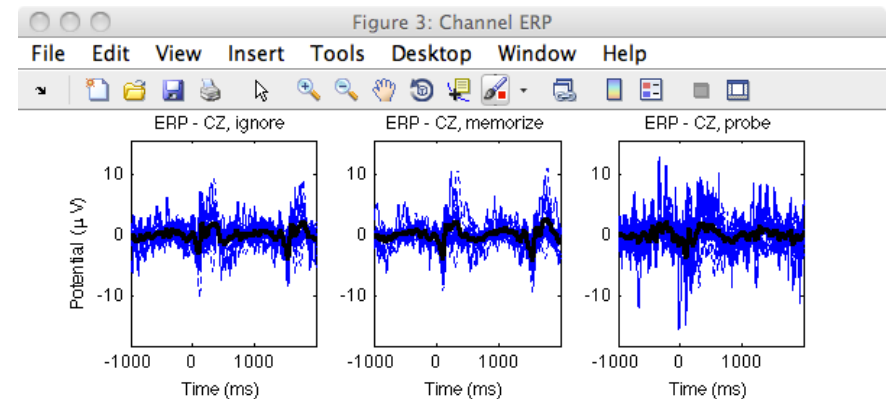
Choose which subject



```
STUDY = std_erplot(STUDY,ALLEEG,'channels',{'FP1'});
```

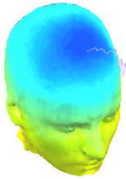


```
STUDY = std_erplot(STUDY,ALLEEG,'channels',{'FP1' ... });
```

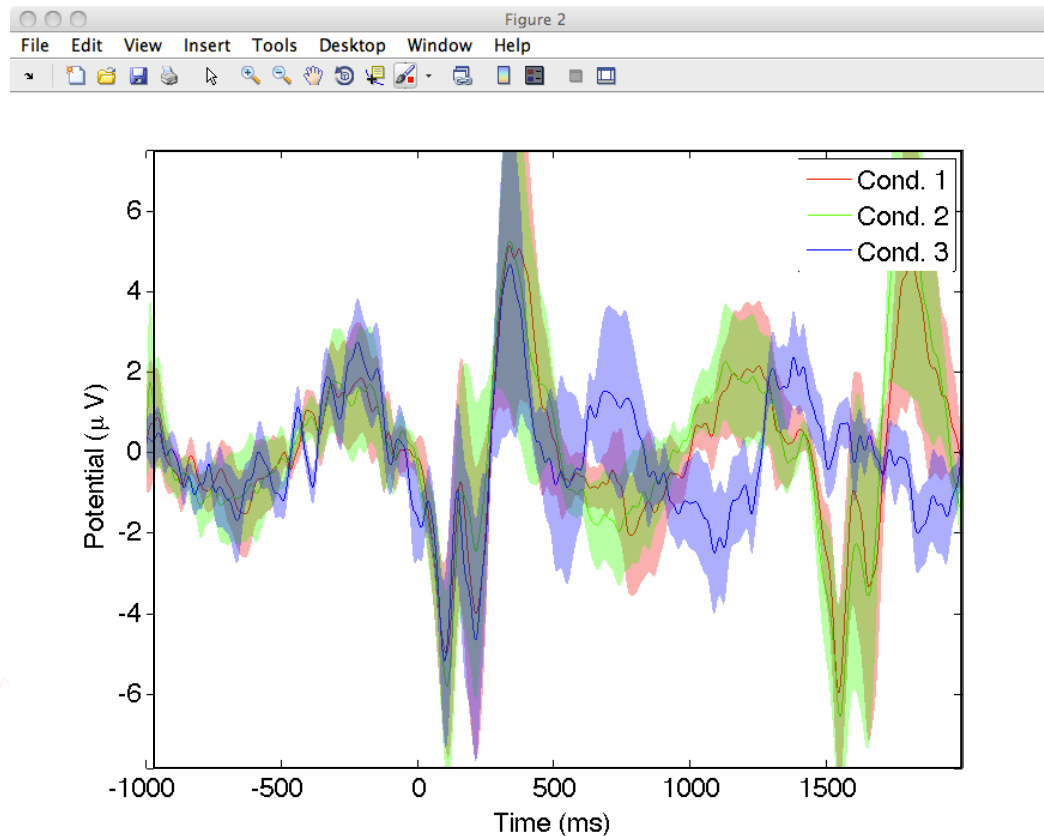


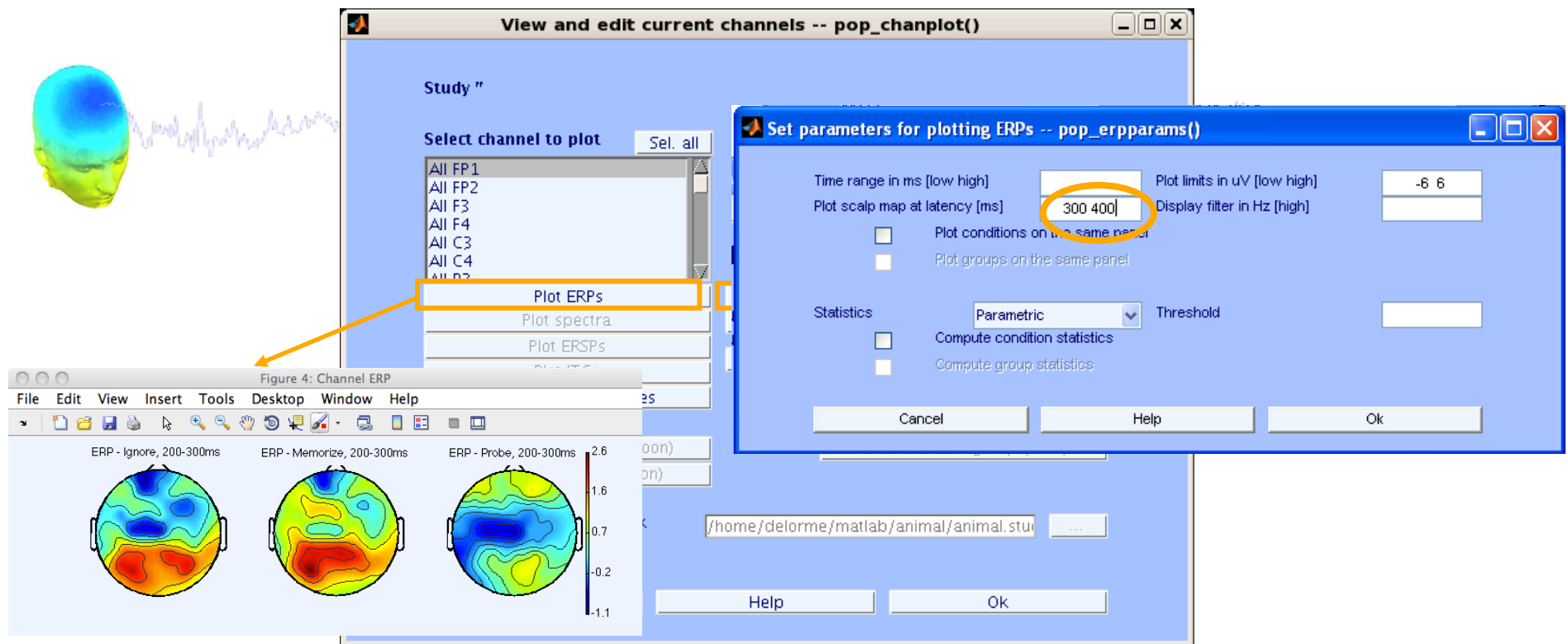
```
STUDY = std_erplot(STUDY,ALLEEG,'channels',{'FP1'}, 'plotsubjects', 'on' );
```

Advanced plotting features



```
STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'CZ'});  
std_plotcurve(STUDY.changrp(39).erptimes, STUDY.changrp(39).erpdata,  
    'plotconditions', 'together', 'plotstderr', 'on', 'filter', 30);
```





```
STUDY = std_erpplot(STUDY,ALLEEG, 'topotime',[200 300] , 'channels',{'OZ' 'O2' 'FP1' 'FPZ' 'FP2' ... });
[STUDY erpdata] = std_erpplot(STUDY,ALLEEG, , 'topotime',[200 300] , 'channels',{'OZ' 'O2' ... });
```



Exporting to excell file

[1x67x13 double]

[1x67x13 double]

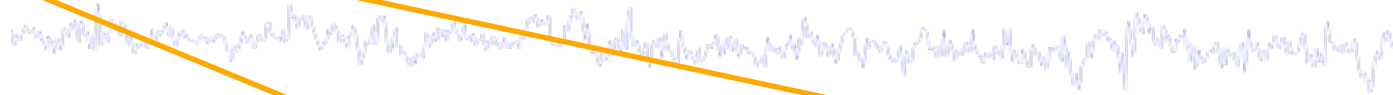
[1x67x13 double]

```
xlswrite('myxlsfile',squeeze(erpdata{1}),1);
```

```
xlswrite('myxlsfile',squeeze(erpdata{2}),2);
```

```
xlswrite('myxlsfile',squeeze(erpdata{3}),3);
```

Exporting text file



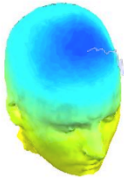
-0.13	-0.4	3.7	-0.9	-1.5	0.23	-0.98	1.8	2.3	-1.4	-2.8	-0.03	3.5
-0.54	-1.3	3.6	-1.1	-1.2	0.62	-0.91	1.6	2.2	-0.98	-7.7	-0.42	3.2
-0.77	-0.06	3.6	-1.4	-1.2	0.78	-0.91	1.2	2.1	-0.66	-0.76	-1	2.5
-0.61	-0.83	3.7	-1.2	-1.2	0.53	-0.88	1.1	1.7	-1.2	-1.8	-1.2	1.6
-0.34	-0.79	3.7	-0.98	-1.2	0.17	-0.72	1	1.4	-1.7	-2.3	-0.72	1.4
-0.27	-0.42	3.2	-0.69	-1.4	-0.04	-0.29	0.97	0.81	-2.5	-1.5	-0.38	1.7
0.097	-0.58	3.2	-0.61	-1.2	-0.32	0.36	0.47	2.1	-0.96	-2.8	0.89	2.4
0.43	-0.04	2.3	-0.47	-0.87	-0.37	0.21	0.83	3.1	-0.53	-0.85	1.2	3.4
0.21	-0.54	2.4	-0.07	-0.05	-0.08	-0.08	1	3.3	-0.42	-3.7	0.92	3.8
-0.1	-1.1	2.7	-0.33	-0.28	0.48	-0.5	1.2	3.3	-0.53	-2	0.36	4
-0.51	-2.2	2.9	-0.59	-0.23	1.3	-0.72	1.4	3.3	-0.14	-16	-0.05	3.9

```
dlmwrite('erpfile.txt',squeeze(erpdata{1}),'delimiter','\t','precision',2);
```

```
dlmwrite('erpfile.txt',squeeze(erpdata{2}),'-append','roffset',1,'delimiter','\t','precision',2);
```

```
dlmwrite('erpfile.txt',squeeze(erpdata{2}),'-append','roffset',1,'delimiter','\t','precision',2);
```

STUDY Script



```
% create the STERN STUDY
eeglab
basedir = pwd;
subjs = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' ...
        'S08' 'S09' 'S10' 'S11' 'S12' 'S13'};
commands = {}; % initialize STUDY dataset list

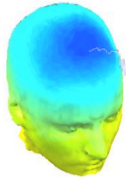
% Now loop through subjects and add to the STUDY
for subj = 1:length(subjs) % for each subject
    fileIgnore = fullfile(basedir, subjs{subj}, 'Ignore.set');
    fileMemorize = fullfile(basedir, subjs{subj}, 'Memorize.set');
    fileProbe = fullfile(basedir, subjs{subj}, 'Probe.set');
    commands = { commands{:} ...
        {'index' 3*subj-2 'load' fileIgnore 'subject' subjs{subj} 'condition' 'Ignore' } ...
        {'index' 3*subj-1 'load' fileMemorize 'subject' subjs{subj} 'condition' 'Memorize' } ...
        {'index' 3*subj 'load' fileProbe 'subject' subjs{subj} 'condition' 'Probe' } };
end;
commands = { commands{:} { 'dipselect', 0.15 } };
[STUDY ALLEEG] = std_editset( STUDY, ALLEEG, 'name', 'Sternberg', ...
    'task', 'Sternberg', 'commands', commands, ...
    'updatedat','off', 'filename', fullfile(basedir, 'stern_autogenerated.study'));

% update workspace variables and redraw EEGLAB
CURRENTSTUDY = 1; EEG = ALLEEG; CURRENTSET = [1:length(EEG)];
[STUDY, ALLEEG] = std_checkset(STUDY, ALLEEG);
eeglab redraw

% compute and plot ERP scalp maps between 200 and 300 ms
[STUDY ALLEEG] = std_precomp(STUDY, ALLEEG, {}, 'interp', 'on', 'allcomps', 'on', 'erp', 'on');
STUDY = pop_erpparams(STUDY, 'topotime', [200 300] );
[STUDY erpdata ] = std_erpplot(STUDY, ALLEEG, 'channels', {'LEYE' 'REYE' 'OZ' 'O2' 'FP1' 'FPZ' 'FP2' ...
    'AF7' 'AF3' 'AFZ' 'AF4' 'AF8' 'F9' 'F7' 'F5' 'F3' 'F1' 'FZ' 'F2' 'F4' 'F6' 'F8' 'F10' 'FT9' ...
    'FT7' 'FC5' 'FC3' 'FC1' 'FCZ' 'FC2' 'FC4' 'FC6' 'FT8' 'FT10' 'T7' 'C5' 'C3' 'C1' 'CZ' ...
    'C2' 'C4' 'C6' 'T8' 'TP9' 'TP7' 'CP5' 'CP3' 'CP1' 'CPZ' 'CP2' 'CP4' 'CP6' 'TP8' 'TP10' ...
    'P7' 'P5' 'P3' 'P1' 'PZ' 'P2' 'P4' 'P6' 'P8' 'PO9' 'PO7' 'PO3' 'POZ' 'PO4' 'PO8' 'PO10' 'O1'});

% export the data to text file
dlmwrite('erpfile.txt', squeeze(erpdata{1}), 'delimiter', '\t', 'precision', 2);
dlmwrite('erpfile.txt', squeeze(erpdata{2}), '-append', 'roffset', 1, 'delimiter', '\t', 'precision', 2);
dlmwrite('erpfile.txt', squeeze(erpdata{2}), '-append', 'roffset', 1, 'delimiter', '\t', 'precision', 2);
```

STUDY datafiles

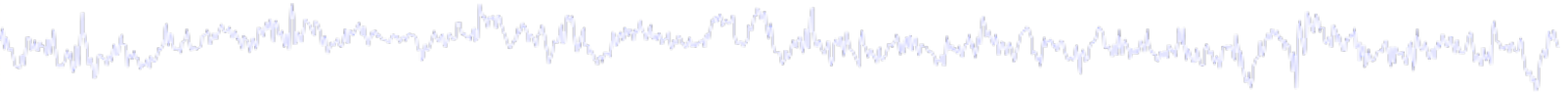
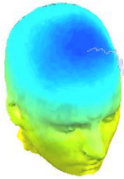


Name	Date Modified	Size
design1_S01_ignore_3.daterp	Today, 12:02 AM	487 KB
design1_S01_ignore_7.daterp	Today, 12:03 AM	487 KB
design2_S01.daterp	Yesterday, 2:52 PM	487 KB
Ignore.daterp	Nov 9, 2010 2:59 PM	487 KB
Ignore.datersp	Nov 17, 2010 11:48 PM	1.5 MB
Ignore.datitc	Nov 17, 2010 11:48 PM	2.9 MB
Ignore.datspec	Nov 17, 2010 11:07 PM	283 KB
Ignore.fdt	Jun 15, 2010 4:51 AM	56.9 MB
Ignore.icaerp	Nov 16, 2009 10:01 PM	434 KB
Ignore.icaersp	Nov 17, 2009 11:59 AM	2 MB
Ignore.icaitc	Nov 17, 2009 11:59 AM	4 MB
Ignore.icaspec	Nov 12, 2009 9:09 PM	156 KB
Ignore.icatopo	Nov 18, 2009 3:17 AM	4 KB
Ignore.set	Jun 15, 2010 4:51 AM	2.7 MB
Memorize.daterp	Nov 9, 2010 3:00 PM	487 KB
Memorize.datersp	Yesterday, 2:53 AM	1.5 MB
Memorize.datitc	Yesterday, 2:53 AM	2.9 MB
Memorize.datspec	Nov 17, 2010 11:12 PM	283 KB
Memorize.fdt	Nov 8, 2009 8:06 AM	90.7 MB
Memorize.icaerp	Nov 16, 2009 10:01 PM	434 KB
Memorize.icaersp	Nov 17, 2009 11:40 AM	2 MB
Memorize.icaitc	Nov 17, 2009 11:40 AM	4 MB
Memorize.icaspec	Nov 12, 2009 9:08 PM	156 KB
Memorize.icatopo	Nov 16, 2009 9:43 PM	2.6 MB
Memorize.set	Nov 15, 2010 10:25 PM	3.4 MB
Probe.daterp	Nov 9, 2010 3:00 PM	487 KB
Probe.datersp	Yesterday, 8:20 AM	1.5 MB
Probe.datitc	Yesterday, 8:20 AM	2.9 MB
Probe.datspec	Nov 17, 2010 11:18 PM	279 KB
Probe.fdt	Nov 12, 2009 11:02 AM	19.4 MB
Probe.icaerp	Nov 16, 2009 10:01 PM	434 KB
Probe.icaersp	Nov 17, 2009 12:05 PM	2 MB
Probe.icaitc	Nov 17, 2009 12:05 PM	4 MB
Probe.icaspec	Nov 12, 2009 9:09 PM	156 KB
Probe.icatopo	Nov 16, 2009 9:44 PM	2.6 MB
Probe.set	Nov 15, 2010 10:49 PM	2.1 MB

donnees > data > STUDYstern > S01

36 items, 155.21 GB available

STUDY datafiles



Datafiles (old scheme)

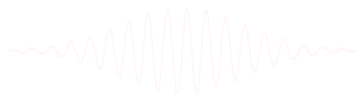
- *syn02-S253-clean.daterp* (ERPs)
- *syn02-S253-clean.datspec* (power spectra)
- *syn02-S253-clean.datersp* (ERSPs)
- *syn02-S253-clean.datitc* (ITCs)

- *syn02-S253-clean.icaerp* (ERPs)
- *syn02-S253-clean.icaspec* (power spectra)
- *syn02-S253-clean.icatopo* (scalp maps)
- *syn02-S253-clean.icaersp* (ERSPs)
- *syn02-S253-clean.icaitc* (ITCs)

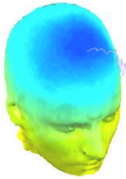
Datafiles (new scheme)

- *design1_S01_ignore.daterp* (ERPs)
- *design1_S01_ignore.datspec* (power spectra)
- *design1_S01_ignore.datersp* (ERSPs)
- *design1_S01_ignore.datitc* (ITCs)

- *design1_S01_ignore.icaerp* (ERPs)
- *design1_S01_ignore.icaspec* (power spectra)
- *design1_S01_ignore.icatopo* (scalp maps)
- *design1_S01_ignore.icaersp* (ERSPs)
- *design1_S01_ignore.icaitc* (ITCs)



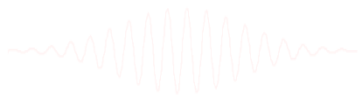
STUDY datafiles



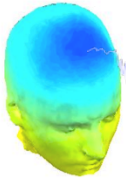
```
tmp = load('-mat', 'design1_S01_ignore.daterp');  
>> tmp
```

```
tmp =
```

```
    chan1: [1x750 double]  
    chan2: [1x750 double]  
    chan3: [1x750 double]  
    chan4: [1x750 double]  
    chan5: [1x750 double]  
    chan6: [1x750 double]  
    chan7: [1x750 double]  
    ...  
    chan69: [1x750 double]  
    chan70: [1x750 double]  
    chan71: [1x750 double]  
    labels: {1x71 cell}  
    times: [1x750 double]  
    datatype: 'ERP'  
    parameters: {'rmcomps' {1x1 cell} 'interp' [1x71 struct]}  
    datafile: '/Volumes/donnees/data/STUDYstern/S01/Ignore.set'
```



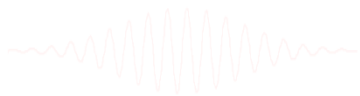
STUDY datafiles



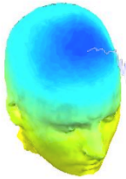
```
>> tmp = load('-mat', 'design1_S01_ignore.datersp');  
>> tmp
```

```
tmp =
```

```
      chan1_ersp: [50x100 single]  
      chan1_erspbase: [1x50 single]  
      chan1_erspboot: []  
      chan2_ersp: [50x100 single]  
      chan2_erspbase: [1x50 single]  
      chan2_erspboot: []  
           freqs: [1x50 double]  
           times: [1x100 double]  
      datatype: 'ERSP'  
      parameters: {1x26 cell}  
      chanlabels: {1x71 cell}  
      datafile: '/Volumes/donnees/data/STUDYstern/S01/Ignore.set'
```



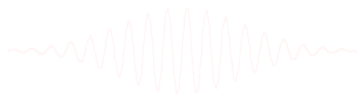
STUDY datafiles



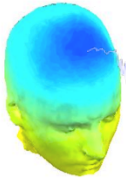
```
>> tmp = load('-mat', 'design1_S01_ignore.icaersp');  
>> tmp
```

```
tmp =
```

```
    comp1_ersp: [50x100 single]  
comp1_erspbase: [1x50 single]  
  comp1_erspboot: []  
    comp2_ersp: [50x100 single]  
comp2_erspbase: [1x50 single]  
  comp2_erspboot: []  
        freqs: [1x50 double]  
        times: [1x100 double]  
    datatype: 'ERSP'  
  parameters: {1x26 cell}  
  chanlabels: {1x71 cell}  
    datafile: '/Volumes/donnees/data/STUDYstern/S01/Ignore.set'
```



Exercises



Suggestion for exercises:

Load stern.study in STUDY folder

Choose a cluster to investigate. Plot mean power in a small time/frequency window across all ICs and conditions for this cluster

Run the script to build the STUDY automatically.

Modify the script to plot spectrum at 10 Hz instead of ERP.

Load an ICA ERSP file Matlab files and use the *tftopo* function to replot one component ERSP.

