STUDY design and plotting overview

STEP 1
Build a STUDY

STEP 2
Build design(s)

STEP 3
Precompute the data

STEP 4
Plot the data

Exercise...
Memory options should change when using STUDY vs single dataset
Create simple ERP STUDY

This interface creates a simple STUDY and computes its condition grand average ERPs. For each subject, trials for each condition must first be stored in a separate dataset. Create other STUDY using the standard editor.

Number of conditions: 2
Number of subjects: 15
Create simple ERP STUDY

<table>
<thead>
<tr>
<th>Condition 1 name</th>
<th>Condition 2 name</th>
</tr>
</thead>
<tbody>
<tr>
<td>letter-ignore</td>
<td>letter-memorize</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition 1 datasets</th>
<th>Condition 2 datasets</th>
</tr>
</thead>
<tbody>
<tr>
<td>/data/STUDY/S01/Ignore.set</td>
<td>/data/STUDY/S01/Memorize.set</td>
</tr>
<tr>
<td>/data/STUDY/S02/Ignore.set</td>
<td>/data/STUDY/S02/Memorize.set</td>
</tr>
<tr>
<td>/data/STUDY/S03/Ignore.set</td>
<td>/data/STUDY/S03/Memorize.set</td>
</tr>
</tbody>
</table>

When using more than 1 condition, datasets on each line must correspond to the same subject.
Create simple ERP STUDY
Exercises

Suggestion for exercise

1. From the GUI, select “File > Create STUDY > Simple ERP STUDY”

2. Enter 2 conditions “letter-ignore” and “letter-memorize”

3. In the column for “letter-ignore” select datasets “ignore.set” for 3 subjects S01, S02, S03 (in the STERN folder)

4. In the column for “letter-memorize” select datasets “memorize.set” for 3 subjects S01, S02, S03 (in the STERN folder)

5. Press OK.
Create design

1x3 design
Design independent of # of files per subject
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Exercise...
Precompute data measures

- Precompute channel measures
  - Precompute component measures
  - PCA clustering (original)
  - Edit/plot clusters
  - Cluster components by correlation (CORRMAP)
  - std_ErpCalc

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

- Channel list (default: all)
  - Spherical interpolation of missing channels (performed after optional ICA removal below)
  - Remove ICA artifactual components pre-tagged in each dataset
  - Remove artifactual ICA cluster or clusters (hold shift key)

List of measures to precompute
- ERPs
- Power spectrum
- ERSPs
- ITCs

- Save single-trial measures for single-trial statistics - requires disk space
- Recompute even if present on disk

Help  Cancel  Ok
Computing Spectrum
Choose which channel

Choose which subject
Computing ERSP

'cycles', [3 0.8], 'nfreqs', 50, 'ntimesout', 100
Figure 4

Set ERSP/ITC plotting parameters -- pop_erspparams()

ERSP/ITC plotting options

- Time range in ms [Low High]: -500 1000
- Freq. range in Hz [Low High]: 3 30
- Power limits in dB [Low High]:
- Compute common ERSP baseline (assumes additive baseline):

Plot scalp map at time [ms]:
Plot scalp map at freq. [Hz]:
ITC limit (0-1) [High]:
ERP-image across subjects

View and edit current channels -- pop_chanplot()

STUDY name 'Sternberg' - 'Comparing conditions'

Select channel to plot        Sel. all

Select subject(s) to plot

Plot ERPs

Plot spectra

Plot ERP(s)

Set statistical parameters -- pop_statparams()

General statistical parameters

- Compute 1st independent variable statistics
- Compute 2nd independent variable statistics
- Use single trials (when available)

Use EEGLAB statistics
- Use parametric statistics
- Use FDR correction
- Statistical threshold (p-value): 0.05
- Randomization (n): auto

Use Fieldtrip statistics
- Use analytic/parametric statistics
- Do not correct for multiple comparisons
- CC channel neighbor parameters
- CC clustering parameters
- Statistical threshold (p-value)
- Randomization (n)
- 'method', 'triangulation'
- 'clustersistatic', 'maxsum'

Figure 4: Channel ERP

ERP - CZ
- ignore
- memorize
- probe

Potential (µV)

Time (ms)

-1000 -500 0 500 1000 1500
std_stat() function in EEGLAB
Exercises

1. Load “stern.study” file in STUDY folder

2. Edit STUDY design and delete current variable(s)

3. Create a new indep. Variable design to compare Ignore vs. Memorize letter

4. Recompute spectrum and ERP.

5. Plot spectrum and ERP for electrode Cpz

6. Plot scalp topography at 10 Hz (spectrum) and 200-300 ms (ERP) for both conditions

7. Plot spectrum for electrode CPz within 1 to 50 Hz and compute parametric statistics (with and without FDR correction)

8. Plot scalp topography at 10Hz for both conditions using permutation statistics cluster correction (Fieldtrip – statistics)
EEGLAB and BIDS

- Export EEGLAB STUDY to BIDS
- Import BIDS to EEGLAB STUDY
- HED support (meta-tags)
- Mapping the BIDS architecture

https://github.com/sccn/bids-matlab-tools
BIDS data structure...

- changes compared to previous release of data
- scripts and program to process/convert the data
- description of dataset in JSON format
- description of participants table file columns (below)
- participants table files in tab delimited format
- readme file for users
- original raw data if converted to a supported format
- original stimuli (sound files and images)
- anonymized subject 1 folder
- file describing channels
- raw EEG data file (not all raw formats are possible)
- amplifier and recording information
- events in tabular format

Preprocessing pipeline

- **Raw EEG data**
  - Import into EEGLAB
  - Remove unwanted channels
  - High pass filter (~0.5 – 1 Hz)
  - Identify/reject bad channels
  - Reject large artifact time points

- **Re-reference/down-sample**
  - Re-reference
  - Run ICA
  - Reject components

**ASR**

**IClabel**
% Create Stern STUDY
[ALLEEG EEG CURRENTSET ALLCOM] = eeglab;
pop_editoptions( 'option_storedisk', 1);
subjects = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' 'S08' 'S09' 'S10' 'S11' 'S12'};
filepath = '/Users/arno/temp/STUDY'; % XXXXX Change path here XXXXX
if ~exist(filepath), error('You need to change the path to the STUDY'); end;
commands = {}; % initialize STUDY dataset list

% Loop through all of the subjects in the study to create the dataset
for loopnum = 1:length(subjects) % for each subject
    IgnoreFile = fullfile(filepath, subjects{loopnum}, 'Ignore.set');
    MemorizeFile = fullfile(filepath, subjects{loopnum}, 'Memorize.set');
    ProbeFile = fullfile(filepath, subjects{loopnum}, 'Probe.set');
    commands = {commands{:} ... 
                 {'index' 3*loopnum-2 'load' IgnoreFile 'subject' subjects{loopnum} 'condition' 'Ignore' ... 
                 {'index' 3*loopnum-1 'load' MemorizeFile 'subject' subjects{loopnum} 'condition' 'Memorize' ... 
                 {'index' 3*loopnum 'load' ProbeFile 'subject' subjects{loopnum} 'condition' 'Probe'}}};
end;
% Uncomment the line below to select ICA components with less than 15% residual variance
% commands = {commands{:} {'dipselect', 0.15}};
[STUDY, ALLEEG] = std_editset(STUDY, ALLEEG, 'name', 'Sternberg', 'commands', commands, 'updatedat', 'on');

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

[STUDY ALLEEG] = std_precomp(STUDY, ALLEEG, {}, 'rmicacomps', 'on', 'interp', 'on', 'recompute', 'on', 'erp', 'on');
STUDY = pop_erpparams(STUDY, 'topotime', [200 300]);
[STUDY erpdata] = std_erpplot(STUDY, ALLEEG, 'channels', {'LEYE' 'REYE' 'OZ' 'O2' 'FP1' 'FP2' 'FPZ' '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' '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'});
dlmwrite('erpfille.txt', squeeze(erpdata{1}), 'delimiter', '	', 'precision', 2);
dlmwrite('erpfille.txt', squeeze(erpdata{2}), '-append', 'roffset', 1, 'delimiter', '	', 'precision', 2);
dlmwrite('erpfille.txt', squeeze(erpdata{2}), '-append', 'roffset', 1, 'delimiter', '	', 'precision', 2);