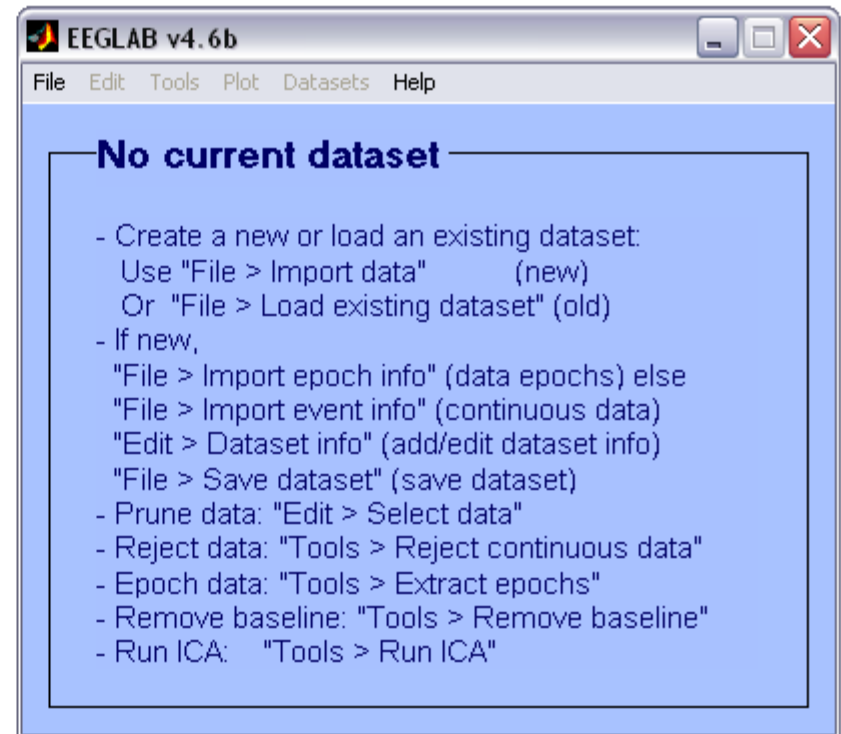


EEGLAB Plugins/Extensions

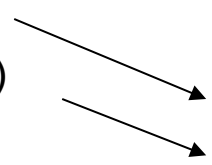
Starting EEGLAB

```
>> eeglab
eeglab: options file is /Volumes/donnees/data/STUDYst
Adding path to all EEGLAB functions
Adding path to eeglab/external/bioelectromagnetism_lig
Adding path to eeglab/external/biosig-partial
Adding path to eeglab/external/fieldtrip-partial
Adding path to eeglab/external/fieldtrip-partial subfolders
EEGLAB: adding plugin function "eegplugin_VisEd"
EEGLAB: adding "eepimport1.02" plugin (see >> help ee
EEGLAB: adding "bdfimport" plugin (see >> help eegplu
EEGLAB: adding "brainmovie0.1b" plugin (see >> help e
EEGLAB: adding "ctfimport1.03" plugin (see >> help eeg
EEGLAB: adding "dipfit2.2" plugin (see >> help eegplugi
EEGLAB: adding "EEG toolbox ERP plotting" plugin (see >> help eegplugin_eeg_toolbox)
EEGLAB: adding "erpssimport1.00" plugin (see >> help eegplugin_erpssimport)
EEGLAB: adding "fmrib1.21" plugin (see >> help eegplugin_fmrib)
EEGLAB: adding "iirfilt1.01" plugin (see >> help eegplugin_iirfilt)
EEGLAB: adding "eepimport1.02" plugin (see >> help eegplugin_ascinstep)
EEGLAB: adding "loreta1.0" plugin (see >> help eegplugin_loreta)
EEGLAB: adding "Butter1.0" plugin (see >> help eegplugin_ERPLAB_filters)
EEGLAB: adding "Measure_Product1.0" plugin (see >> help eegplugin_mp_clustering)
EEGLAB: adding plugin function "eegplugin_miclust"
EEGLAB: adding "4dneuroimaging1.00" plugin (see >> help eegplugin_4dneuroimaging)
>>
```



EEGLAB plugins

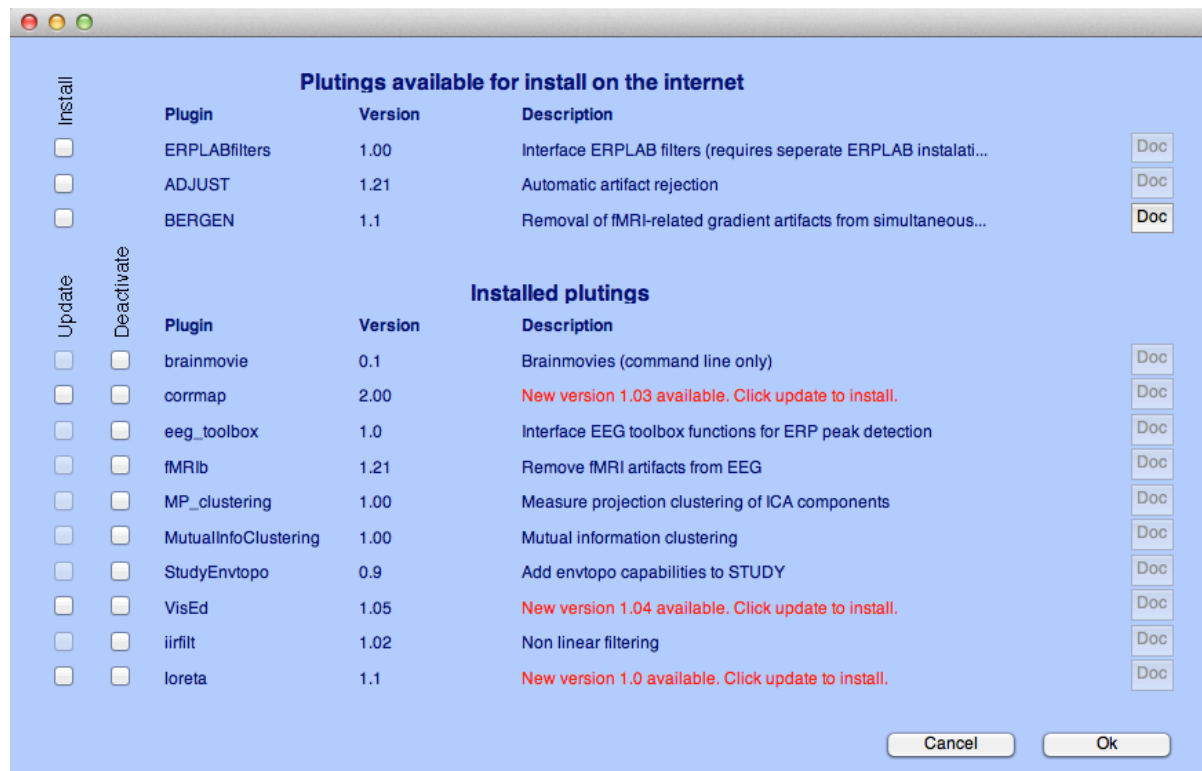
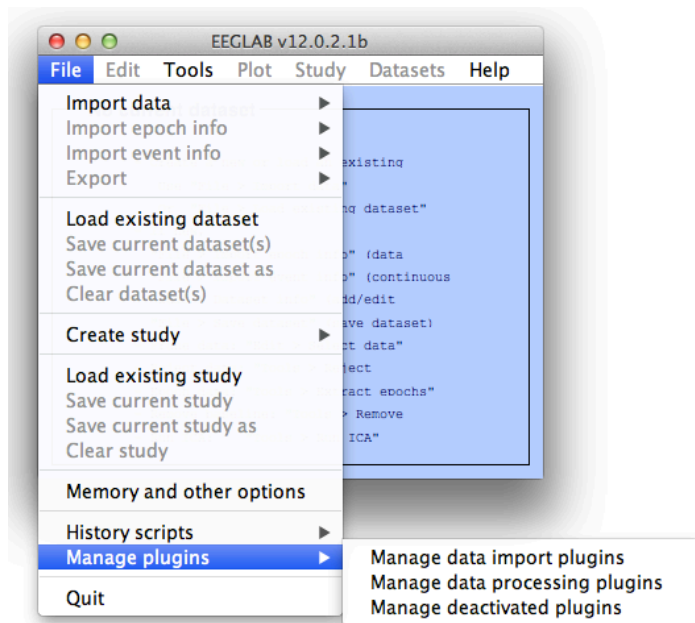
eepimport1.02	Data importing for EEprobe data (Oostenved & ANT company)
bva_io1.30	Brain vision analyzer import/export plugin (Widmann & Delorme)
ctfimport1.01	MEG CTF import plugin (Carver, Weber & Delorme)
dipfit2.0	4-shell and BEM (Oostenveld & Delorme)
fmrib1.2b	Removal of artifact from simultaneously EEG/fMRI recording (Niazi)
icaclust1.00	Clustering ICA components (Serby, Delorme, Makeig)
iirfilt1.0	Non-linear IIR filtering (Pozdin)
loreta1.0	Interface to LORETA-KEY (Delorme)
newtimefreq1.00	Time-freq. decomposition (Delorme)



**Better than FIR
Coregistration...**

Matlab toolboxes interfaced

BIOSIG	Data importing for rare data binary format (Schloegl)
Fieldtrip	Source localization and time-freq. decompositions (Oostenveld)
ICALAB	20 ICA algorithms (automatically detected by EEGLAB)
SPM2	Spatial normalization of anatomical MRI



Writing EEGLAB plugins

- Assuming that you have a signal processing function called xxxxx → Process any Input data Timef()
- a pop_xxxxx function will interface your signal processing function → Process EEG structure Pop_timef()
- a eegplugin_xxxxx function will add the menu to the main interface (and history etc...)

Pop functions

- Called with the EEG structure only pop_xxxxx(EEG), they pop-up a GUI asking for more arguments
- Called with enough arguments, they simply call the signal processing function

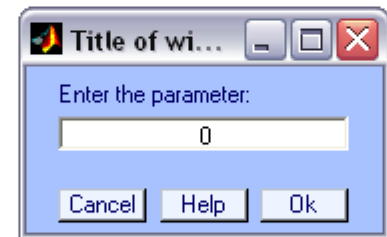
```
function [EEG, com] = pop_sample( EEG, param1 );

com = ""; % empty history
if nargin < 2
    % pop up window if less than 2 arguments
    result = inputdlg( { 'Enter the parameter:' }, 'Title of window', 1, { '0' } )
    if length( result ) == 0 return; end;

    param1 = eval( [ '[' result{1} ']' ] ); % the brackets allow to process matlab arrays
end;

sample( EEG.data, param1); % run sample function

com = sprintf('pop_sample(EEG, %d );', param1); % return history
```



eegplugin functions

- eegplugin_xxxx function

```
% eegplugin_erp() - plot ERP plugin
```

```
function eegplugin_erp( fig, try_strings, catch_strings);
```

```
% create menu
```

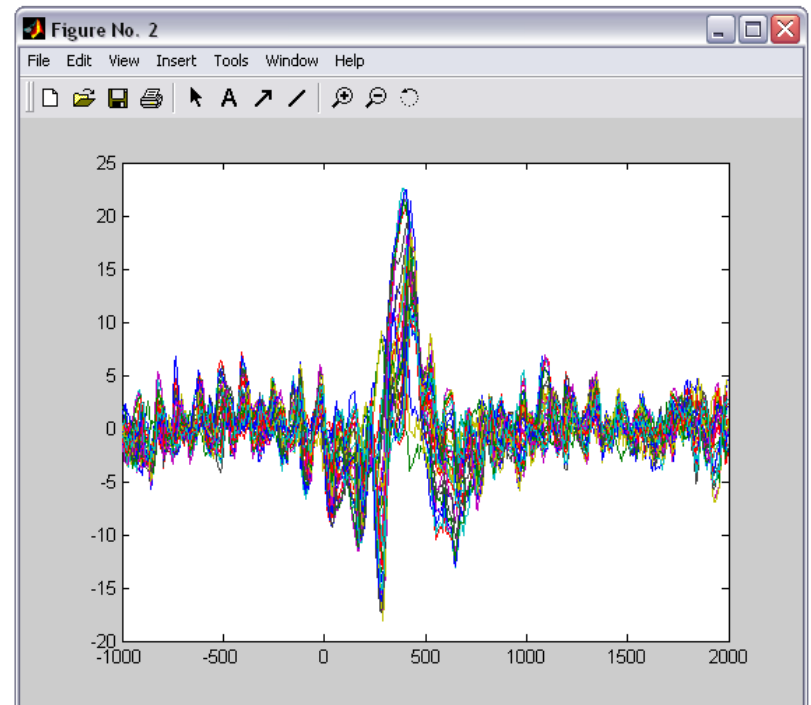
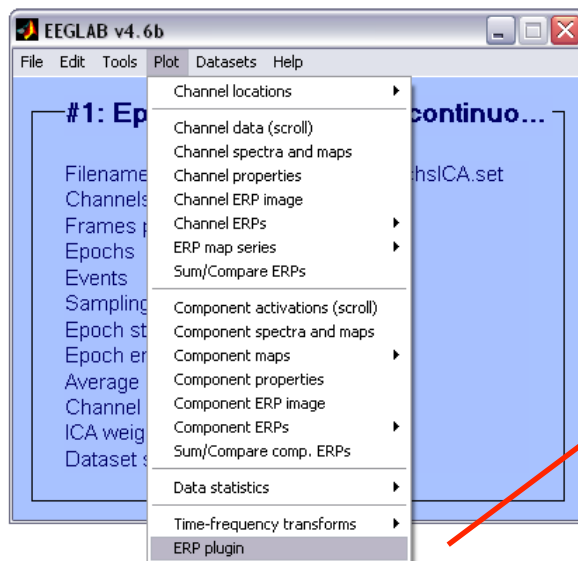
```
plotmenu = findobj(fig, 'tag', 'plot'); % find plot menu
```

```
% create submenu
```

```
uimenu( plotmenu, 'label', 'ERP plugin', ...  
        'callback', 'figure; plot(EEG.times, mean(EEG.data,3));');
```


eegplugin functions

```
>> eeglab
eeglab: adding "BIOSIGv0.86" plugin
eeglab: adding "eepimport1.02" plugin (see >> help eegplugin_eepimport)
eeglab: adding "bva_io1.30" plugin (see >> help eegplugin_bva_io)
eeglab: adding "ctfimport1.01" plugin (see >> help eegplugin_ctfimport)
eeglab: adding "dipfit2.0" plugin (see >> help eegplugin_dipfit2_0)
eeglab: adding plugin function "eegplugin_erp"
eeglab: adding "fmrib1.2b" plugin (see >> help eegplugin_fmrib)
eeglab: adding "icaclust1.00" plugin (see >> help eegplugin_icaclust)
eeglab: adding "iirfilt1.0" plugin (see >> help eegplugin_iirfilt)
eeglab: adding "loreta1.0" plugin (see >> help eegplugin_loreta)
eeglab: adding "newtimefreq1.00" plugin (see >> help eegplugin_ne
>>
```



PCA plugin

```
function vers = eegplugin_pca(fig, trystrs, catchstrs)
```

```
vers = 'pca1.00';  
if nargin < 3, error('eegplugin_pca requires 3 arguments'); end;
```

```
% add icacust folder to path  
if ~exist('eegplugin_pca')  
    p = which('eegplugin_pca');  
    p = p(1:findstr(p,'eegplugin_pca.m')-1);  
    addpath( p );  
end;
```

```
% find tools menu  
menu = findobj(fig, 'tag', 'tools');
```

```
% PCA command  
cmd = [ '[tmp1 EEG.icawinv] = runpca(EEG.data(:,:));' ];  
cmd = [ cmd 'EEG.icaweights = pinv(EEG.icawinv);' ];  
cmd = [ cmd 'EEG.icasphere = eye(EEG.nbchan);' ];  
cmd = [ cmd 'clear tmp1;' ];
```

```
% create menu  
uimenu( menu, 'Label', 'Run PCA', 'Callback', cmd, 'separator', 'on');
```

'import data' -> File > import data menu
'import epoch' -> File > import epoch menu
'import event' -> File > import event menu
'export' -> File > export
'tools' -> tools menu
'plot' -> plot menu

EEGLAB documentation

EEGLAB Home Page

sccn.ucsd.edu/eeglab/

EEGLAB Tutorial Index

sccn.ucsd.edu/wiki/EEGLAB

- 200 pages of tutorial (including “how to” for plugins) WEB or PDF
- Function documentation (next slide)
- Send questions to the mailing list eeglablist@sccn.ucsd.edu
(or search mailing list archive using google)
- Bug submission <http://sccn.ucsd.edu/eeglab/bugzilla>
- Email us (suggestions) eeglab@sccn.ucsd.edu
- Workshop with practicum every year

Help message

Import dataset info - **pop_importdata()**

EEGLAB dataset name (optional):

Data file/array (click on the selected option): **Matlab variable**

Number of channels (0->set from data):

Time points per epoch (0=continuous data):

Data sampling rate (Hz):

Optional epoch start time for data epochs (sec):

Channel locations file or array: **Help**

(note: use menu "Edit > Channel locations" to import specific file formats)

ICA weights array or text/binary file (if any): **Browse**

ICA sphere array or text/binary file (if any): **Browse**

Cancel **Help** **Ok**

>> help pop

M-File Help: pop_importdata

File Edit View Go Debug Desktop Window Help

Location: M-File Help: pop_importdata

M-File Help: pop_importdata [View code for pop_importdata](#) [Default Topics](#)

pop_importdata

pop_importdata() - import data from a Matlab variable or disk file by calling `importdata()`.

Usage:

```
>> EEGOUT = pop_importdata(); % pop-up a data entry window
>> EEGOUT = pop_importdata('key', val,...); % no pop-up window
```

Graphic interface (refer to a previous version of the GUI):

- "Data file/array" - [Edit box] Data file or Matlab variable name to import to EEGLAB. Command line equivalent: 'data'
- "Data file/array" - [list box] select data format from listbox. If you browse for a data file, the graphical interface might be able to detect the file format from the file extension and his list box accordingly. Note that you have to click on the option to make it active. Command line equivalent is 'dataformat'
- "Dataset name" - [Edit box] Name for the new dataset. In the last column of the graphic interface, the "EEG.setname" text indicates which field of the EEG structure this parameter is corresponding to (in this case 'setname'). Command line equivalent: 'setname'.
- "Data sampling rate" - [Edit box] In Hz. Command line equivalent: 'srate'
- "Time points per epoch" - [Edit box] Number of data frames (points) per epoch.

Out of Memory

- Solution

- Buy more RAM
- Use option “use memory mapped arrays”
- Close all programs, remove Windows services (Adobe etc...), reboot
- Try different memory manager “start Matlab from the DOS command line with *matlab -memmgr fast* option
- Use older Matlab versions (how old?)
- Change of OS (Windows 10 or 8 vs 7)
- Look at <http://www.mathworks.com/support/tech-notes/1100/1107.html>

- OSX and Unix/Linux

- Buy more RAM
- Matlab cannot allocated inactive memory. To free it, type *du -sx /*

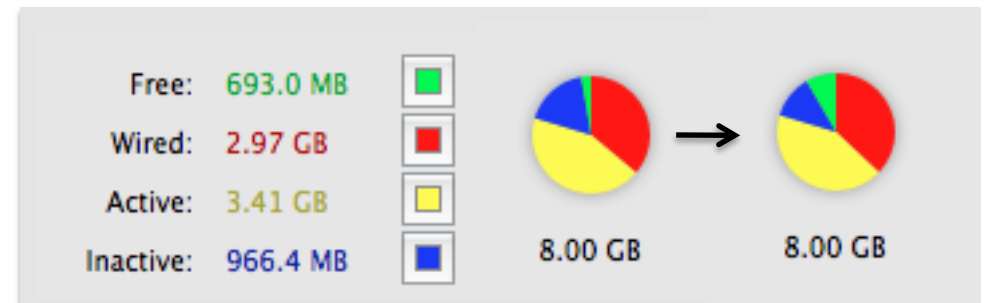


Figure problem



and export



For crashes, freezes, etc... use a non Open-GL renderer

At startup type in `set(0,'defaultfigurerenderer','zbuffer' )` or `set(0,'defaultfigurerenderer','painter' )`. Note that these cannot handle transparency and 3-D graphics or type “opengl software”

To export figures for publication, use .eps format (postscript) and edit for instance with adobe illustrator. Use “`set(gcf, 'renderer', 'painter')`” before exporting complex figures. Use the “plot2svg” matlab toolbox to export figure for transparency.

Exercise

Write a plugin to plot ERPs