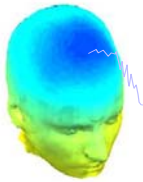
Artifact processing and ERP analysis



Task 1

Reject bad channels

Task 2

Reject continuous data

Task 3

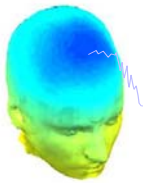
Reject data epochs

Task 4

Analysis of channel ERPs

Exercise...

Artifact processing and ERP analysis



Task 1

Reject bad channels

Task 2

Reject continuous data

Task 3

Reject data epochs

Task 4

Analysis of channel ERPs

Exercise...

The example data: faces vs. objects

File

../data/faces_3.set

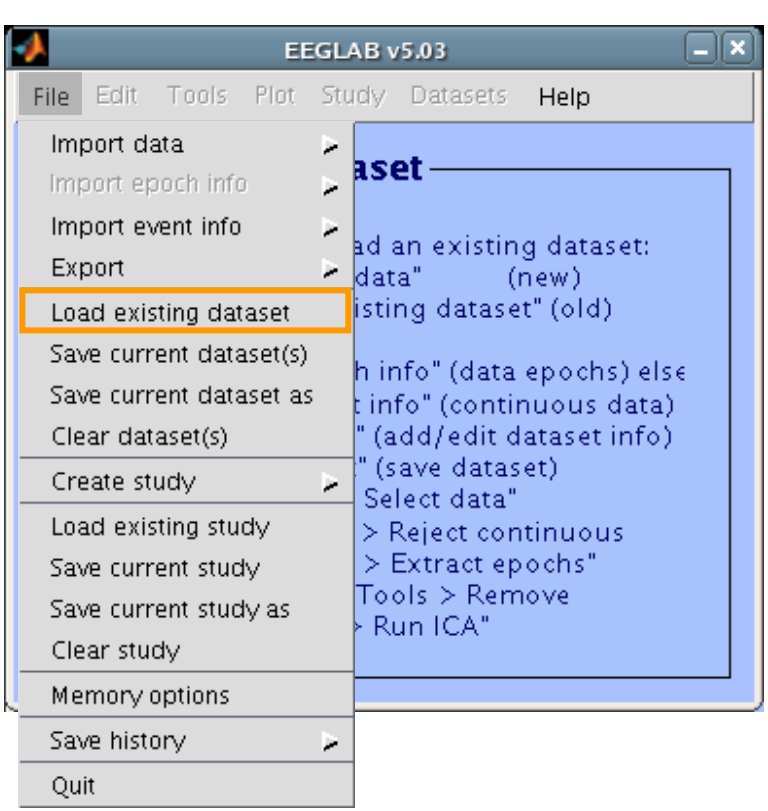
Data

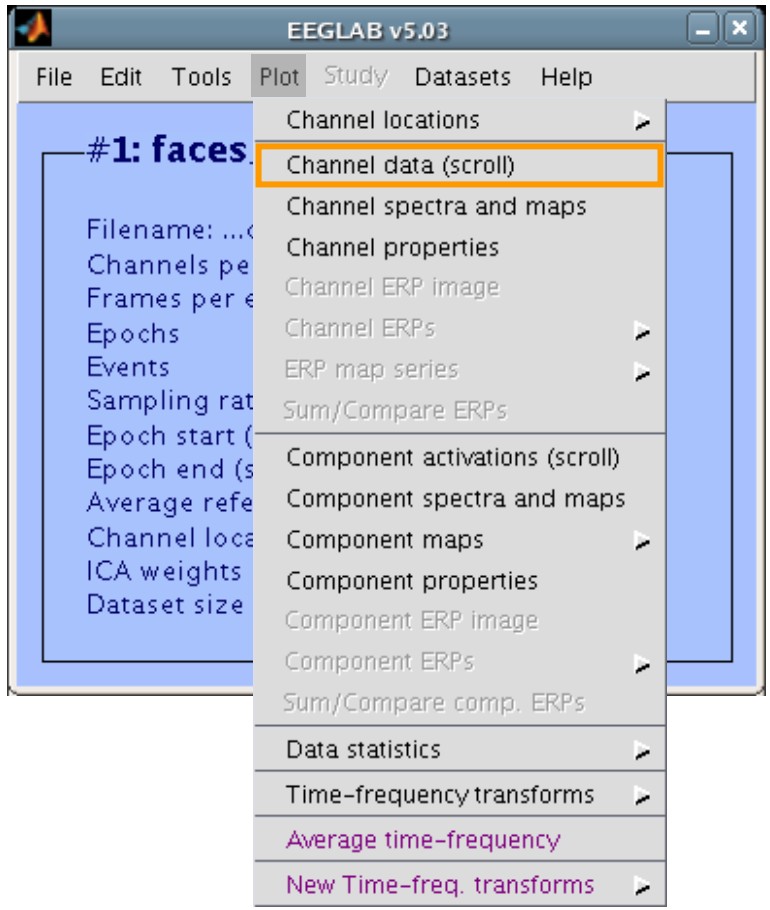
33 channel EEG, nose-tip reference, 250 Hz sampling rate, 0.5-100 Hz, 16 bit, BrainAmps

Task

speeded discrimination between objects and faces, 500 ms presentation duration, ISI 500-1900 ms, 362 trials

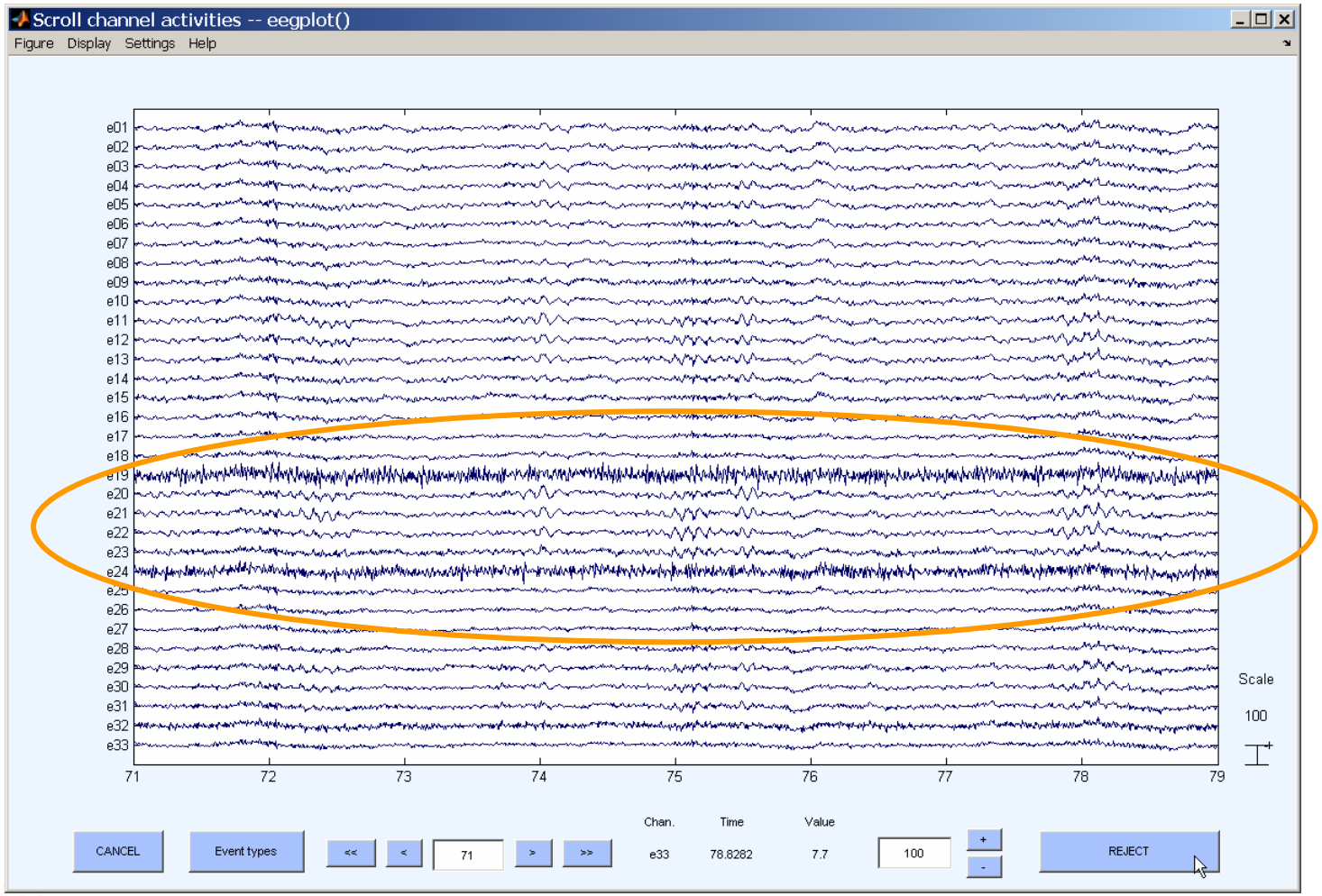
Load/scroll data





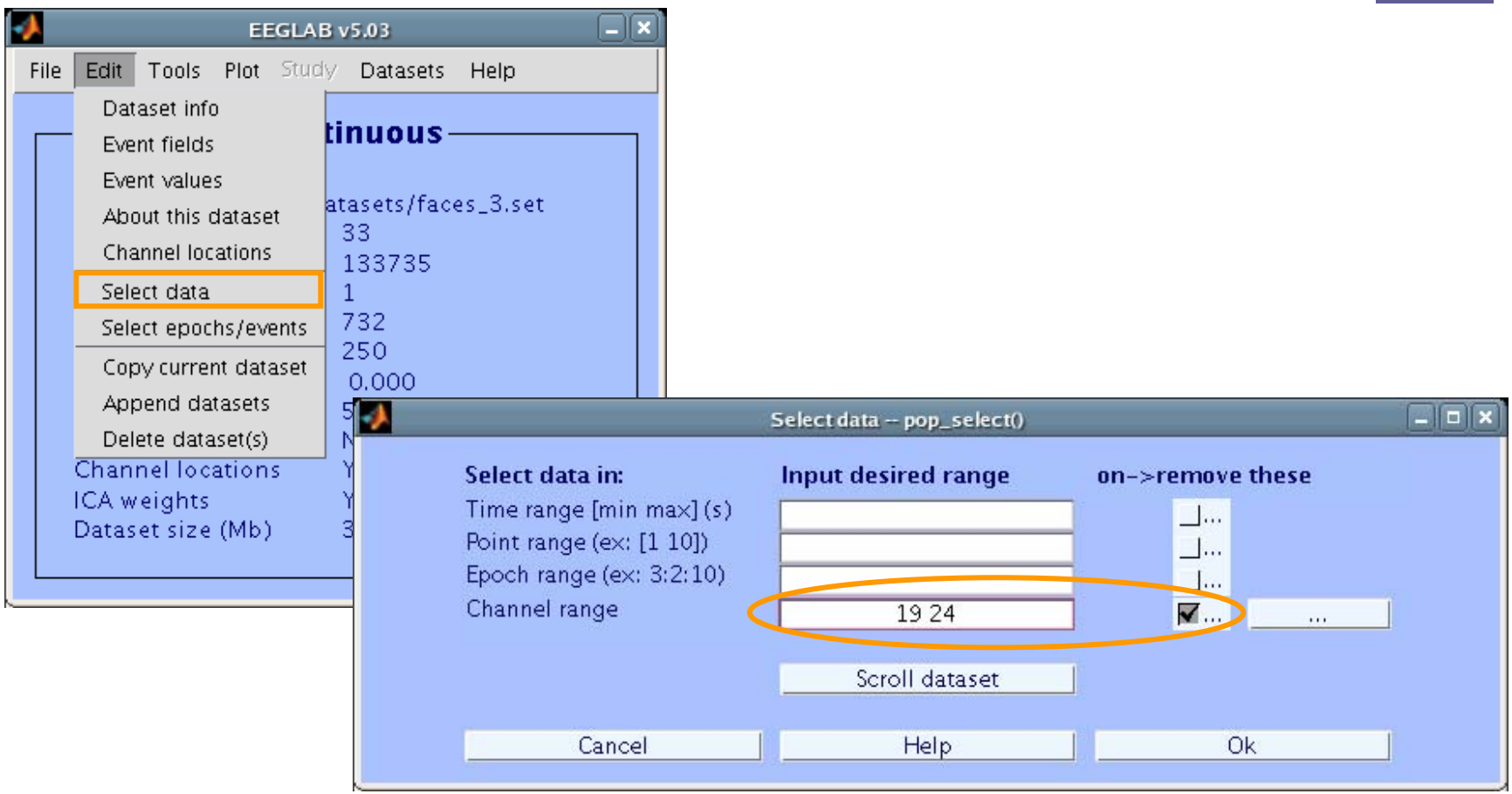

```
>> EEG = pop_loadset('faces_3.set', '...\data\');
>> [ALLEEG EEG CURRENTSET] = eeg_store(ALLEEG, EEG, 0);
```

Reject bad channels



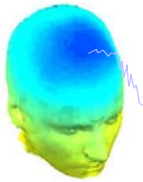

```
>> pop_eegplot(EEG, 1, 1, 1);
```

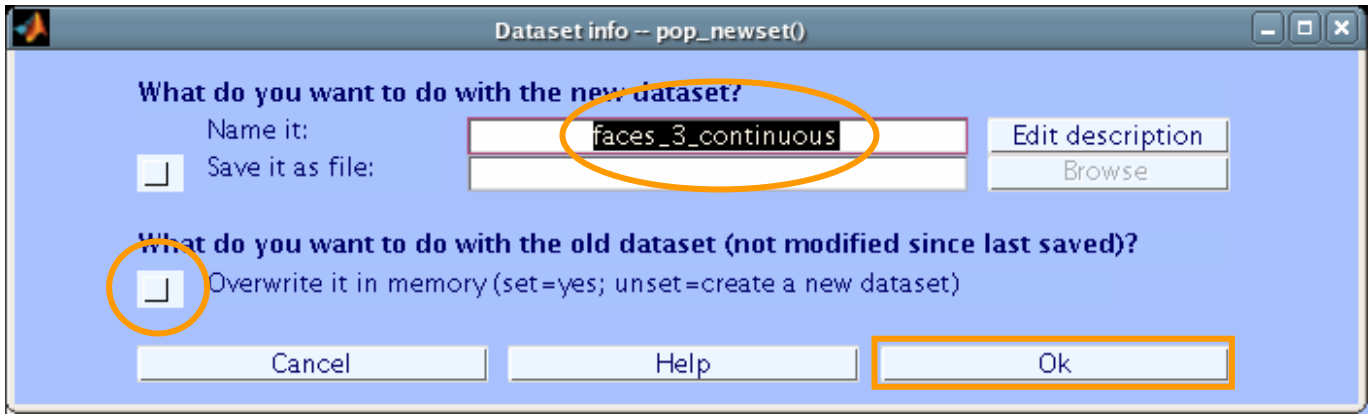
Reject bad channels

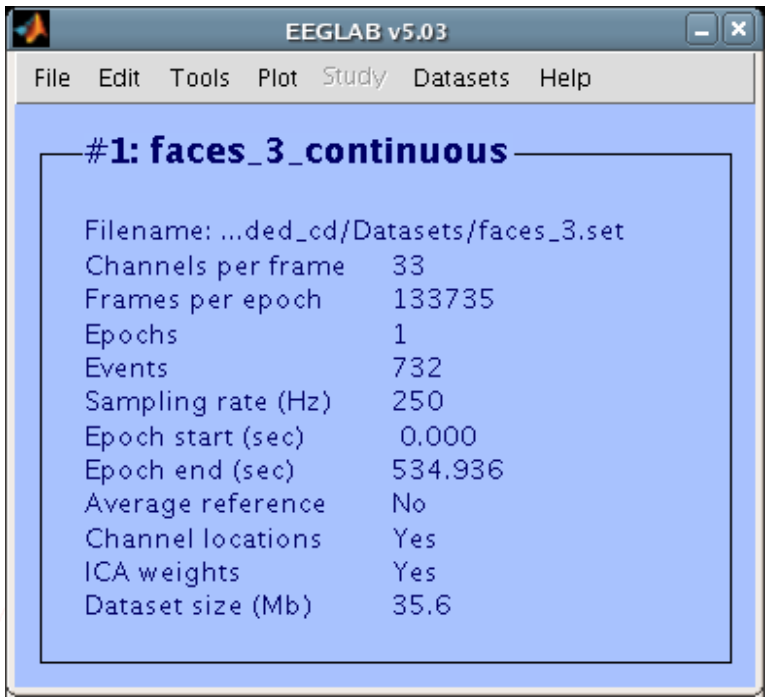


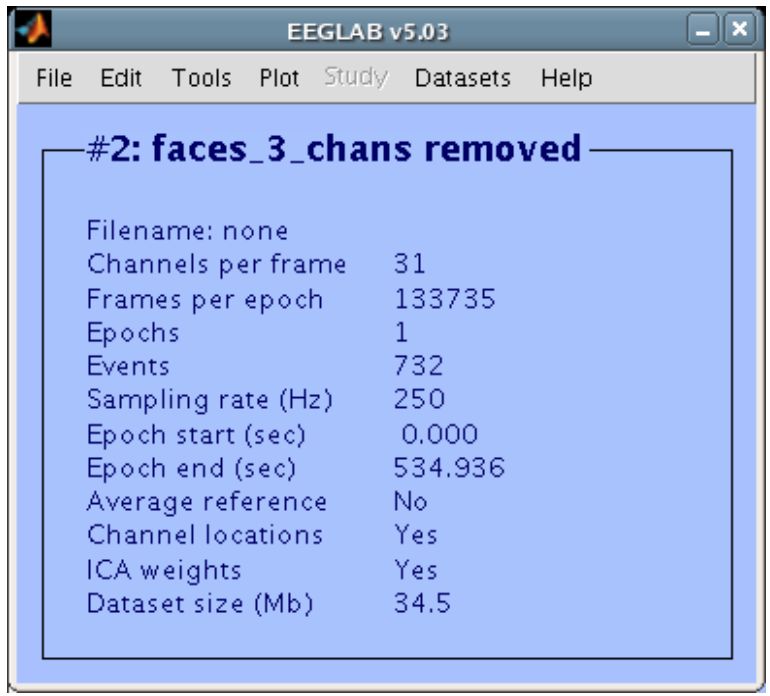

```
EEG = pop_select(EEG, 'nochannel', [19 24]);
```

Reject bad channels

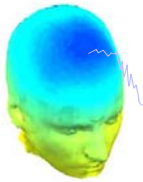








Artifact processing and ERP analysis



Task 1

Reject bad channels

Task 2

Reject continuous data

Task 3

Reject data epochs

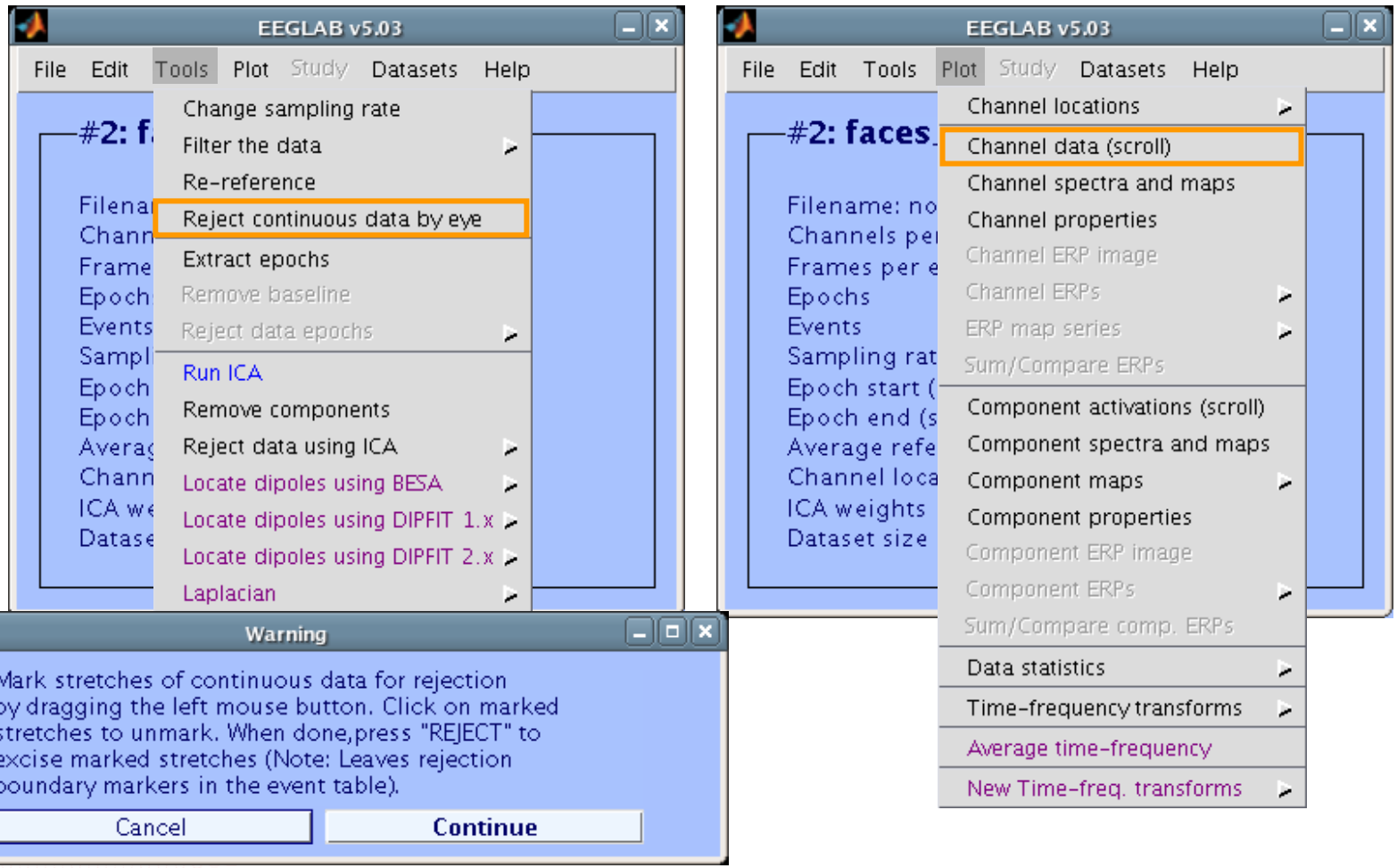
Task 4

Analysis of channel ERPs

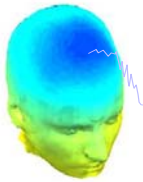
Exercise...

Reject continuous data

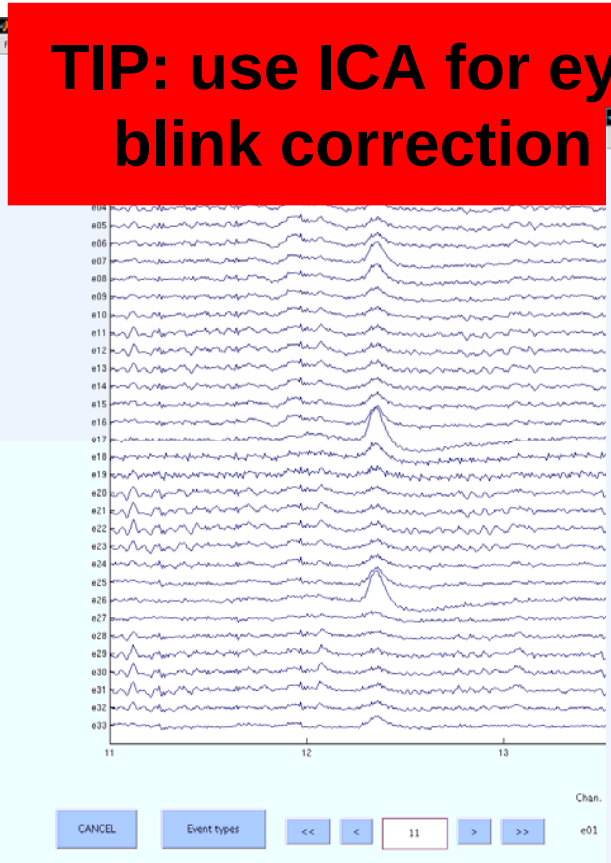
Equivalent!!

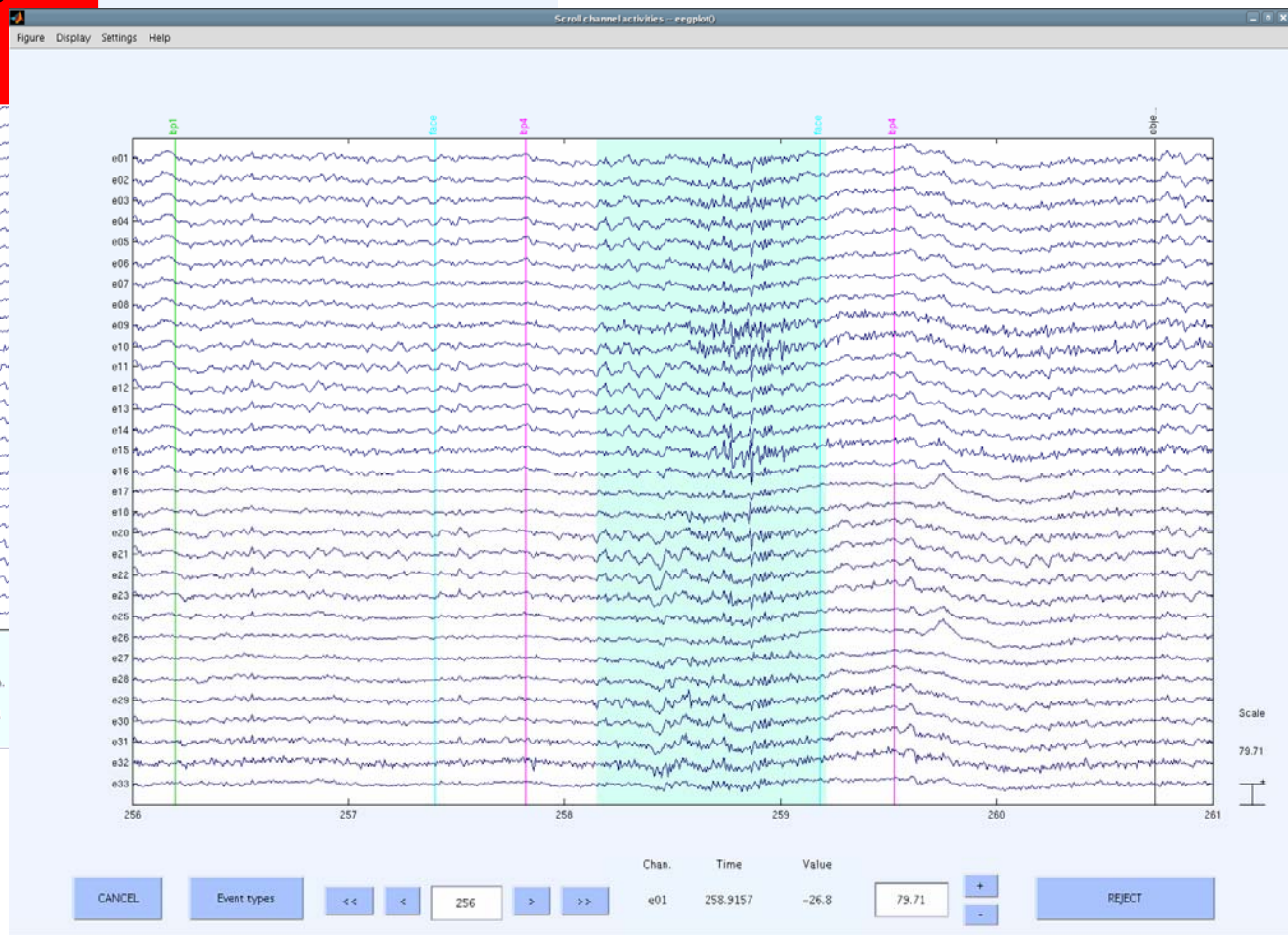


Reject continuous data



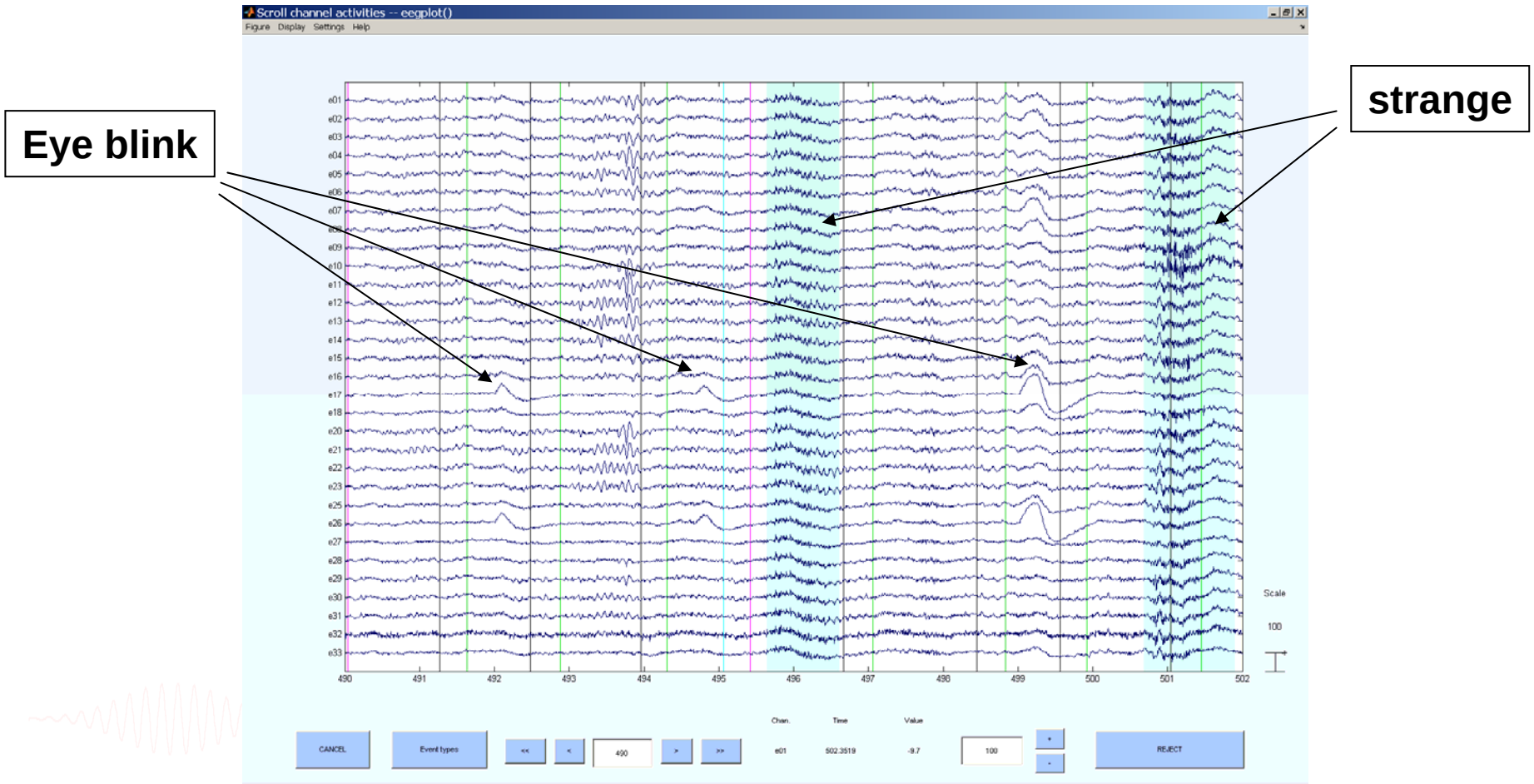
TIP: use ICA for eye blink correction



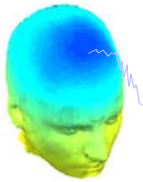


Reject continuous data

To prepare data for ICA, reject odd artifacts and keep stereotyped artifacts



Artifact processing and ERP analysis



Task 1

Reject bad channels

Task 2

Reject continuous data

Task 3

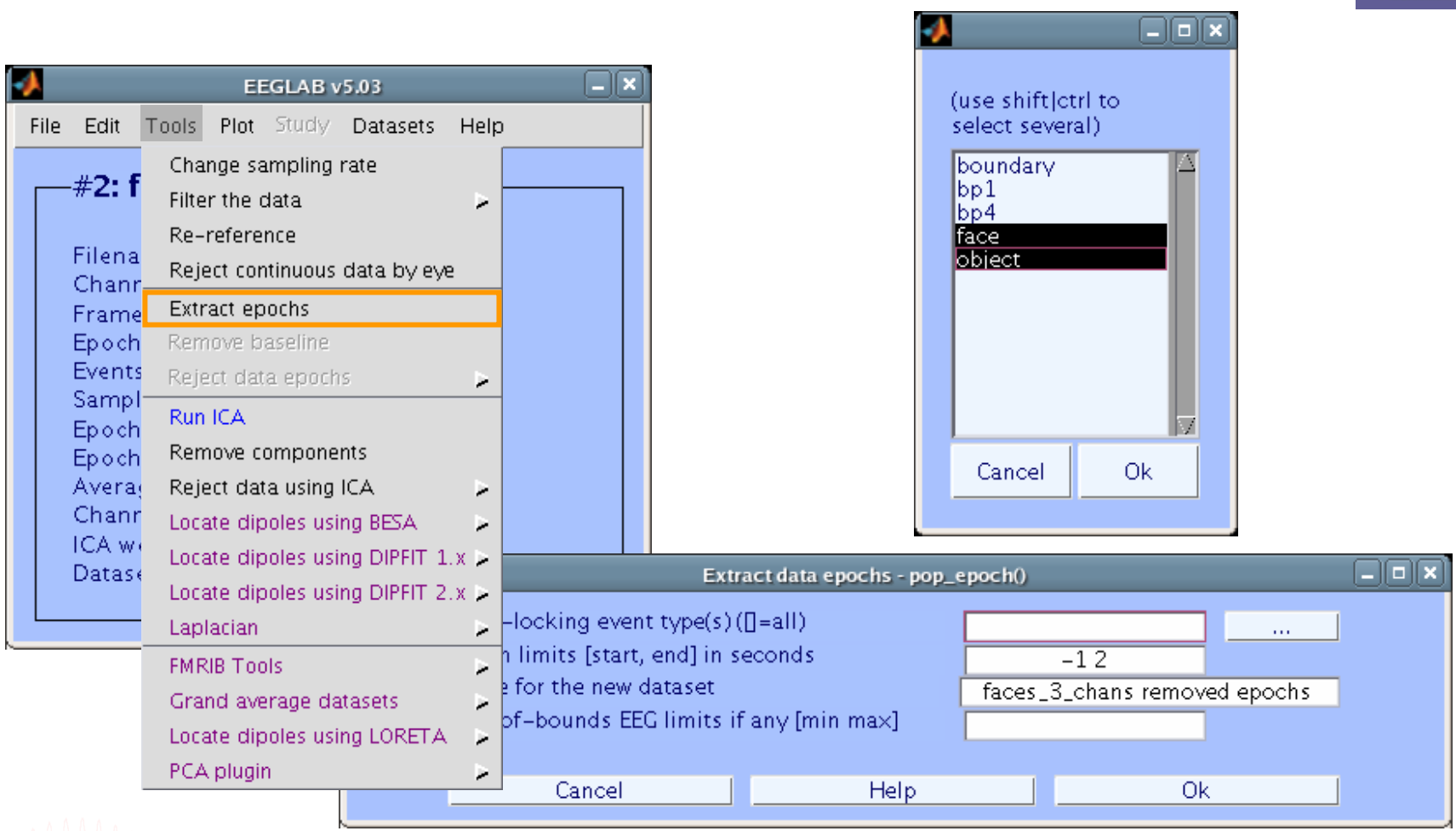
Reject data epochs

Task 4

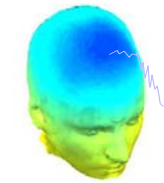
Analysis of channel ERPs

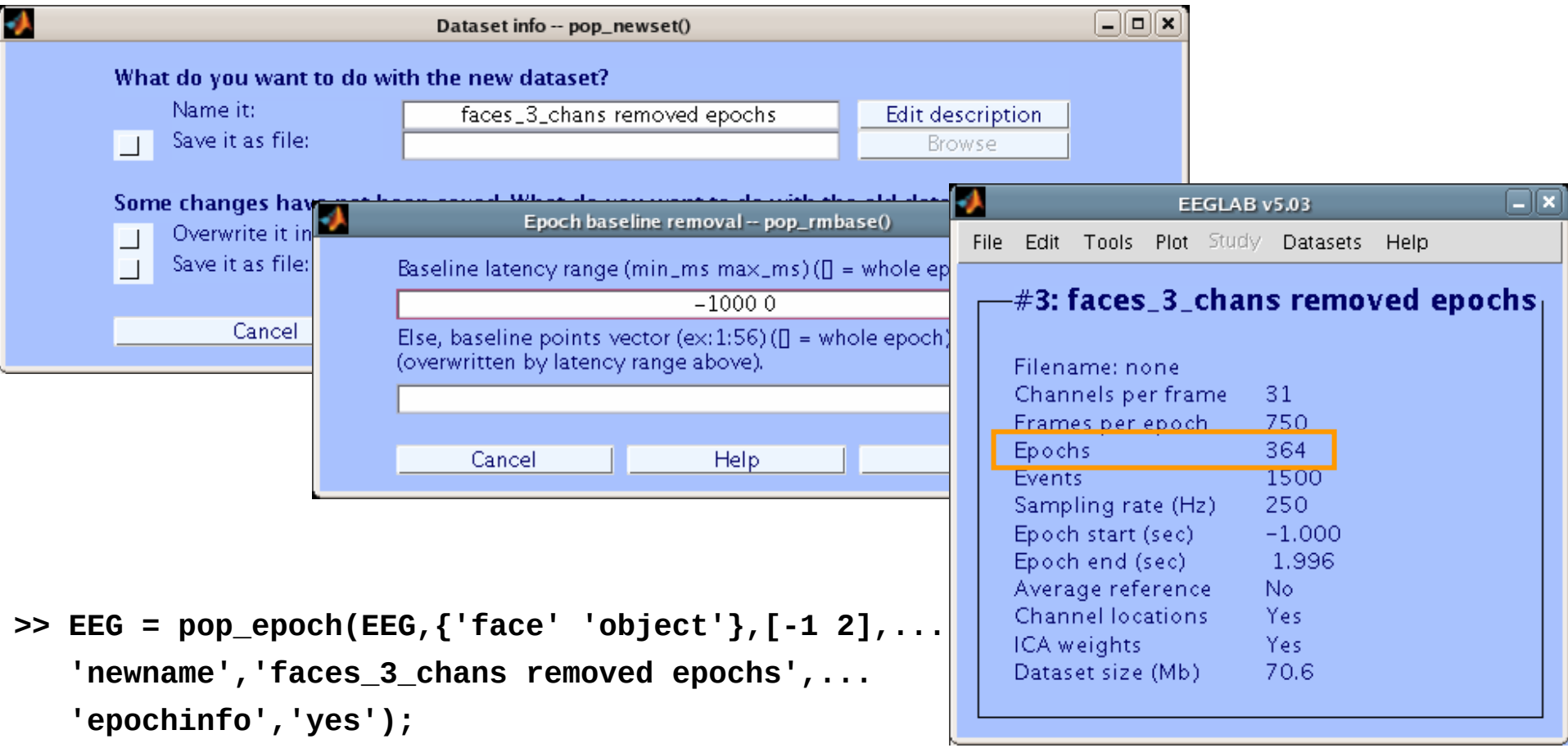
Exercise...

Extract Epochs (review)



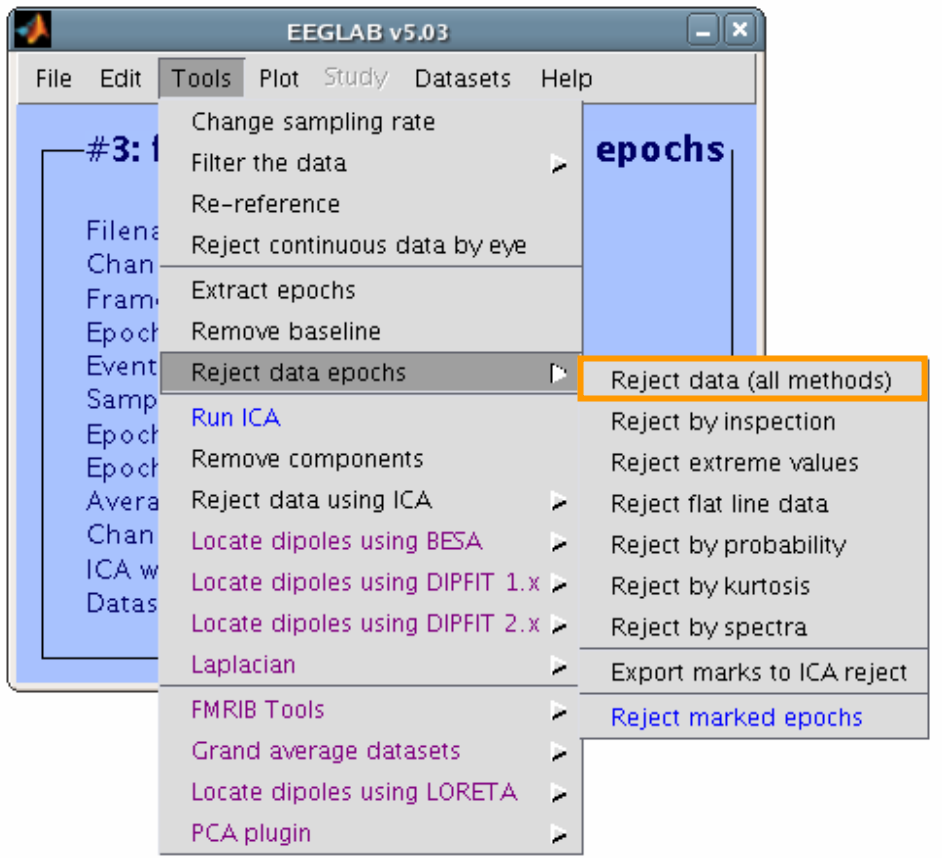
Extract Epochs (review)



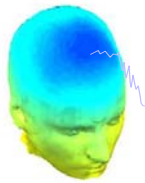



```
>> EEG = pop_epoch(EEG,{'face' 'object'},[-1 2],...
   'newname','faces_3_chans removed epochs',...
   'epochinfo','yes');
>> [ALLEEG EEG CURRENTSET] = pop_newset(ALLEEG,EEG,...
   CURRENTSET,'setname',' 'faces_3_chans removed epochs ');
```

Reject data epochs



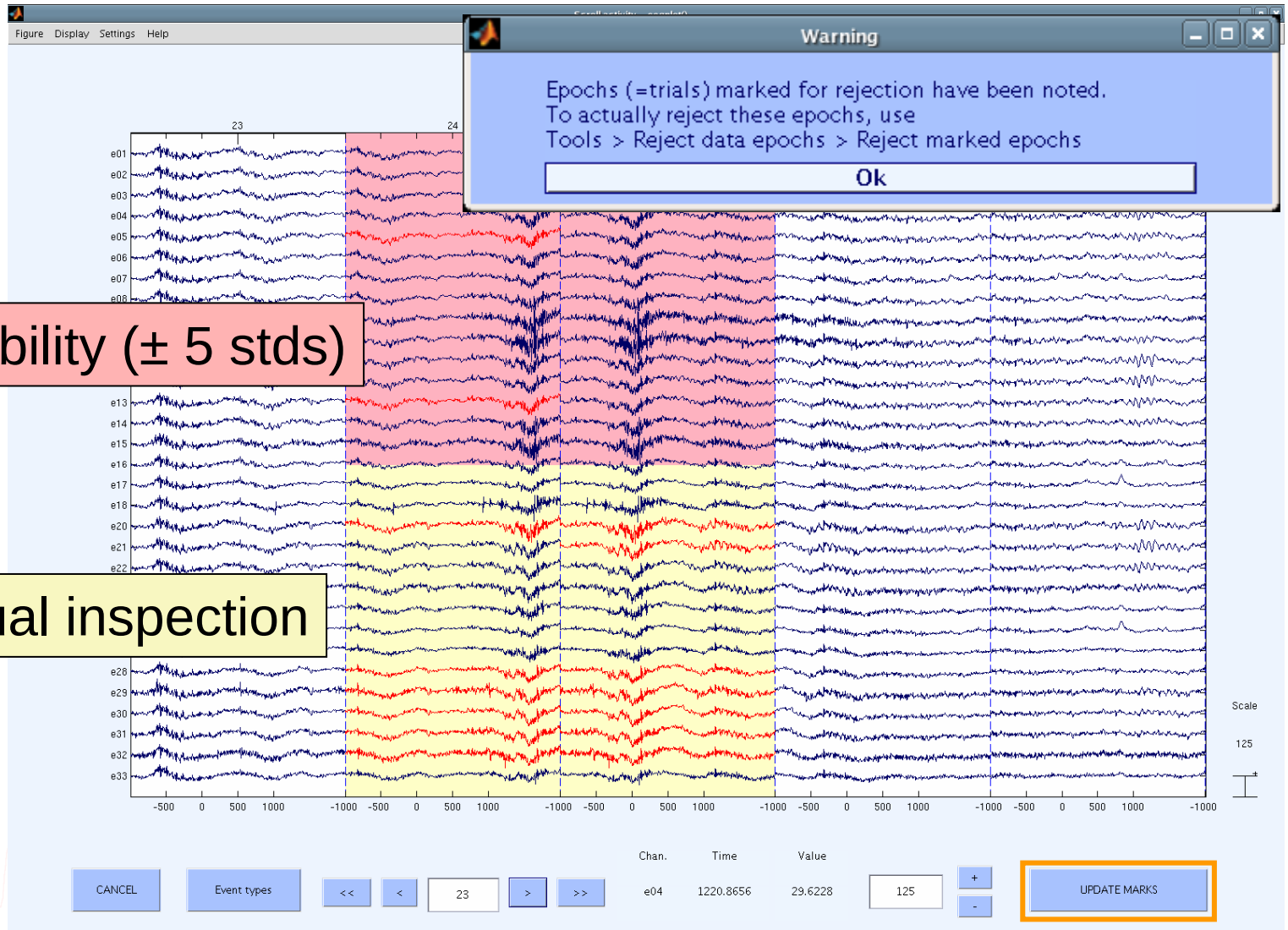
Reject data epochs



visual inspection

probability

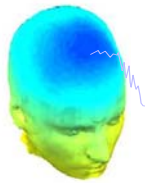
Reject data epochs



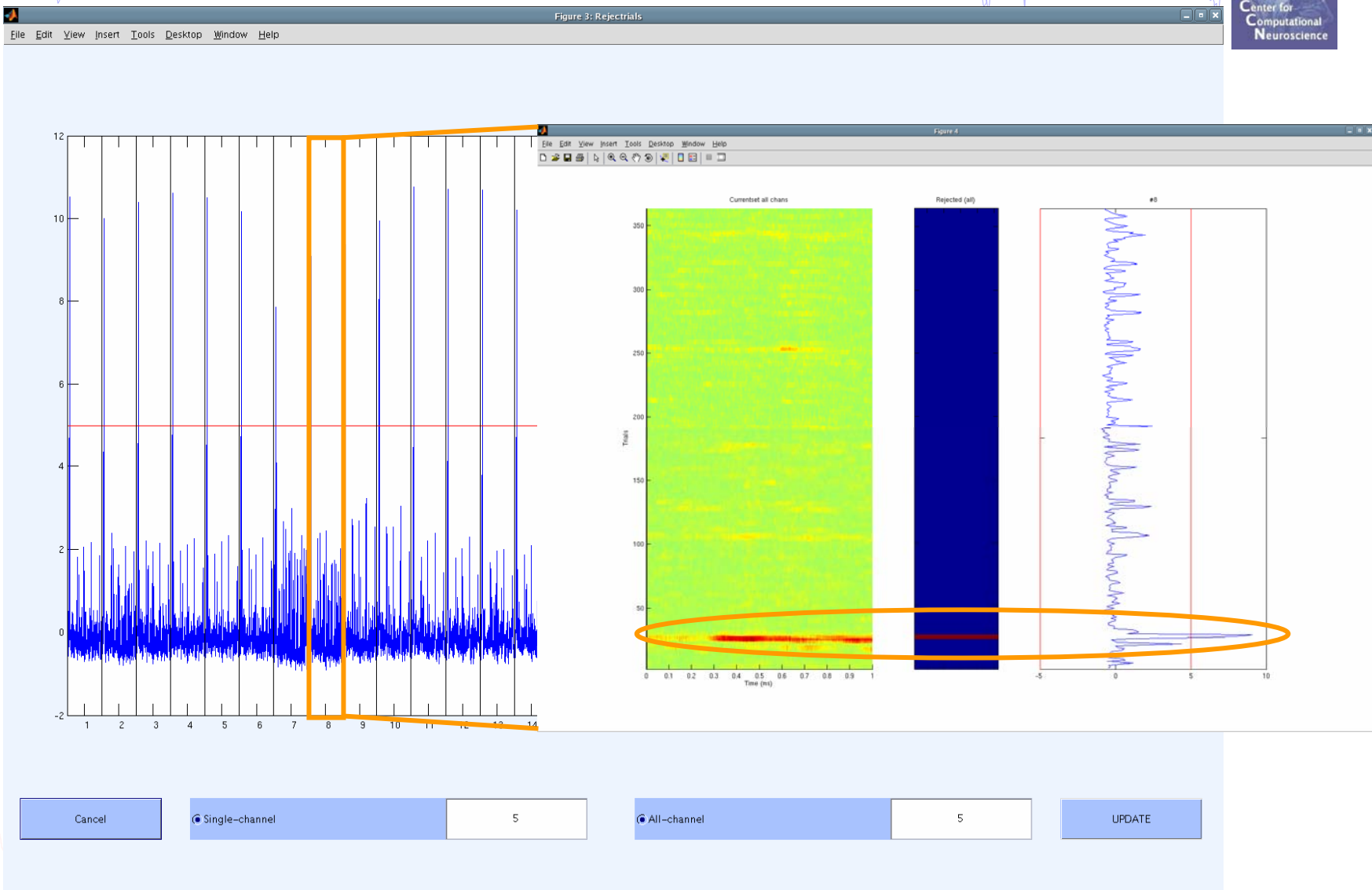
Probability (± 5 stds)

Visual inspection

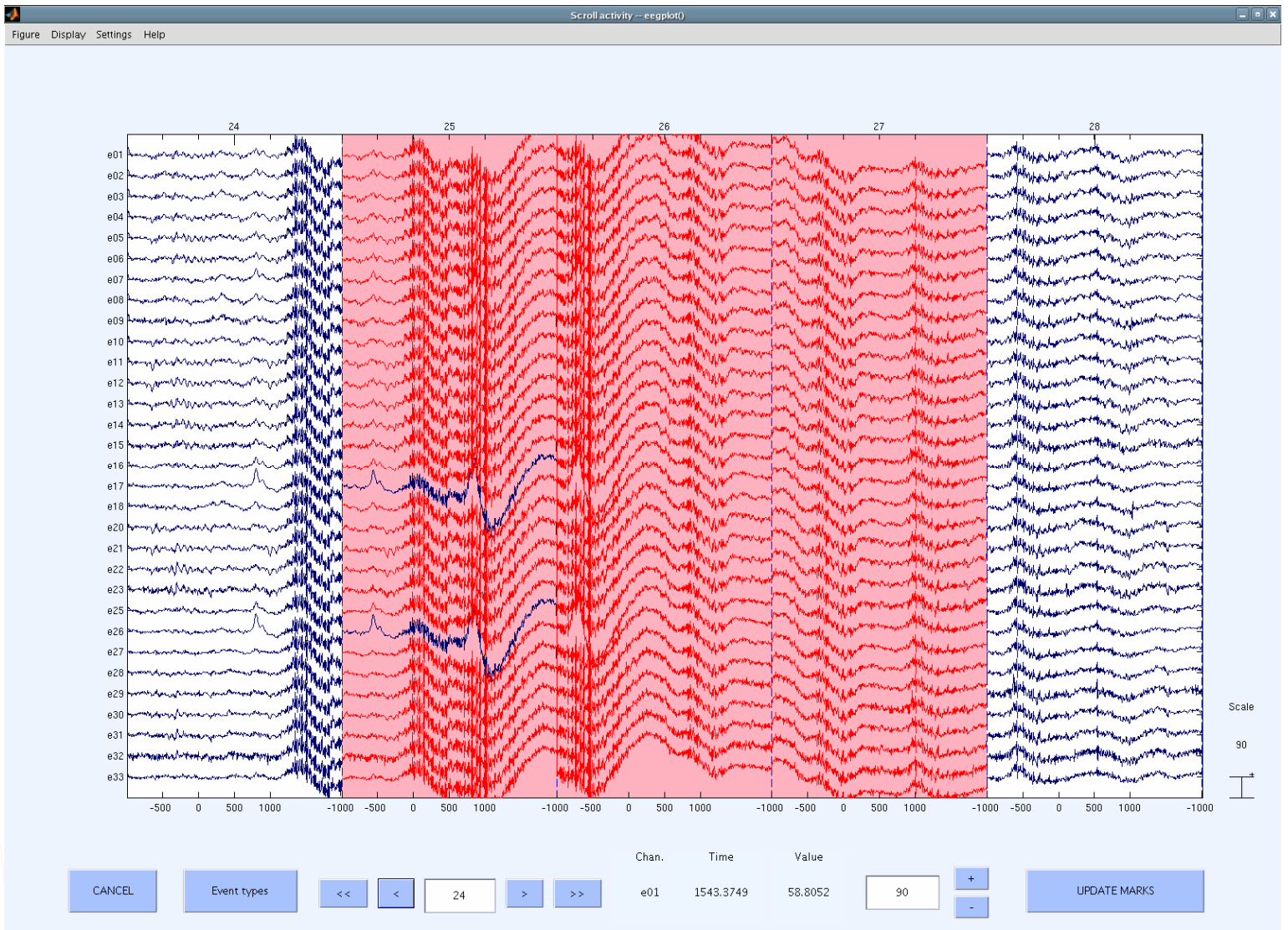
Plot channel measures over time



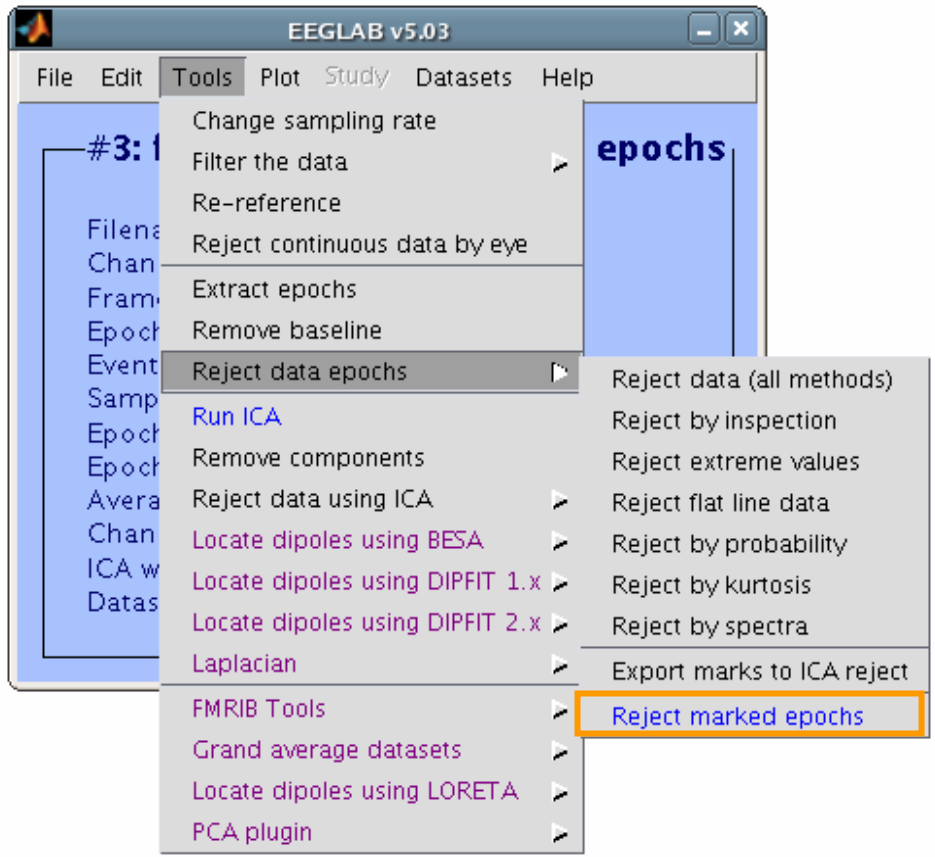
Reject data epochs



Reject data epochs

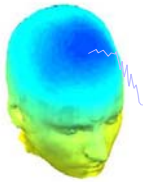


Reject data epochs




```
>> EEG = pop_jointprob(EEG,1,[1:31],5,5,0,0);
>> EEG = pop_rejepoch(EEG,find(EEG.reject.rejglobal),0);
```

Artifact processing and ERP analysis



Task 1

Reject bad channels

Task 2

Reject continuous data

Task 3

Reject data epochs

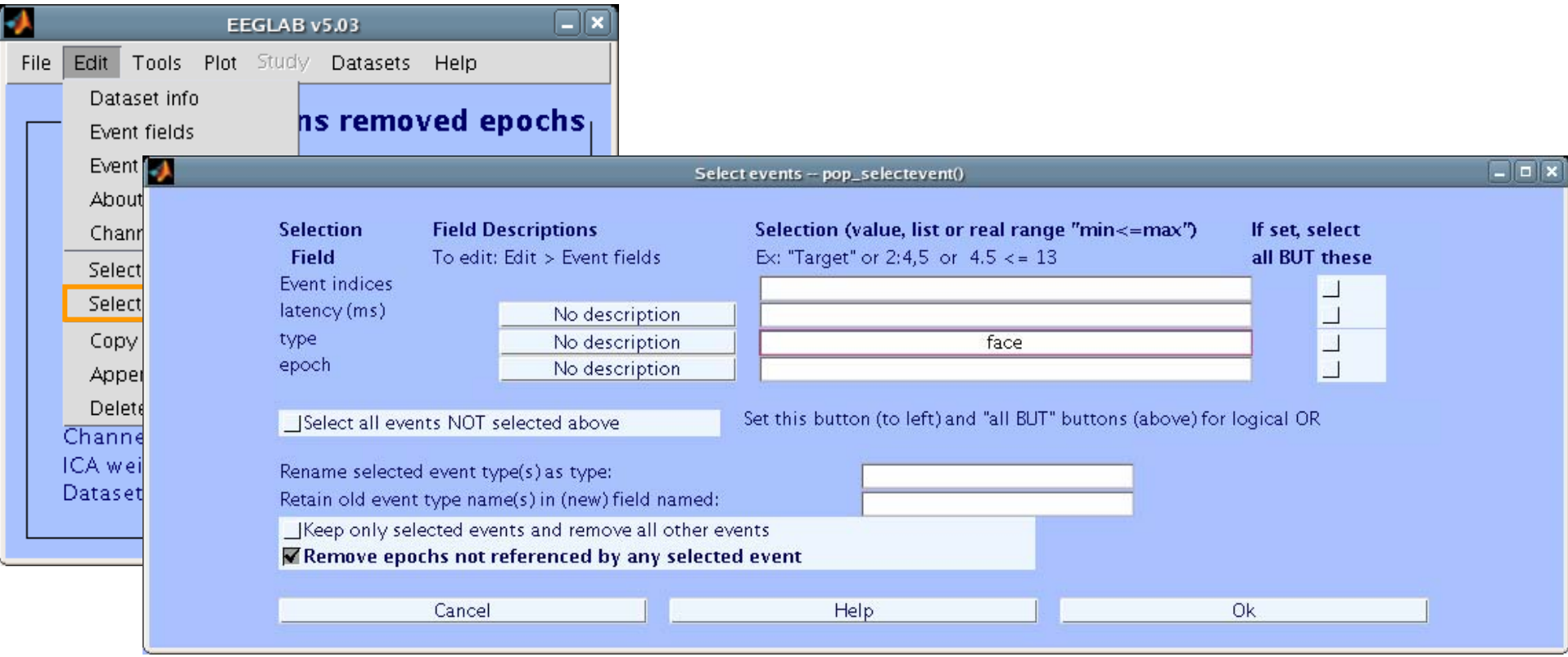
Task 4

Analysis of channel ERPs

Exercise...

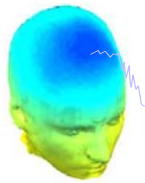
Select epochs (review)

Create separate data sets for face and object trials

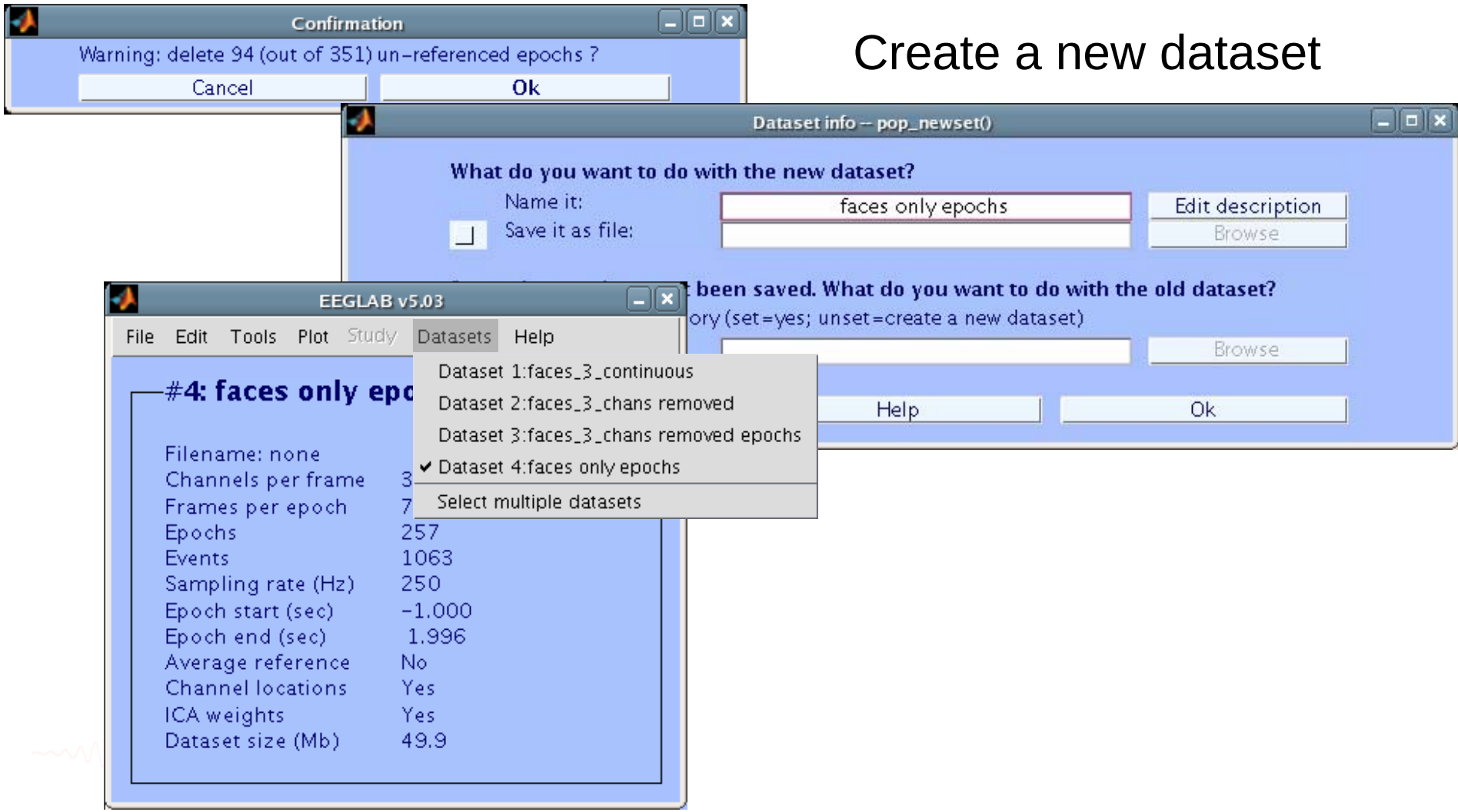



```
>> EEG=pop_selectevent(EEG,'type',{'face'},'deleteevents', ...
  'off','deleteepochs','on');
>> [ALLEEG EEG CURRENTSET]=pop_newset(ALLEEG,EEG,4,...
  'setname','faces only epochs');
```

Select epochs (review)

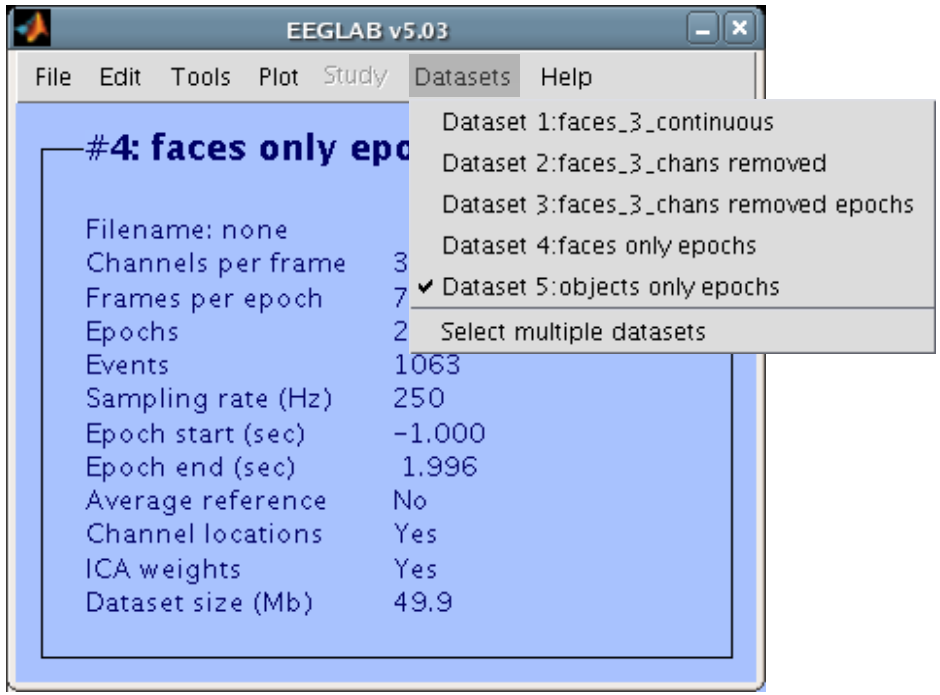


Create a new dataset



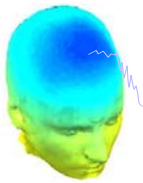
Select epochs (review)

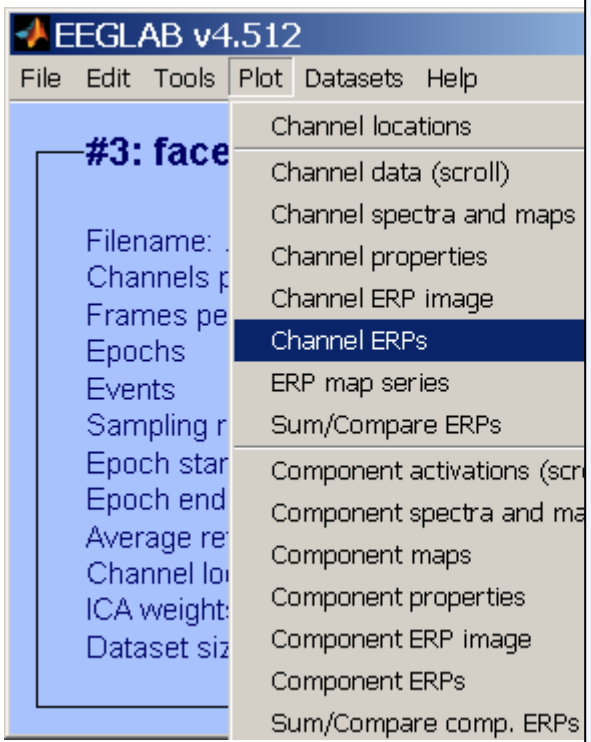
Do the same thing for 'object' epochs

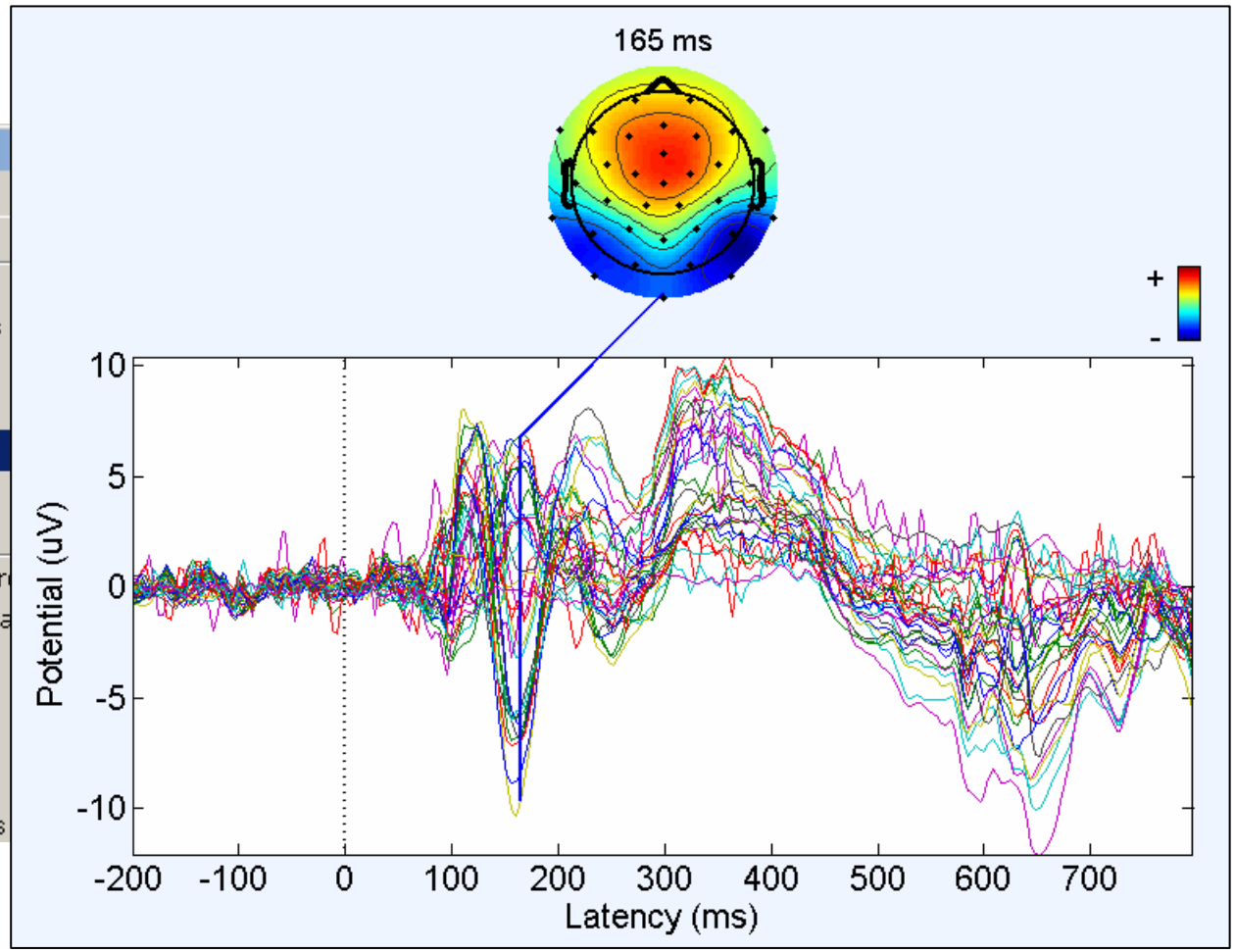



```
>> [EEG,ALLEEG,CURRENTSET]=pop_newset(ALLEEG,EEG,4, ...
   'retrieve',3,'study',0);
>> EEG=pop_selectevent(EEG,'type',{'object'},'deleteevents', ...
   'off','deleteepochs','on');
>> [ALLEEG EEG CURRENTSET]=pop_newset(ALLEEG,EEG,5, ...
   'setname','object only epochs');
```

Analysis of ERPs

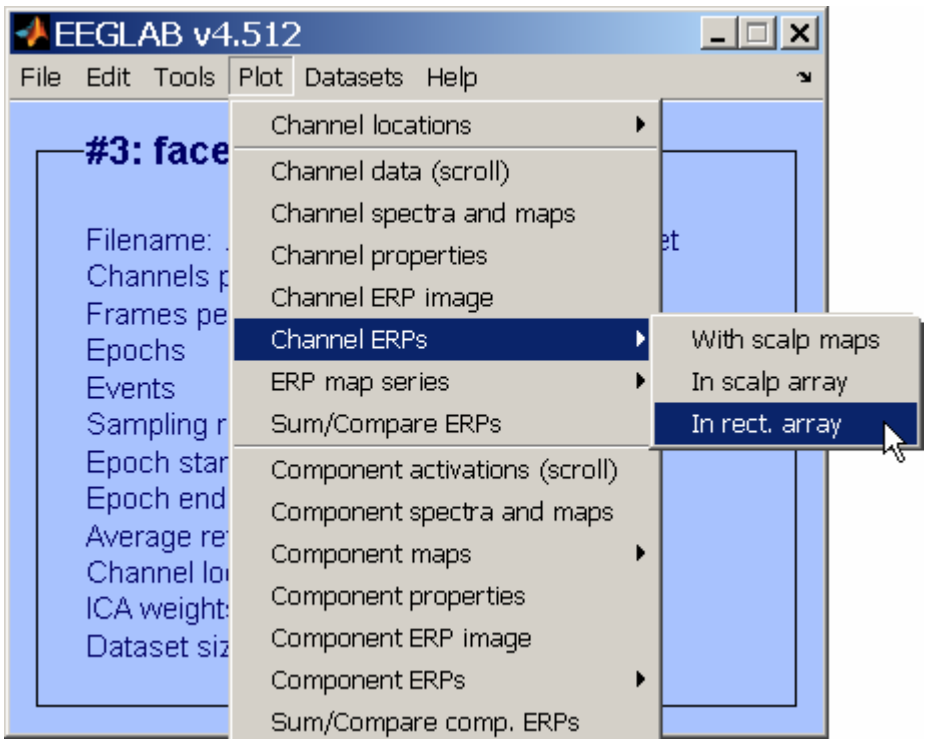


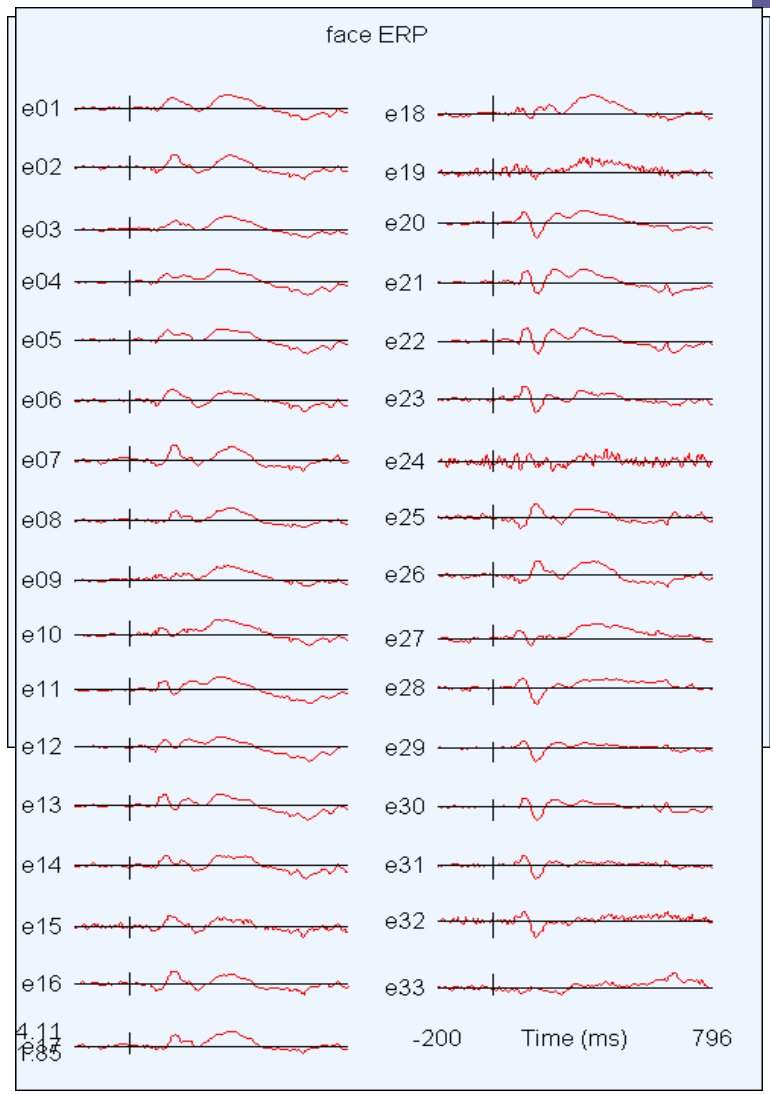




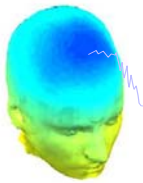

```
>> pop_timtopo(EEG,[-200 796],[165],'ERP data and scalp maps');
```

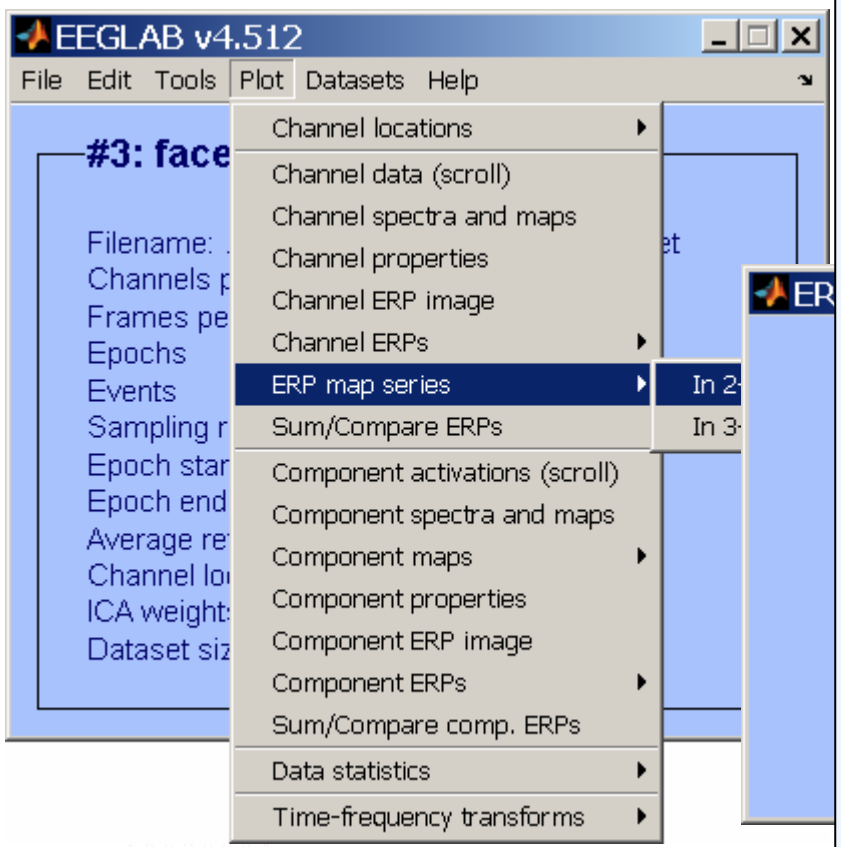
Analysis of ERPs

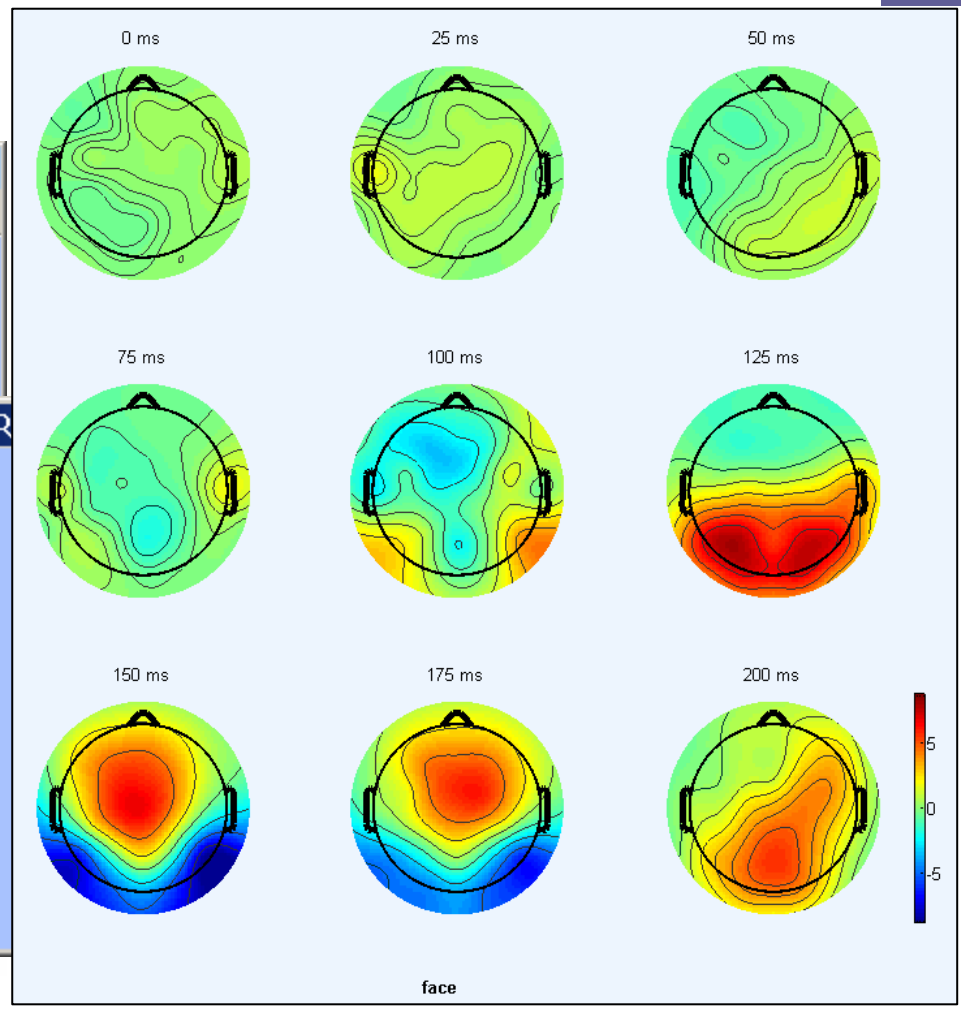




Analysis of ERPs

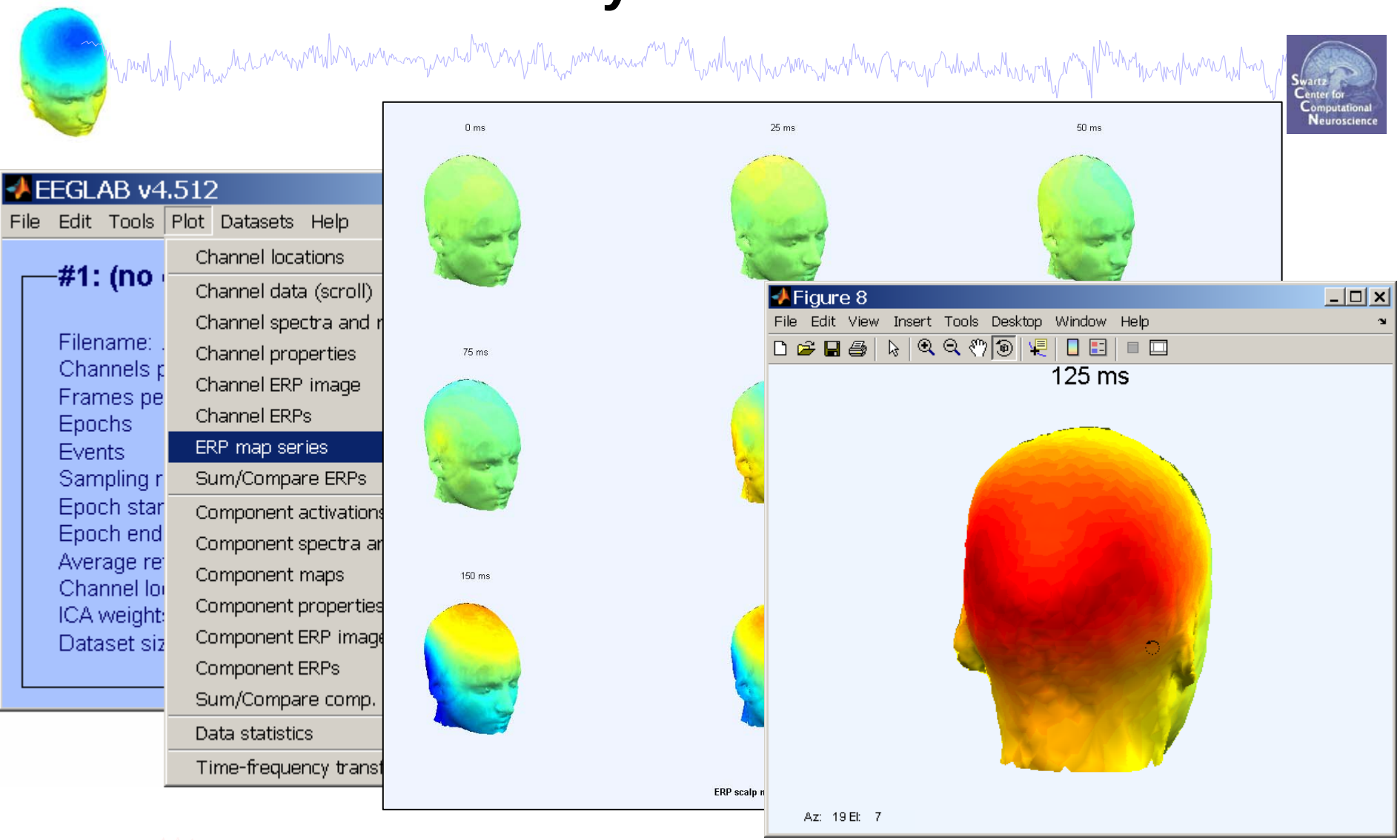






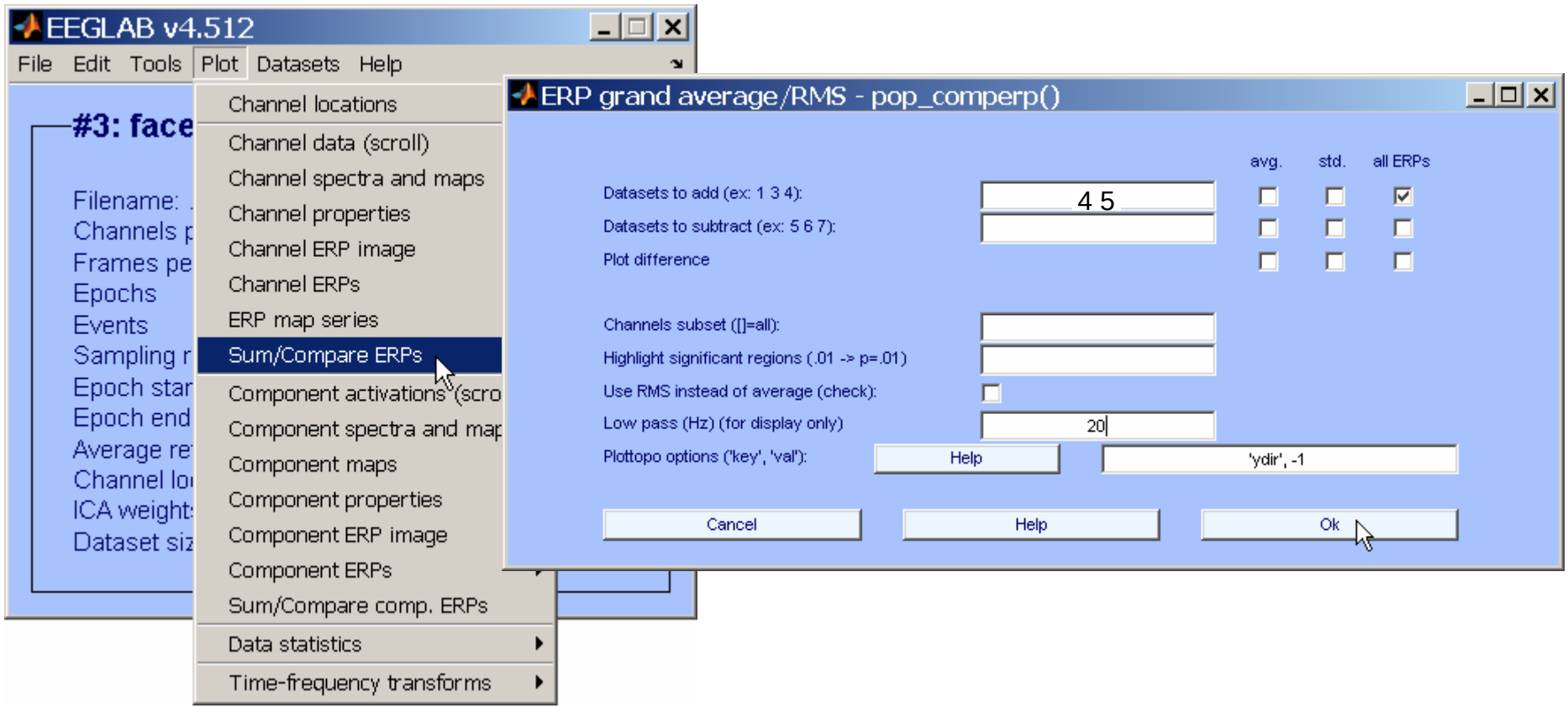

```
>>pop_topoplot(EEG,1,[0:25:200],'face',[3 3],0,'electrodes','off');
```

Analysis of ERPs



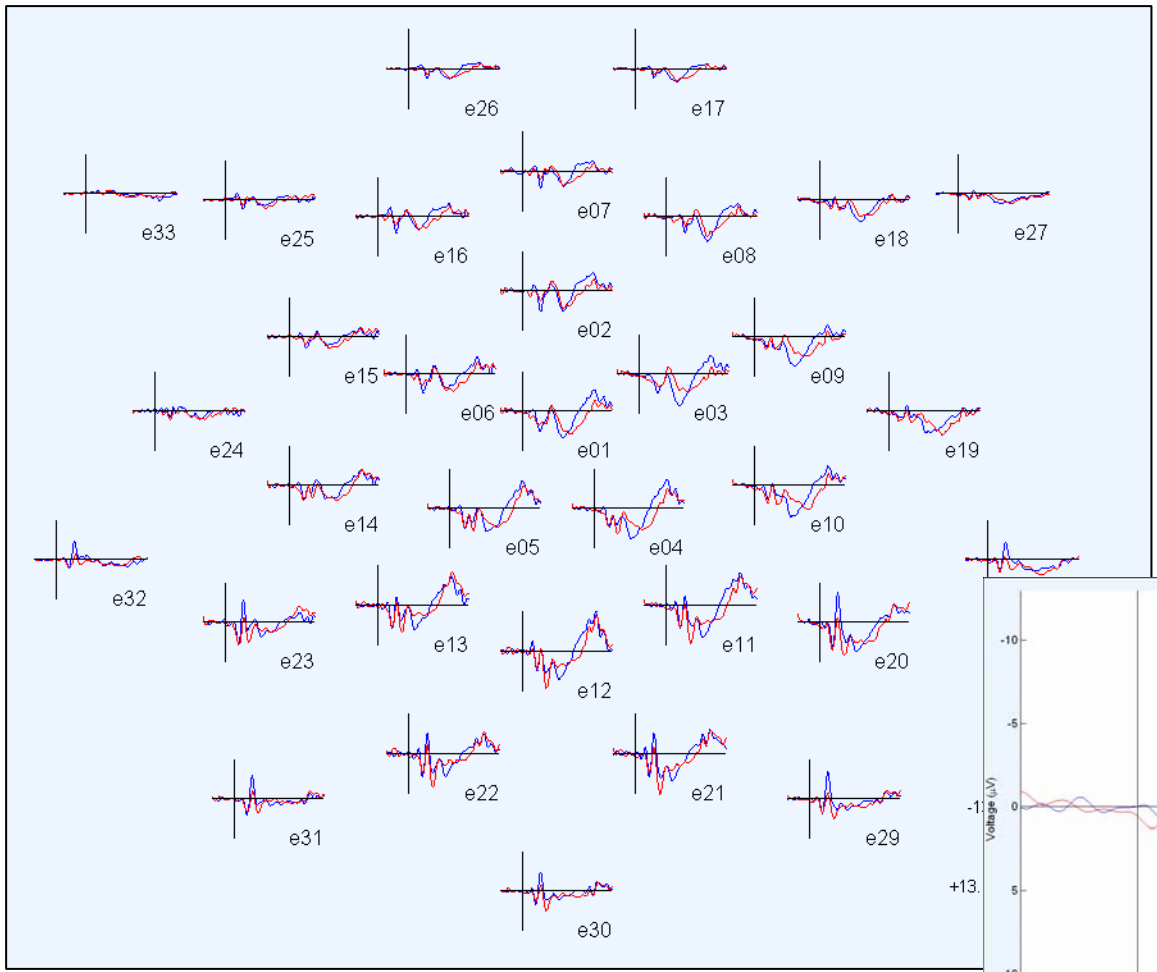

```
>>pop_headplot(EEG,1,[0:25:200],'ERP scalp maps',[3 3],...
  'electrodes', 'off');
```

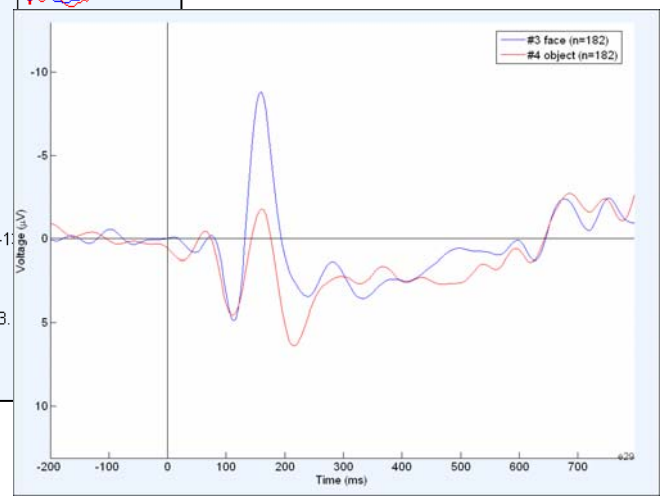
Analysis of ERPs



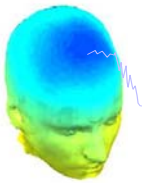

```
>>pop_comperp(ALLEEG,1,[4 5],[],'addavg','off','addstd','off',...
  'addall','on','diffavg','off','diffstd','off','lowpass',20,...
  'tplotopt',{'ydir',-1});
```

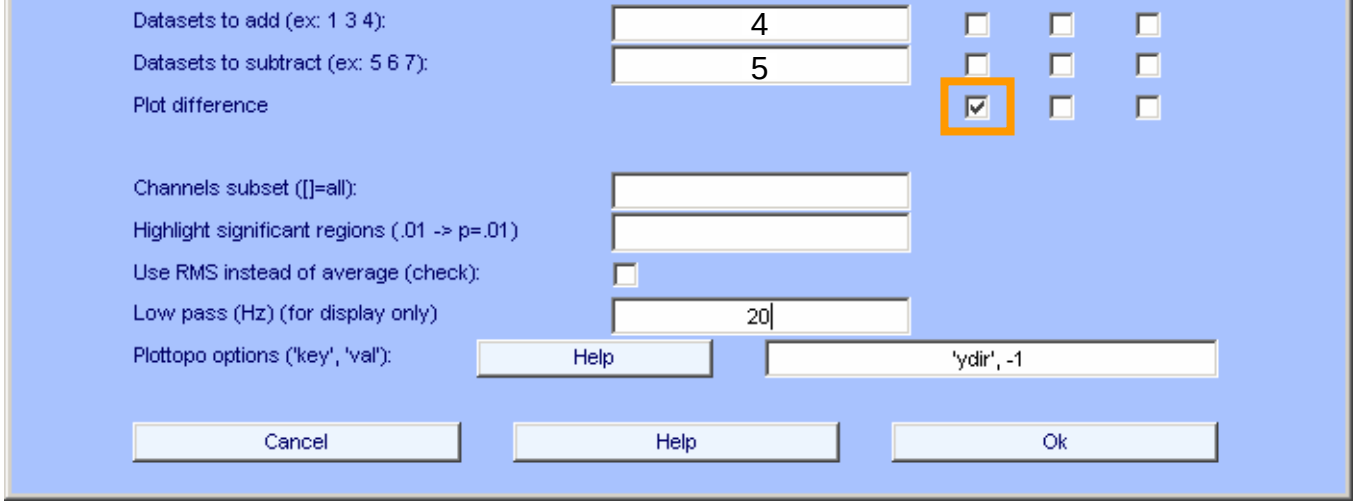
Analysis of ERPs



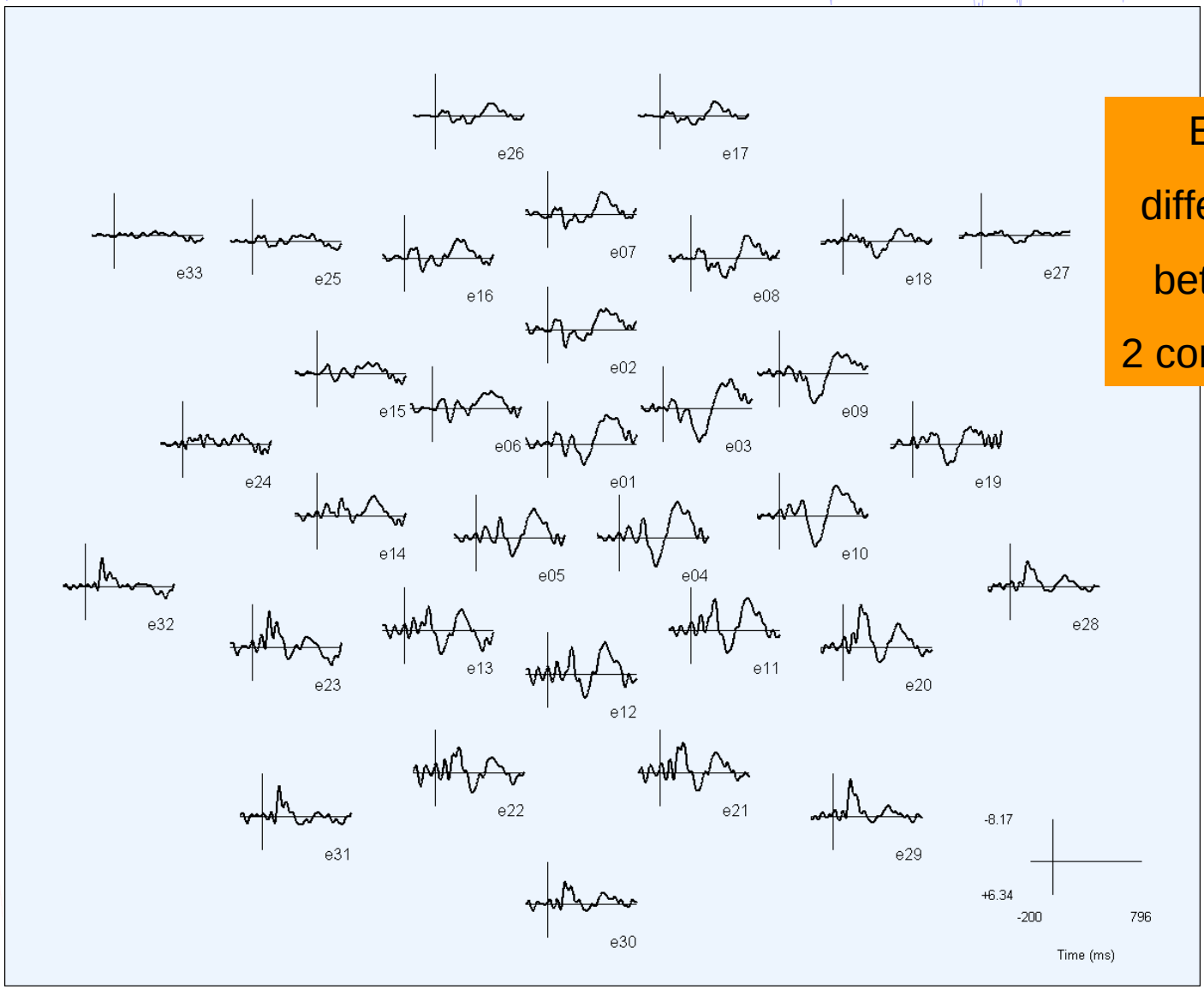


Analysis of ERP *differences*



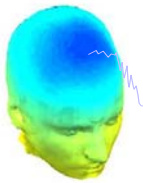


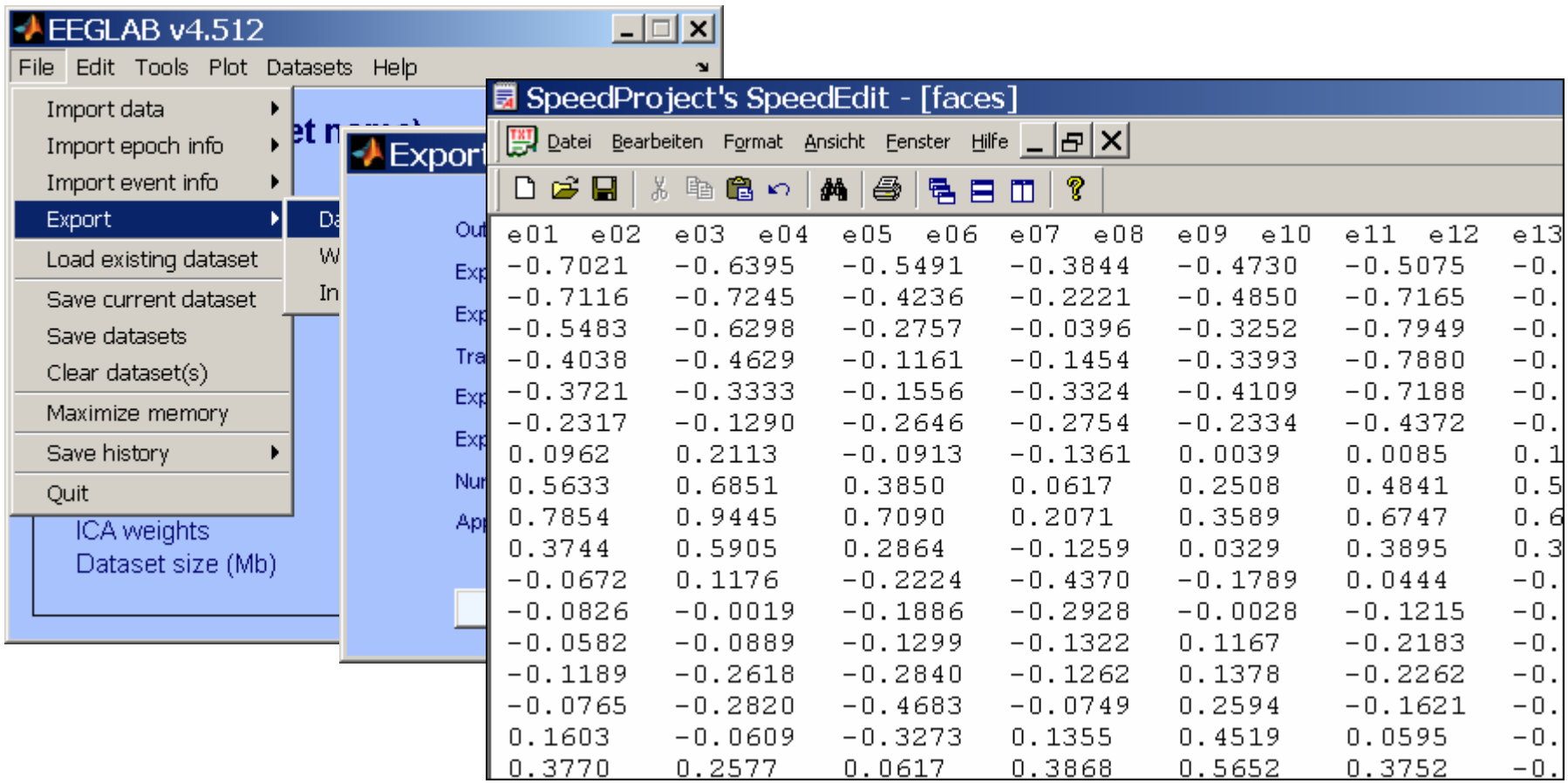
Analysis of ERP differences



ERP difference between 2 conditions

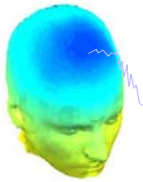
Export EEG data






```
>> pop_export(EEG,'D:\tmp\faces.dat','erp','on',...
   'transpose','on','time','off');
```

Exercise



- Load dataset ***'faces_3.set'*** from **'…/data/'** directory
- Reject noisy channels
- (optional: reject continuous data stretches)
- Epoch dataset on all 'face' and 'object' events
- Explore 1 or more of the following:
  - Reject noisy epochs by hand or use auto-rejection
    - Compare rejection methods and thresholds
  - Select 'face' and 'object' epochs separately
    - Plot ERPs
      - superimposed ERP envelopes
      - rectangular/scalp array
      - Compare 'face' vs 'object' ERPs
  - Export 'face' ERPs into an ascii file