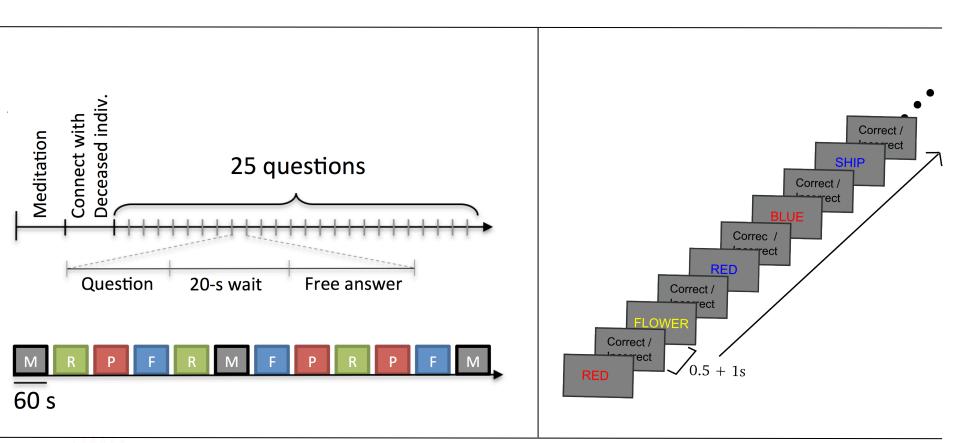


STEP 1 Build a STUDY STEP 2 Build design(s) STEP 3 Precompute the data STEP 4 Plot the data Exercise...



Formalizing experimental protocols

way water and



Memory options

-

File Edit To

Save current study

Clear study

Save history

Quit

Save current study as

Memory and other options

ract epochs"

> Remove ICA"

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how have a server and the server and the

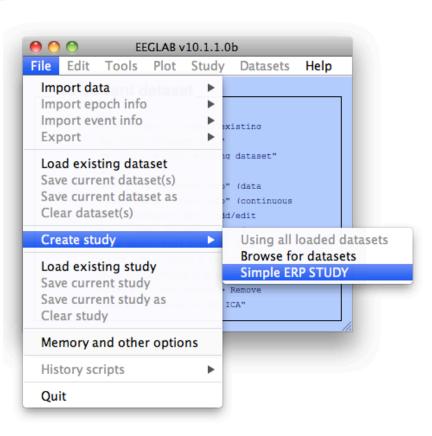


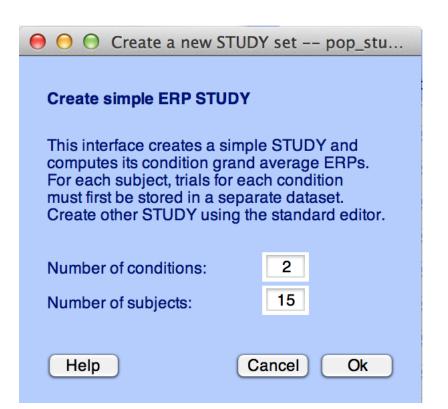
1	Memory options - pop_editoptions()	
		Set/Unset
	STUDY options (set these checkboxes if you intend to work with studies)	
	If set, keep at most one dataset in memory. This allows processing hundreds of datasets within studies.	
	If set, save not one but two files for each dataset (header and data). This allows faster data loading in studies.	☑.
	If set, write ICA activations to disk. This speeds up loading ICA components when dealing with studies.	
EEGLAB	Memory options	
	If set, use single precision under Matlab 7.x. This saves RAM but can lead to rare numerical imprecisions.	☑.
e Edit Tools Plot Sti	If set, use memory mapped array under Matlab 7.x. This may slow down some computation.	
Import data	ICA options	
Import epoch info	If set, precompute ICA activations. This requires more RAM but allows faster plotting of component activations.	☑.
Import event info	If set, scale ICA component activities to RMS (Root Mean Square) in microvolt (recommended).	☑.
Export	Folder options	
	If set, when browsing to open a new dataset assume the folder/directory of previous dataset.	☑.
Load existing dataset		
Save current dataset(s)	Option file: C:\Users\julie\Documents\MATLAB\functions\adminfunc\eeg_options.m	
Save current dataset as		
Clear dataset(s)	Help Cancel	Ok
Create study		
Load existing study	ect continuous ract epochs"	

Memory options should change when using STUDY vs single dataset

Create simple ERP STUDY

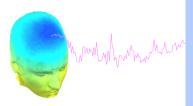
Man Marken Mar





0 0

Create a new STUDY set -- pop_studyerp()



	icale a liew			
Create simple ERP STUDY				
STUDY set name:		Le	etter memorization task	
Condition 1 name			Condition 2 name	
letter-ignore			letter-memorize	
Condition 1 datasets			Condition 2 datasets	1
/data/STUDY/S01/Ignore	e.set		/data/STUDY/S01/Memorize.set	
/data/STUDY/S02/Ignore	e.set		/data/STUDY/S02/Memorize.set	
/data/STUDY/S03/lgnore	e.set		/data/STUDY/S03/Memorize.set	
				 1



When using more than 1 condition, datasets on each line must correspond to the same subject.

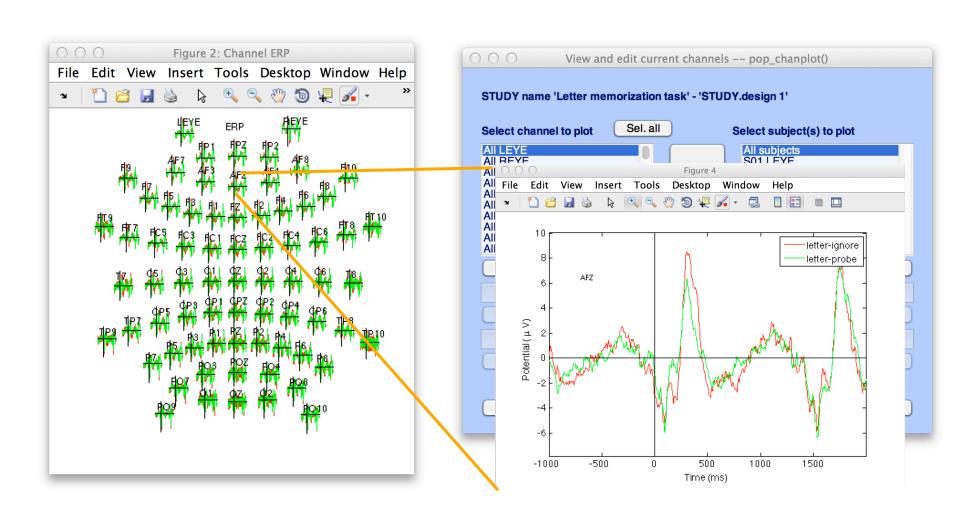
Help

Cancel

Ok

Create simple ERP STUDY

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Swartz Center for Computational Neuroscience

Build a STUDY



EEGLAB v OEEGLAB v		Datasets	Help
Import data		Dutubbtb	
Import epoch info			
Import event info			
Export			
Study task name			
Load existing dataset	1		
Save current dataset(s)		subject	
Save current dataset as		subject	
Clear dataset(s)	per	subject	
Create study		-	oaded dataset
Load existing study	yes		r datasets
Save current study	1	Simple ER	
Save current study as	Ready	to precluster	
Clear study	18.1		
-	_		
Memory and other option	IS		
History scripts			
Manage plugins	•		



Build a STUDY, cont'd



Edit dataset info

000

Help

hand have have a second with a second with a second with the second of t Create a new STUDY set -- pop_study()



Edit STUDY set information - remember to save changes Sternberg STUDY set name: Sternberg STUDY set task name: STUDY set notes: Select by r.v. dataset filename subject browse session condition group All comp. Clear /Volumes/donnees/data/STU[S01 ... memorize 1 /Volumes/donnees/data/STU[S01 All comp. Clear ... ignore 2 Clear /Volumes/donnees/data/STU[S01 All comp. ... probe 3 /Volumes/donnees/data/STU[S02 All comp. Clear memorize 4 Clear /Volumes/donnees/data/STU[All comp. S02 ignore 5 /Volumes/donnees/data/STU[All comp. Clear S02 probe 6 /Volumes/donnees/data/STU[All comp. Clear S03 ... memorize 7 Clear /Volumes/donnees/data/STU[S03 All comp. ... ignore 8 /Volumes/donnees/data/STU[S03 All comp. Clear ••• probe 9 Clear /Volumes/donnees/data/STU[S04 All comp. memorize 10 Important note: Removed datasets will not be saved before being deleted from EEGLAB memory < > Page 1

E Dataset info (condition, group, ...) differs from study info. [set] = Overwrite dataset info.

 $\mathbf{\nabla}$ Delete cluster information (to allow loading new datasets, set new components for clustering, etc.)

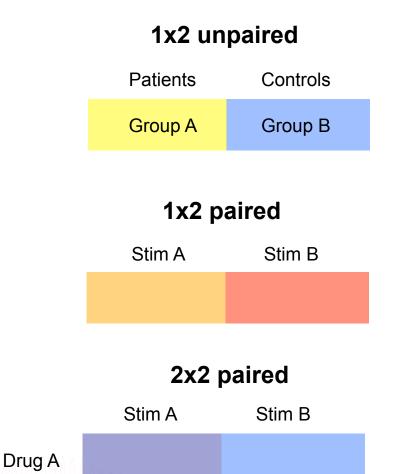
Cancel

Ok

Experimental design

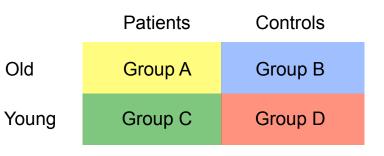
hand have a second with the second with the second with the second with the second of the second with the seco



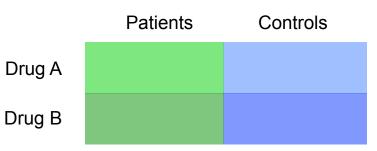


Drug B

2x2 unpaired



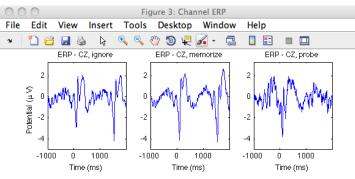
2x2 paired & unpaired

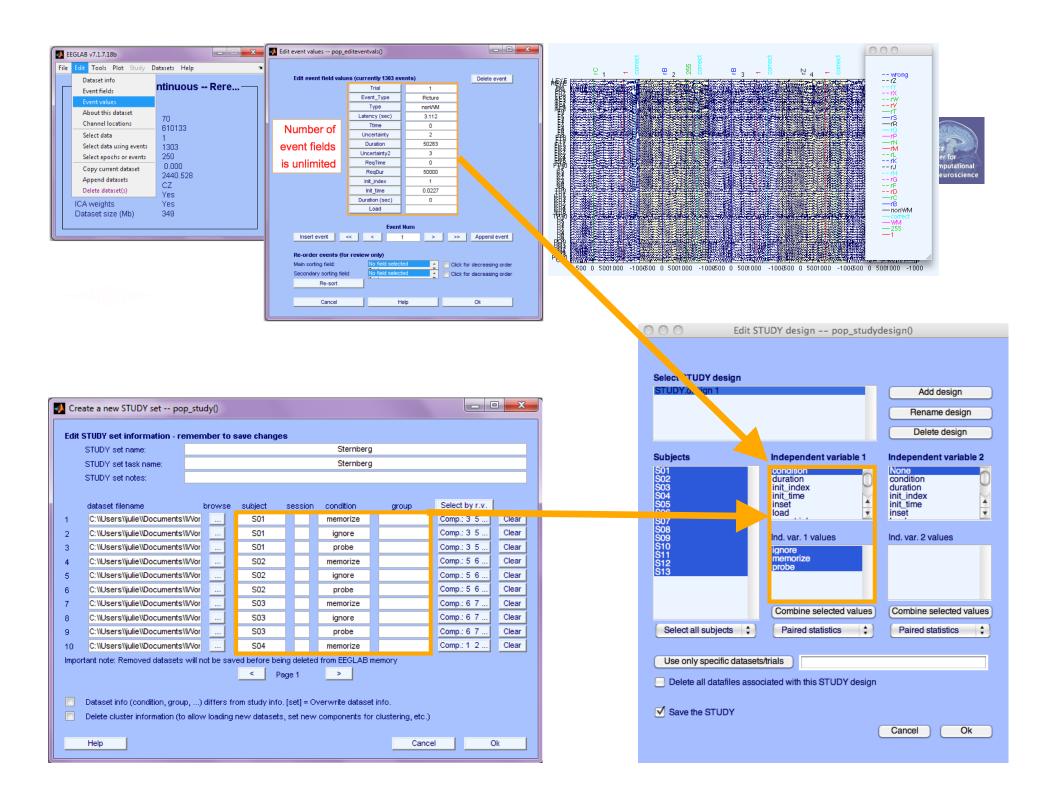


0	0	E	EGLAB	v9.0.0.0k)			
File	Edit	Tools	Plot	Study	Datasets	Help		
–	STUD	Y set:			tudy info t/Edit stud	y design(s	s)	
s	tudy ta		s/data		mpute cha hannel me		sures	
N N N	ib of se ib of gr	nditions ssions		Meas PCA d	ompute con ure Produc clustering (plot cluster	t clusterii original)		25 ►
0	hannels	per fram	e	61				
0	hannel	locations		ves				
0	lusters			1				
S	tatus			Pre-cl	ustered			
1	otal si	TO (Mb)		8.2				

Create design Edit STUDY design -- pop_studydesign() 0 Select STUDY design STUDY.design 1 Add design Rename design Delete design Subjects Independent variable 1 Independent variable 2 condition None S01 S02 S03 S04 S05 S06 S07 S08 S09 S10 S11 S12 S13 duration condition init index duration init time init index ¥ * * inset init time ¥ load inset Ind. var. 1 values Ind. var. 2 values ignore memorize probe Combine selected values Combine selected values \$ + Select all subjects + Paired statistics Paired statistics Use only specific datasets/trials Delete all datafiles associated with this STUDY design Save the STUDY Cancel Ok

1x3 design





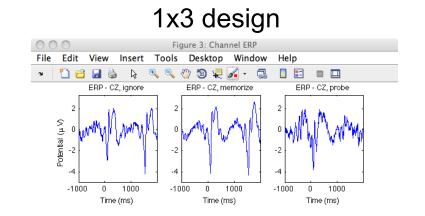
Build a STUDY, alternative method Marked when a second when a second when a second when a second of the se 000 Create a new STUDY set -- pop_study() Create a new STUDY set STUDY set name: STUDY set task name: STUDY set notes: Select by r.v. dataset filename browse subject session condition group Clear ... 1 Clear 2 ... Choose dataset to add to STUDY -- pop_study() 3 Cle ... 4 + S01 Cle ... 5 Cle Name Date Modified 6 Memorize.icaspec Thursday, November 12, 2009 9:08 PM Cle 7 Memorize.icatopo Monday, November 16, 2009 9:43 PM Cle ... 🐴 Memorize.set 8 Sunday, November 8, 2009 8:06 AM Cle Probe.daterp Monday, June 14, 2010 11:45 PM ... 9 Probe.fdt Thursday, November 12, 2009 11:02 AM Cle ... 10 Probe.icaerp Monday, November 16, 2009 10:01 PM Important note: Removed datasets will not be saved before being deleted from EEGLAB memory Probe.icaersp Tuesday, November 17, 2009 12:05 PM < Probe.icaitc > Tuesday, November 17, 2009 12:05 PM Page 1 Probe.icaspec Thursday, November 12, 2009 9:09 PM Probe.icatopo Monday, November 16, 2009 9:44 PM ☑ Update dataset info - datasets stored on disk will be overwritten (unset = Keep study info separate). 🐴 Probe.set Thursday, November 12, 2009 11:02 AM S01.fdt Tuesday, November 9, 2010 12:05 PM Delete cluster information (to allow loading new datasets, set new components for clustering, etc.) S01.set Tuesday, November 9, 2010 12:05 PM Cancel Help Ok (*.set, *.SET) + File Format: Cancel Open

Edit dataset info



	STUDY set name:				Sternberg			
	STUDY set task name:				Sternberg			
	STUDY set notes:							
	dataset filename	browse	subject	session	condition	group	Select by r.v.	
1	/Volumes/donnees/data/STU[S01			3.000	Comp.: 1 2	Clea
2	/Volumes/donnees/data/STU[S02				Comp.: 1 2	Clea
3	/Volumes/donnees/data/STU[S03				Comp.: 1 2	Clea
4	/Volumes/donnees/data/STU[S04				Comp.: 1 2	Clea
5	/Volumes/donnees/data/STU[S05				Comp.: 1 2	Clea
6	/Volumes/donnees/data/STU[S06				Comp.: 1 2	Clea
7	/Volumes/donnees/data/STU[S07				Comp.: 1 2	Clea
, B	/Volumes/donnees/data/STU[S08				Comp.: 1 2	Clea
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9 10	/Volumes/donnees/data/STU[S10				Comp.: 1 2	Clea
	tant note: Removed datasets will	not be s		eing deleti Page 1	ed from EEGLAE	3 memory		
⊻	Update dataset info - datasets sto	ored on	disk will be ov	erwritten (u	inset = Keep stu	dy info separate).	

00)	E	EGLAB	v9.0.0.0ł)			
File E	dit	Tools	Plot	Study	Datasets	Help		
ST	UD	Y set:			tudy info t/Edit stud	y design(s)	
Stud	y ta	lename: . sk name	s/data		mpute cha hannel me		sures	
Nb o Nb o Nb o	f co f se f gr	bjects nditions ssions oups nsistency		Meas PCA d	ompute con ure Produc clustering (plot cluster	t clusteri original)		* *
Char	nels	per fram	e	61				-
Char	nel	locations		yes				
Clus	ters			1				
Stat	us			Pre-cl	ustered			
Tota		(20-)		8.2				



Create design Edit STUDY design -- pop_studydesign() Select STUDY design Ignore vs. Memorize vs. Probe Add design Rename design Delete design

Independent variable 1

01 02 03 04 05 06 07	stimtype stimulus ttime type uncertainty1 uncertainty2	None duration init_index init_time inset load
07 08 09 10 11 12 13	Ind. var. 1 values Ignore Memorize Probe	Ind. var. 2 values
Select all subjects	Combine selected values Paired statistics	Combine selected values Paired statistics

Use only specific datasets/trials

Delete all datafiles associated with this STUDY design

Save the STUDY

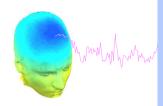
Cancel

Independent variable 2

00

Subjects

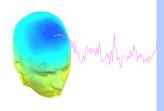
S01 S02 S03 S04 S05 S06 S07 S08 S09 S10 S11 S12 S13



Audio preceeded by diffe Audio versus ligh accros	Ilus type - non dual subjects only	Rename design Delete design
Subjects	Independent variable 1	Independent variable 2
21 22 23 24 25 26 27 28	None group stimulusType presentation session prevevent	None group stimulusType presentation session prevevent
26 nd1 nd2 nd3 nd4 nd5 nd6 nd7 nd8	Ind. var. 1 values audio blank both light audio - light	Ind. var. 2 values control nondual
Select all subjects	Combine selected values	Combine selected values
Use only specific d Delete all datafiles a	atasets/trials ssociated with this STUDY design	

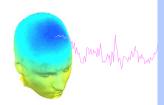


MAMA



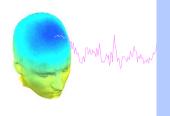
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Audio versus light accross p	essions - non dual subjects only resentation - non dual subjects only	Delete design
Subjects	Independent variable 1	Independent variable 2
2 2 3 4 5 5 6 7	None group stimulusType presentation session prevevent	None group stimulusType presentation session prevevent
28 nd1	Ind. var. 1 values	Ind. var. 2 values
nd2 nd3 nd4 nd5 nd6 nd7 nd8	audio blank both light audio - light	
	Combine selected values	Combine selected values
Select all subjects	Unpaired statistics	Unpaired statistics
Use only specific datas	sets/trials	
Delete all datafiles asso	ciated with this STUDY design	

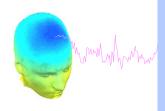


Audio preceeded by differe Audio versus ligh accross	s type - non dual subjects only	Add design Rename design Delete design
Subjects	Independent variable 1	Independent variable 2
51 52 53 54 55 56 57	None group stimulusType presentation session prevevent	None group stimulusType presentation session prevevent
c8 nd1 nd2 nd3 nd4 nd5 nd6 nd7 nd8	Ind. var. 1 values audio blank both light audio - light	Ind. var. 2 values
	Combine selected values	Combine selected values
Select all subjects	Unpaired statistics	Unpaired statistics
Use only specific dat Delete all datafiles ass Save the STUDY	asets/trials	



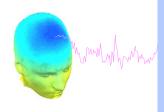


Audio versus light all subject: All stimulus type - non dual si Blank versus other stimulus t	Add design	
Audio preceeded by different Audio versus ligh accross se	ssions - non dual subjects only	Rename design
Audio versus light accross pr	esentation - non dual subjects only	Delete design
Subjects	Independent variable 1	Independent variable 2
51 52 53 54 55 56 57	None group stimulusType presentation session prevevent	None group stimulusType presentation session prevevent
c8 nd1 nd2 nd3 nd4 nd5 nd6 nd6 nd7 nd8	Ind. var. 1 values audio blank both light	Ind. var. 2 values
	Combine selected values	Combine selected values
Select all subjects	Unpaired statistics	Unpaired statistics
Use only specific datas	ets/trials 's	timulusType',{'audio'}
	ated with this STUDY design	
Save the STUDY		



	esentation - non dual subjects only	Delete design
Subjects Subjec	Independent variable 1 None group stimulusType presentation session prevevent Ind. var. 1 values audio blank both light audio - light	Independent variable 2 None group stimulusType presentation session prevevent Ind. var. 2 values
nd8	Combine selected values	Combine selected values
Select all subjects	Unpaired statistics	Unpaired statistics 🛟
Use only specific datase	ets/trials	
	iated with this STUDY design	





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Audio versus light all subject All stimulus type - non dual s Blank versus other stimulus t	ubjects only type - non dual subjects only	Add design		
Audio preceeded by differen Audio versus ligh accross se	Rename design			
Audio versus light accross p	resentation - non dual subjects only	Delete design		
ubjects	Independent variable 1	Independent variable 2		
2 2 3 4 5 6	None group stimulusType presentation session prevevent	None group stimulusType presentation session prevevent		
27 28 1nd1 1nd2 1nd3 1nd4 1nd5 1nd6 1nd7	Ind. var. 1 values audio blank both light audio - light	Ind. var. 2 values evoked spontaneous		
nd8	Combine selected values	Combine selected values		
Select all subjects	Unpaired statistics	Unpaired statistics		
Use only specific datas	ets/trials			
Delete all datafiles assoc	siated with this STUDY design			
Save the STUDY				

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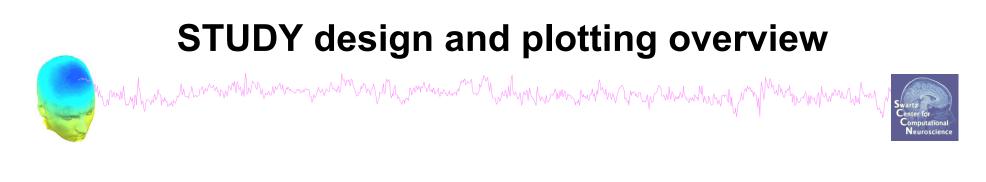
Exercises





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 STUDY folder)
- 4. In the column for "letter-memorize" select datasets "probe.set" for 3 subjects S01, S02, S03 (in the STUDY folder)
- 5. Press OK.



STEP 1 Build a STUDY STEP 2 Build design(s) STEP 3 Precompute the data STEP 4 Plot the data Exercise...





File	Edit	Tools	Plot	Study	Datasets	Help	
	STUD	Y set:			tudy info t/Edit study	/ design(s	5)
	Study fi	lename: .	s/data	Preco	mpute cha	nnel mea	sures
	Study ta	lsk name			hannel me		
	Nb of su	bjects					
	Nb of co	nditions			mpute con		
	Nb of se	ssions			ure Produc		ng 🕨
	Nb of gr	oups			clustering (•
	Epoch co	nsistency		Edit/	plot cluster	s	
	Channels	per fram	е	61			
	Channel	locations		yes			
	Clusters			1			
	Status			Pre-cl	ustered		
	Total si	ze (Mb)		8.2			

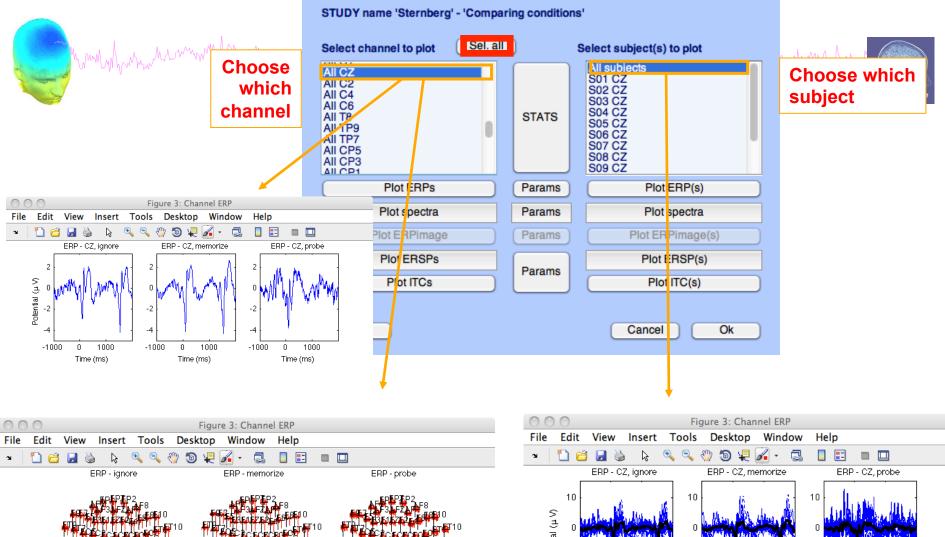
Select and compute component measures for later clustering pop_precor	np()
Pre-compute channel measures for STUDY 'Sternberg' - 'STUDY.design 1'	
Channel list (default:all)	
Spherical interpolation of missing channels (performed after optional ICA removal below)	
Remove ICA artifactual components pre-tagged in each dataset	
Remove artifactual ICA cluster or clusters (hold shift key)	Q •
List of measures to precompute	
ERPs Baseline ([min max] in ms)	
Power spectrum Spectopo parameters 'specmode', 'fft'	st
ERSPs Time/freq. parameters 'cycles', [3 0.5], 'nfreqs', 100 Te	st
TCs	
Save single-trial measures for single-trial statistics - requires disk space Recompute even if present on disk	
Help Cancel Ok	

Contraction of the second seco
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0 0	EEGLAB v9.0.3.4b		
File Edit	Tools Plot Study Datasets H	lelp	
Filename Channels	Change sampling rate Filter the data Re-reference Interpolate electrodes Reject continuous data by eye	•	
Epochs Events	Extract epochs Remove baseline		The second se
Sampling Epoch st Epoch en	Run ICA Remove components		
Referenc Channel ICA weig Dataset	Automatic channel rejection Automatic epoch rejection Reject data epochs	►	
	Reject data using ICA	•	Reject components by map
-	Locate dipoles using DIPFIT 2.x Peak detection using EEG toolbox	•	Reject data (all methods) Reject by inspection
	FMRIB Tools Locate dipoles using LORETA	* *	Reject extreme values Reject by linear trend/variance Reject by probability Reject by kurtosis Reject by spectra
			Export marks to data reject
			Reject marked epochs

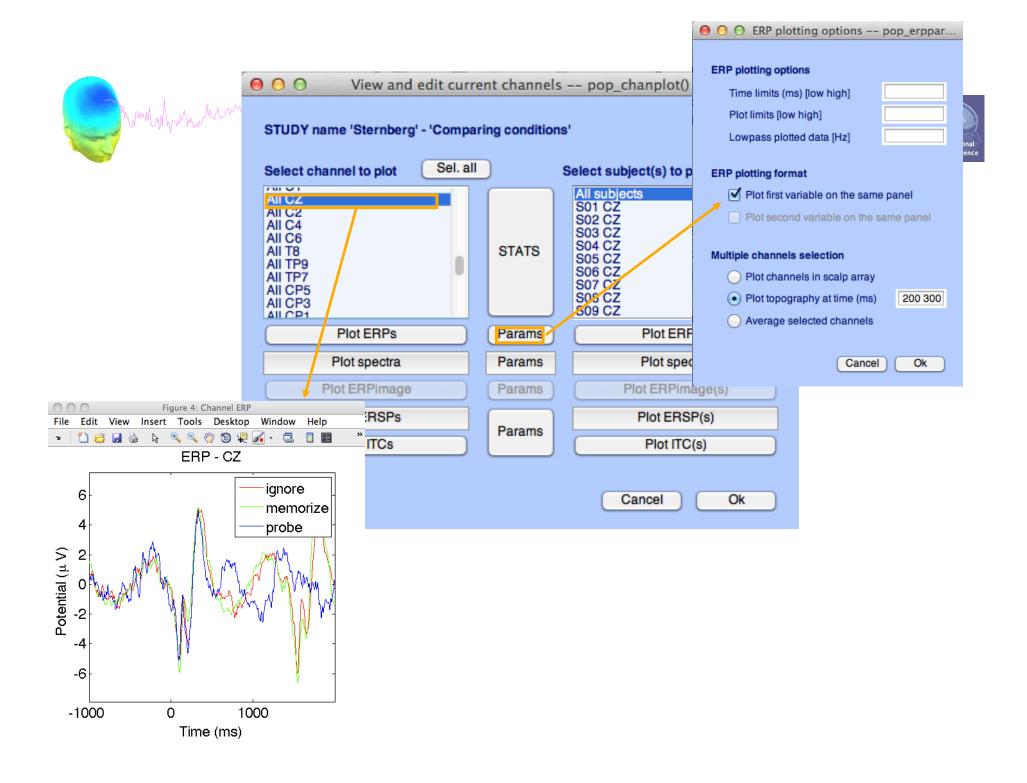
 Reject components b 	oy map - pop_select	comps() (dataset:	8//////////////////////////////////////			//////////////////////////////////////
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33		
				٢		
Cancel	Set ihrehoold:	See comp	, stats See pr	ojection	Help	ок

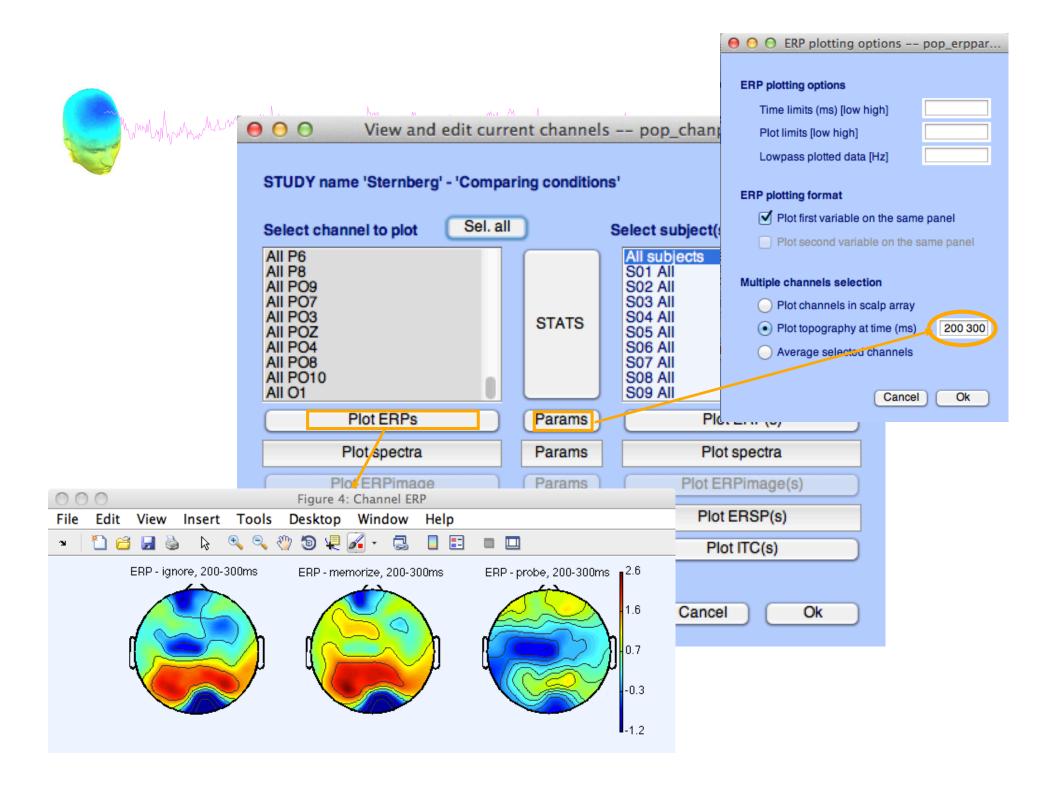
$\Theta \Theta \Theta$ View and edit current channels -- pop chanplot()

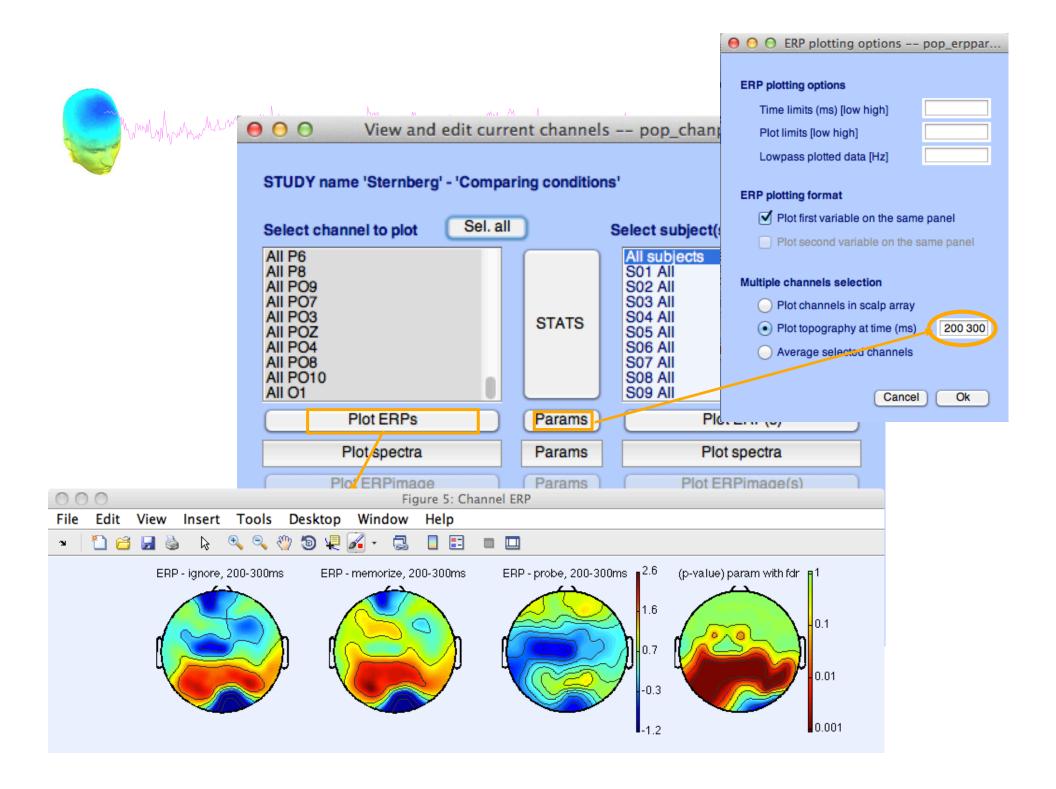


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Potential (μ V) -10 -10 -10 -1000 0 1000 -1000 0 1000 -1000 0 1000 Time (ms) Time (ms) Time (ms)



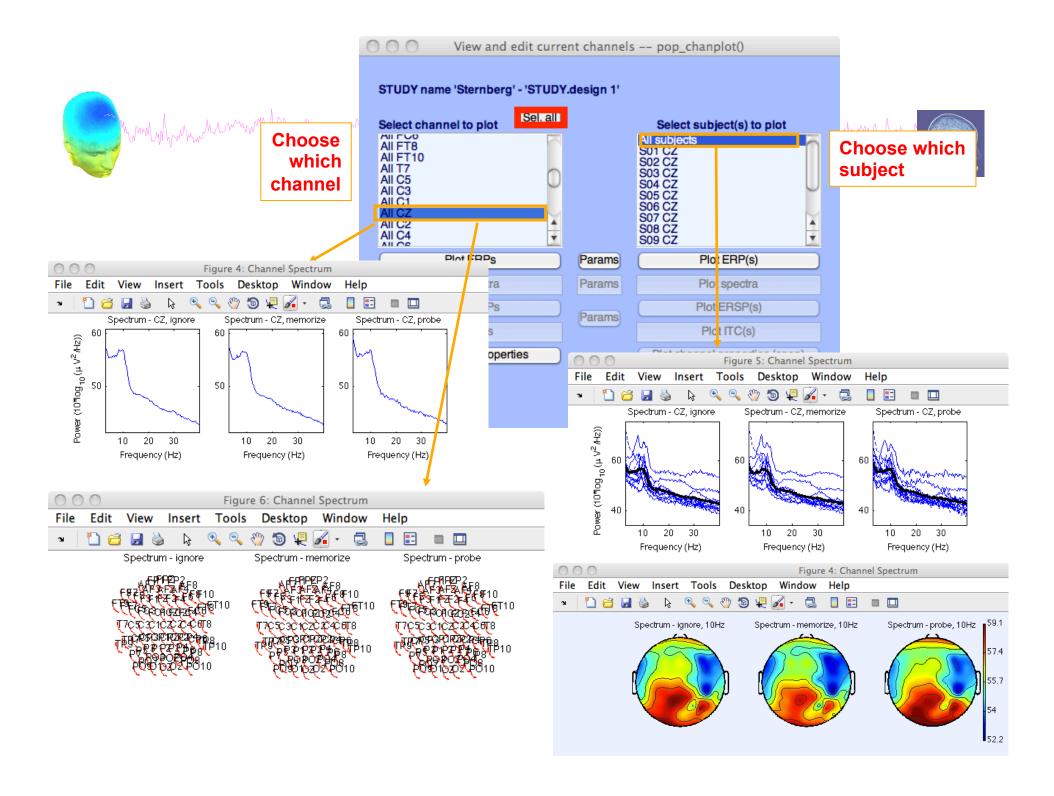




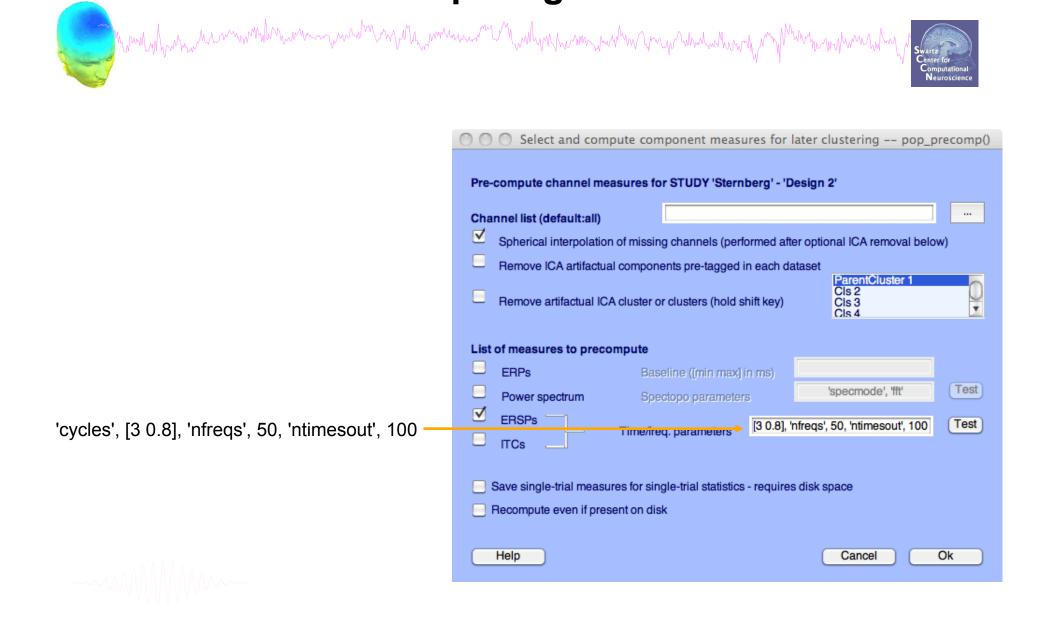


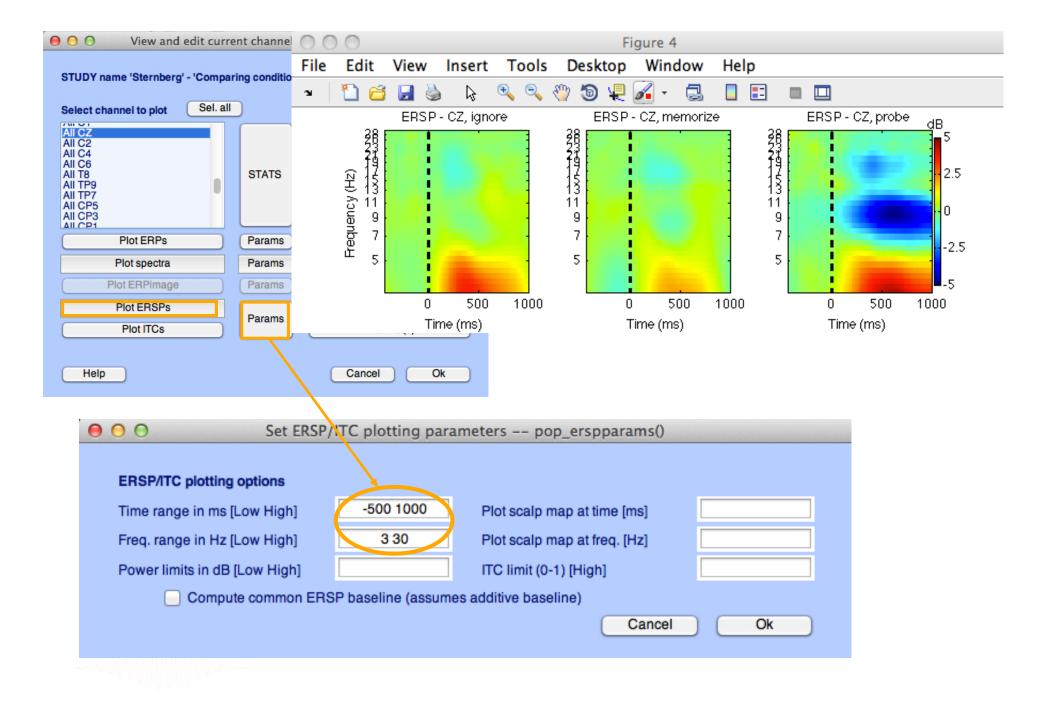
how how have

Select and compute component measures for later clustering -- pop_precomp() Pre-compute channel measures for STUDY 'Sternberg' - 'STUDY.design 1' Channel list (default:all) ... ⊻ Spherical interpolation of missing channels (performed after optional ICA removal below) Remove ICA artifactual components pre-tagged in each dataset ParentCluster Cls 2 Remove artifactual ICA cluster or clusters (hold shift key) Cls 3 Cls 4 Ψ. List of measures to precompute ERPs Baseline ([min max] in ms) $\mathbf{\nabla}$ Test 'specmode', 'fft' Power spectrum Spectopo parameters ERSPs 'cycles', [3 0.5], 'nfreqs', 100 Test Time/freq. parameters ITCs Save single-trial measures for single-trial statistics - requires disk space Recompute even if present on disk Help Ok Cancel



Computing ERSP





3 Mh warmen What when we 0 EEGLAB v9.0.0.0b Plot Study Datasets Help File Edit Tools Edit study info STUDY set: _ Select/Edit study design(s) Precompute channel measures Study filename: ...s/data Plot channel measures Study task name Nb of subjects Precompute component measures Nb of conditions Measure Product clustering ► Nb of sessions PCA clustering (original) ► Nb of groups Edit/plot clusters Epoch consistency 61 Channels per frame Channel locations ves Clusters 1 Status Pre-clustered 8.2 Total size (Mb) Select and compute component measures for later clustering -- pop_precomp() Pre-compute component measures for STUDY 'Sternberg' - 'STUDY.design 1'

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

	Study ta		Plot chan	inel measures	
	Nb of se Nb of gr Epoch co Channels	enditions essions eoups ensistency per frame locations	Measure	ute component m Product clusterin tering (original) clusters	
	Status Total si		1 Pre-cluste: 8.2	red	
Char	compute channel me nnel list (default:all) Spherical interpolatio		-	TUDY.design 1'	elow)
	Remove ICA artifactua Remove artifactual IC	al components pre-t	tagged in each da	taset ParentCluster 1 Cls 2	
			(hold chift kov)	Cle 2	
List	of measures to prece		s (hold shift key)	Cls 3 Cls 4	<u>×</u>
List		ompute	in max] in ms)		Test

EEGLAB v9.0.0.0b

Tools Plot Study Datasets

Edit study info

Select/Edit study design(s)

Plot channel measures

Precompute channel measures

Cancel

Ok

Help

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

Help

— — · ·	

Save single-trial measures for single-trial statistics - requires disk space

Recompute even if present on disk

List of measures to precompute

Power sr ctrum ERSPs

Help

☑

F

ERPs

ITCs

Scalp maps

File

Edit

STUDY set:



Test

Ok

'specmode', 'fft'

Cancel

Ρι	re-co	mpu	ite r	neas	sure)S

View and edit clusters



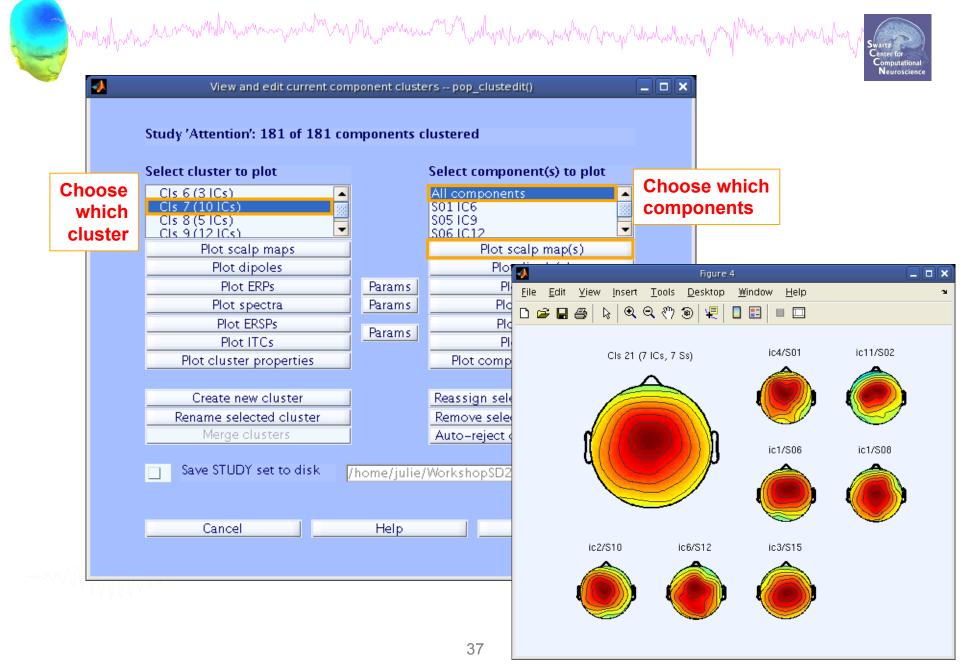
-			EE	GLAB v6.	.0b			
File	Edit	Tools	Plot	Study	Datasets	Help	'n	
	стн	DY se		Edi	t study info			
	5101	51.36	AI		compute ch	annel meas	ures	
	Study	filenar	ne:	Plot	t channel me	easures		
		task n		Pre	compute co	mponent m	easures	
		subjec condit		Buil	ld precluste	ring array		
		sessio		Clu	ster compor	nents		
	Nb of	group	s	Edi	t/plot cluste	rs		
		n consi:		· · ·	es			
		nels pe			1			
	Chanr	nel loca	ations	- ye	es			
	Cluste	ers		2	6			
	Status	5		Pi	re-cluster	ed		
	Total	size (M	lb)	3	9.1			



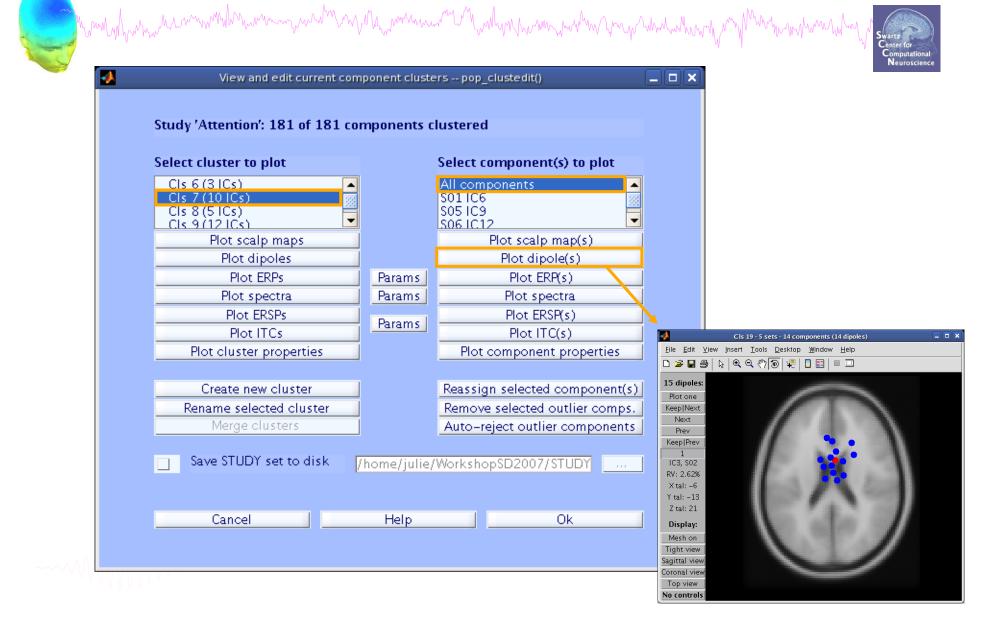
Plot cluster data



Plot cluster data



Plot cluster data

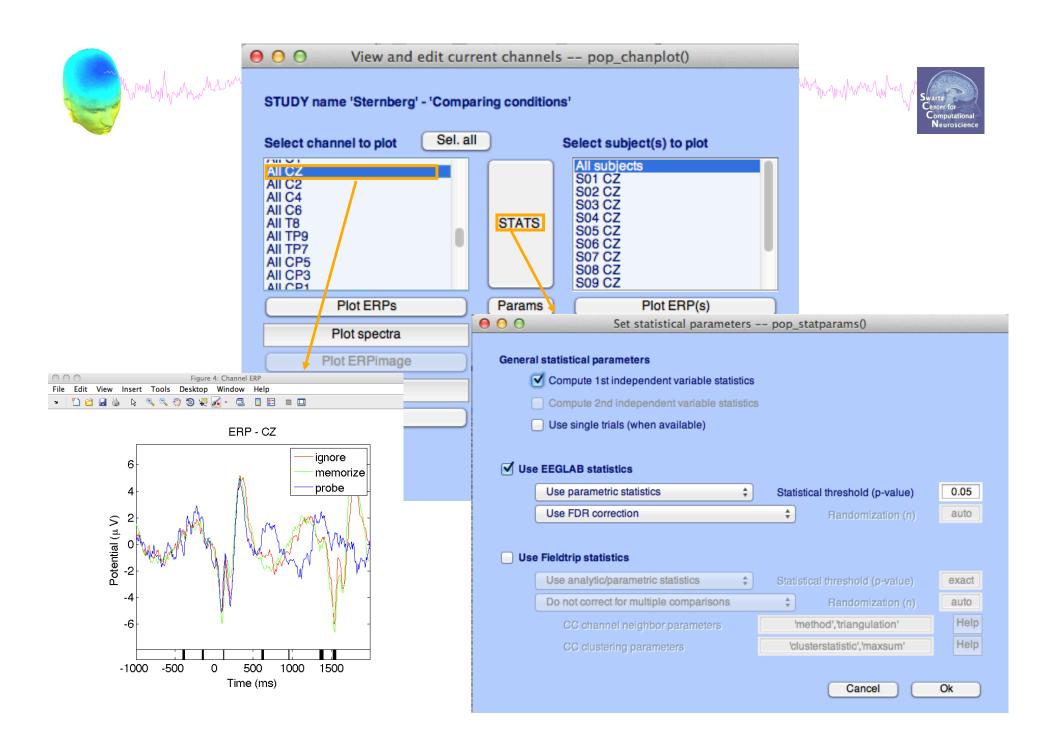


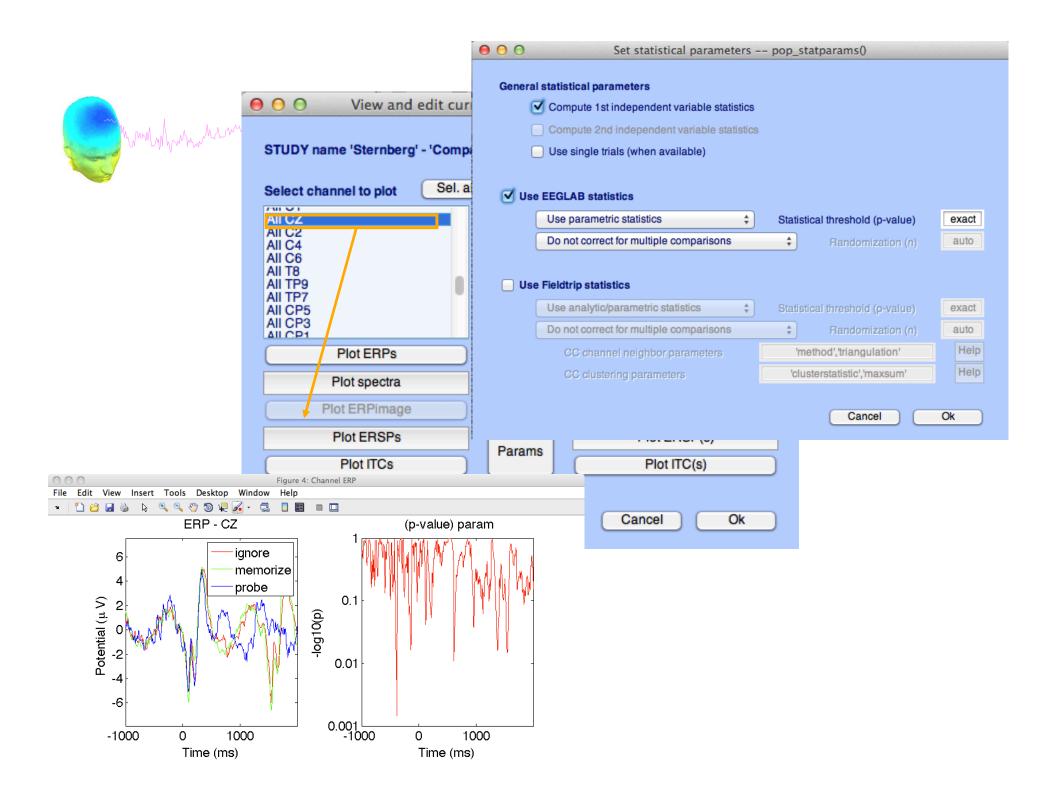
Exercises

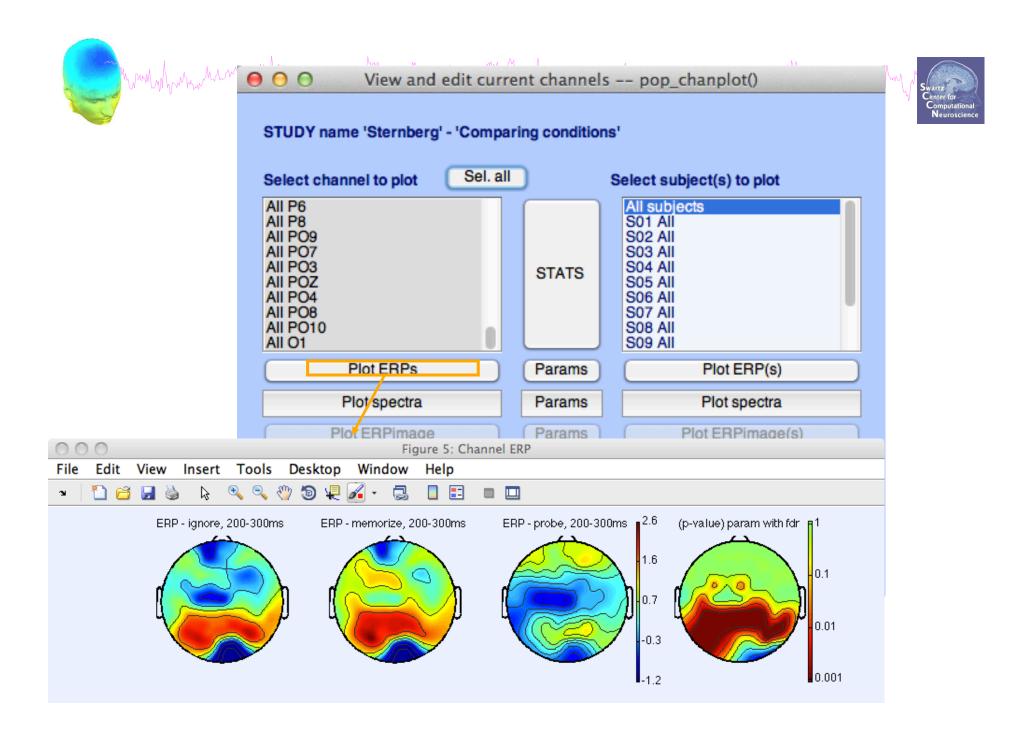


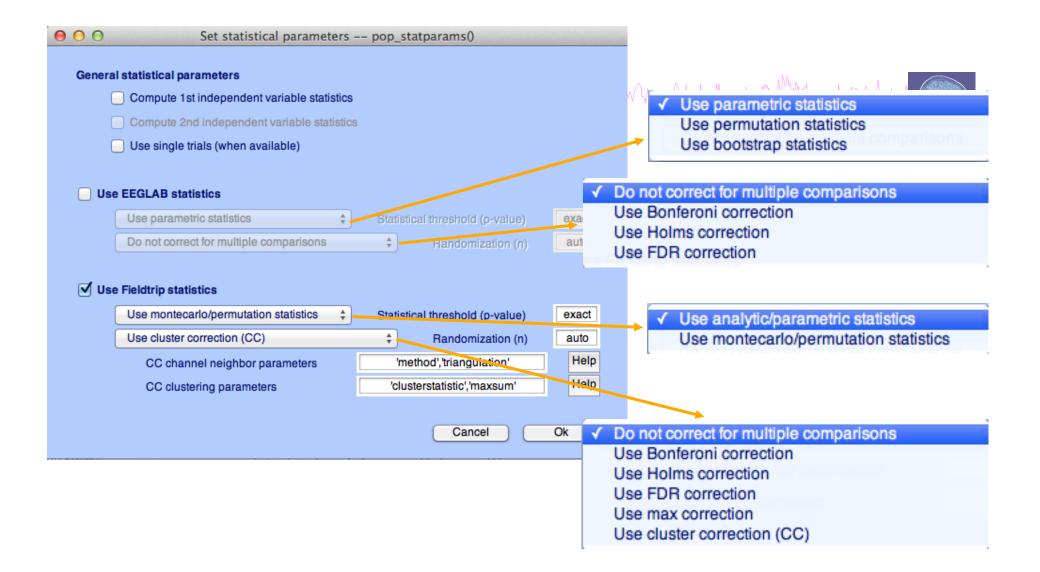
- 1. Load stern.study in STUDY folder
- 2. Create a new STUDY **design** to compare two types of conditions
 - Ignore letter **grouped** with Memorize letter
 - Probe letters
- 3. Recompute spectrum and plot spectrum for electrode Fz
- 4. Plot scalp topography at 10 Hz for both conditions











std_stat() function in EEGLAB

Completingle trials



Pre-	Select and compute component measures for later clustering pop_precom- -compute channel measures for STUDY 'Sternberg' - 'STUDY.design 1'	p()
Cha ✓ □	annel 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) ParentCluster 1 Cls 2 Cls 3 Cls 4	
	t of measures to precompute ERPs Baseline ([min max] in ms) Power spectrum Spectopo parameters ERSPs	
	Save single-trial measures for single-trial statistics - requires disk space Recompute even if present on disk	

Exercices

hand have have made and have a second have a s



Experiment with STUDY statistics

- Load the Stern STUDY
- Look at significant difference in the first default design in channel Fz (time-frequency plot, ERSP) using the cluster method (Fieldtrip – statistics)
- Look at the same difference a component cluster of your choice.

