# The Source Information Flow Toolbox



Practicum

Tim Mullen

# Experimental Data





200 400 600 Time (ms)

-200

Makeig et al, 2001

800 1000 1200

Gehring et al., 2002





### SIFT Requirements:

- Matlab 2008b 2013b
- Signal Processing Toolbox
- Statistics Toolbox
- EEGLAB
- SIFT 1.4.1

EEGLAB v13.6	3.5b
File Edit Tools Plot Stud	ly Datasets Help
Import data Import epoch info Import event info Export	isting
Load existing dataset Save current dataset(s) Save current dataset as Clear dataset(s) Create study	dataset" (data (continuous /edit e dataset) data"
Load existing study Save current study Save current study as Clear study / Clear all	ct ct epochs" Remove CA"
Memory and other options	
History scripts	•
Manage EEGLAB extensions	Data import extensions
Quit	Data processing extensions



### If you can't install SIFT via plugin manager...

Copy <USB-key>/.../SIFTI\_41 to EEGLAB plugins folder (unzipped)





### If you don't have SIFT Installed

		1.					
ile Edit Debug Para	allel Des	sktop	Wir	Idov	w ł	leip	)
New	•	<b>1</b>	È (	0	Curr	rent	Fold
Open	#O	2 S	TART	TCE	e s	IFT	e s
Close Command window	W 96W	lder					
Import Data					0	film	<b>.</b>
Save Workspace As	жs	s	ize ≜		Typ	De .	4.
Set Path					File	e Fo	lder
Preferences	<b>£</b> .				File	e Fo	lder
	,				File	e Fo	lder
Page Setup	<del></del> ሰ ജ P				File	P FO	lder
Print	ЖP				File	E FO	Ider
Print Selection	~℃₩P				File	> Fo	lder
1 st/ost fitM\/APKalm					File	e Fo	lder
1st/est_fitMVARKalma	an.m				File	Fo Fo	lder lder
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD	an.m MM.m				File File	Fo Fo Fo Fo	lder Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users/minimal/mva	an.m MM.m aar.m				File File File File	Fo Fo Fo Fo Fo	lder Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_daISC	an.m MM.m aar.m SA.m	-			File File File File	Fo Fo Fo Fo Fo Fo	lder lder lder lder lder
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_daISC Exit MATLAB	an.m MM.m aar.m SA.m %Q				File File File File File	Fo Fo Fo Fo Fo Fo	lder lder lder lder lder lder
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB	an.m MM.m aar.m SA.m %Q				File File File File File File File	Fo Fo Fo Fo Fo Fo Fo	lder Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo	lder Ider Ider Ider Ider Ider Ider Ider I
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB lost+found User Guides And Inf sw	an.m MM.m aar.m SA.m #Q formation				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo	lder Ider Ider Ider Ider Ider Ider Ider I
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB lost+found User Guides And Inf sw mp	an.m DMM.m aar.m SA.m %Q formation				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB lost+found User Guides And Inf sw tmp usr	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB	an.m MM.m aar.m SA.m #Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB lost+found User Guides And Inf sw tmp usr Developer var bin	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB Iost+found Iost+found Iost+found Sw Developer Var Developer Library	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB Iost+found Iost+found Ioser Guides And Inf Sw Ioser Guides And Inf Developer Ioser Developer Ioser Sw Ioser Sw Ioser Sw Ioser	an.m MM.m aar.m SA.m #Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB Iost+found	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider
1st/est_fitMVARKalma 2 /Users/r/mvar_gIAD 3 /Users/minimal/mva 4 /Users//mvar_dalSC Exit MATLAB lost+found lost+found lost=Guides And Inf sw tmp usr Developer var bin Library sbin etc dev	an.m MM.m aar.m SA.m %Q				File File File File File File File File	Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo Fo F	Ider Ider Ider Ider Ider Ider Ider Ider

#### I. Clear the Matlab Path

Add Folder	MATLAB search path:
	/Users/timmullen/Documents/WORK/Conference:
Add with Subfolders	/Users/timmullen/Documents/WORK/Conference:
	/Users/timmullen/Documents/WORK/Conferences
	/Users/timmullen     ///     ///     ///     ///     ///     ///     ///     ///     //    //     //     //
	/Users/timmullen/Documents/WORK/Conferences
	/Users/timmullen/Documents/WORK/Conference:
	/Users/timmullen/Documents/WORK/Conference:
	/Users/timmullen/Documents/WORK/Conference:
( Move to Top	Users Cot Dath
Movelln	Jusers User
more op	/Users Demonstrate to machine the default math2
( Move Down )	/Users Do you wish to restore the default path?
	Jusers If you do so, you will lose your current path settings
Move to Bottom	/Users
	Users
	/Users NO Tes
	/Users
	/Users/timmullen/Documents/WORK/Conferences
	/Users/timmullen/Documents/WORK/Conference: *
Remove	/Users/timmullen/Documents/WORK/Conferences*



### 2. Add EEGLAB+SIFT to path

00	Set Path							
All always take affect immediat	ali							
All changes take effect immediate	ely.							
Add Folder	MATLAB search path:							
Additionation	/Users/timmullen/Documents/WORK	Conferences						
Add with Subfolders	/Users/timmullen/Documents/WORK	$\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$		Se	elect a Directory			
	/Users/timmullen/Documents/WORK							
	1 /Users/timmullen			eeglab12 0	0.0b			
	/Users/timmullen/Documents/WORK				_0_00	<u> </u>		
	/Users/timmullen/Documents/WORK				Dete			
	/Users/timmullen/Documents/WORK	DEVICES	וכ 🥅 🕖		Data	₽-	ISI_README.txt	
	/Users/timmullen/Documents/WORK	TimMull			eeglab12_0	)_0_0b ►	m Contents.m	
	/Users/timmullen/Documents/WORK						m eeglah m	
Move to Top	/Users/timmullen/Documents/WORK	📔 iDisk						
Maualla	/Users/timmullen/Documents/WORK	Lion					eeglablicense.txt	
Move op	/Users/timmullen/Documents/WORK	isona)					📄 external	- Þ
Move Down	/Users/timmullen/Documents/WORK	▼ SHARED					functions	
	/Users/timmulien/Documents/WORK							
(Move to Bottom	/Users/timmulien/Documents/WORK	Alissa ····					plugins	
	/Users/timmullen/Documents/WORk	💻 Anna Me					🚞 sample_data	- P
	/Users/timmullen/Documents/WORK							- b
	/Users/timmullen/Documents/WORK	MAC-0012					Sample_locs	· · ·
	/Users/timmullen/Documents/WORK							
	/Users/timmullen/Documents/WORK	V PLACES						
	/Users/timmullen/Documents/WORK	🐚 Ideas.rtf						
Remove	/Users/timmullen/Documents/WORK	Processing						
		temp						
(?)	Save Close Revert							
0		Toolboxes			11	11		
		Confere	T C		******			
						(	Cancel ) ( Open	



#### 3. Start EEGLAB

	e
× ≀ → □	Command Window
$f_{x} >> \text{ eeglab}$	



00

\varTheta 🔿 🔿 EEGLAB v	10.2.5.	5b	4 Check FEGLAB memory opti	inne
File Edit Tools Plot Import data Import epoch info Import event info Export	Study	Datasets	Memory options - pop_editoptions()	
Load existing dataset Save current dataset(s) Save current dataset as Clear dataset(s)		ed	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.	Set/Unset
Create study	•		If set, write ICA activations to disk. This speeds up loading ICA components when dealing with studies.	
Load existing study Save current study Save current study as Clear study			Memory options If set, use single precision under Matlab 7.x. This saves RAM but can lead to rare numerical imprecisions. If set, use memory mapped array under Matlab 7.x. This may slow down some computation.	
Memory and other optio	ns	_	If set, use the EEGLAB EEG object instead of the standard EEG structure (beta).	
History scripts	►		ICA options	
Quit	_		If set, precompute ICA activations. This requires more RAM but allows faster plotting of component activations. If set, scale ICA component activities to RMS (Root Mean Square) in microvolt (recommended). Folder options	<b>▼</b>
			If set, when browsing to open a new dataset assume the folder/directory of previous dataset. Toolbox options	Ø
			If set, do not use Matlab additional toolboxes functions even if they are present.	
			If set, enable EEGLAB chat - currently UCSD only - restart EEGLAB after changing that option.	
			Option file: ~/eeg_options.m	-
			Help Cancel	Ok

 $\Box$ .

₫.

 $\Box$ .

 $\Box$ .

 $\Box$ .

 $\Box$ .

₫.

₫.

₫.

 $\Box$ .

 $\square$ .

....



#### <USB Key>/SIFT/Data/

00	Load dataset(s) pop_loadset()
(	Data 🗘
Name	Date Modified
RespCorrect.fdt	Wednesday, June 13, 2012 7:23 AM
RespCorrect.set	Wednesday, June 13, 2012 7:23 AM
RespWrong.fdt	Wednesday, June 13, 2012 7:23 AM
RespWrong.set	Wednesday, June 13, 2012 7:23 AM
File Fi	ormat: (*.SET*, *.set)
	Cancel Open



### Preprocessing: Select Data Range

0	0	EE	GLAB	12.0.0.0	b	
File	Edit	Tools	Plot	Study	Datasets	Help
E E	Dat Eve Eve Abo Cha	aset info nt fields nt values out this o annel loo	s dataset ations	152 1024		
1	Sele Sele	ect data ect epoc	using ( hs or e	events vents		
F	Cor Apr Del	by curren bend dat ete data:	nt data asets set(s)	set	с.	
I	Edit	t events	& marl	k bad ch	annels	

	beleet data pop_beleet	.0
Select data in: Time range [min max] (s) Point range (ex: [1 10]) Epoch range (ex: 3:2:10) Channel range	Input desired range -1 1.25	on->remove these
Help	Scroll dataset	Cancel Ok
00	Dataset info pop_newset(	0
Hat do you want to d	Dataset info pop_newset( o with the new dataset?	0
What do you want to d Name it:	Dataset info pop_newset( o with the new dataset? RespWrong	0 Edit description
What do you want to d Name it: Save it as file:	Dataset info pop_newset( o with the new dataset? RespWrong	0 Edit description Browse

#### Preprocessing: Select Components

0	) 🔿 💧	EEGLAB v12.0.0.0b		0
File	Edit	Tools Plot Study Datasets He	elp	
	#1: Re Filename Channels Frames p	Change sampling rate Filter the data Re-reference Interpolate electrodes Reject continuous data by eye	•	
	Epochs Events Sampling	Extract epochs Remove baseline		
	Epoch st	Run ICA		
	Epoch en	Remove components		
	Referenc Channel ICA weig Dataset	Automatic channel rejection Automatic epoch rejection Reject data epochs Reject data using ICA		Plea
		CleanLine		
		SIFT	•	w
		Locate dipoles using DIPFIT 2.x Peak detection using EEG toolbox	•	
		FMRIB Tools Locate dipoles using LORETA	•	Sc



## Preprocessing: SIFT

EEGLAB v12.0.0.0b
la Edit Taola Plat Study Datasata Hala
le Edit Tools Plot Study Datasets Help
Change sampling rate
Re-reference
Interpolate electrodes
Reject continuous data by eye
Extract epochs
Remove baseline
Run ICA
Remove components
Automatic channel rejection
Automatic epoch rejection
Reject data epochs
keject data using ICA
CleanLine
SIFT > Simulatio
Locate dipoles using DIPEIT 2 x
Peak detection using EEG toolbox Model fitt
EMPIR Tools
Locate dipoles using LORETA 🛛 🕒 Visualizat

	Preprocessing Opt	ions
:] 24 💼 🖭 🖽		
Miscellaneous		
VerbosityLevel		2
SignalType		Components
VariableNames		
ResetConfigs		
▼ Filtering		
DifferenceData		
Detrend		
DetrendingMethod	i i	linear
Piecewise		
SegmentLength		0.33
StepSize		0.082
Plot		
AmplitudeEnvelope		
Normalization		
NormalizeData		
Method		time; ensemble
<b>SignalType</b> Type of signal to anal	yze. If 'Component:	s', data in EEG.icaact will
SignalType Type of signal to anal be processed. If 'Char EEG.srcpot will be pro Help	yze. If 'Components inels' EEG.data will b cessed. Cancel	s', data in EEG.icaact will be processed. If 'Sources' OK
SignalType Type of signal to anal be processed. If 'Char EEG.srcpot will be pro Help	yze. If 'Components inels' EEG.data will b cessed. Cancel Dataset info pop_ne	s', data in EEG.icaact will be processed. If 'Sources' OK
SignalType Type of signal to anal be processed. If 'Char EEG.srcpot will be pro Help	yze. If 'Components inels' EEG.data will b cessed. Cancel Dataset info pop_ne	s', data in EEG.icaact will be processed. If 'Sources' OK
SignalType Type of signal to anal be processed. If 'Char EEG.srcpot will be pro Help What do you want to do w Name it:	yze. If 'Components inels' EEG.data will b cessed. Cancel Dataset info pop_ne with the new dataset? RespWrong	s', data in EEG.icaact will be processed. If 'Sources' OK wset() Edit description
SignalType Type of signal to anal be processed. If 'Char EEG.srcpot will be pro Help What do you want to do v Name it: Save it as file:	yze. If 'Components inels' EEG.data will b cessed. Cancel Dataset info pop_ne with the new dataset? RespWrong	s', data in EEG.icaact will be processed. If 'Sources' OK ewset() Edit description Browse
Some changes have not l	yze. If 'Components inels' EEG.data will b icessed. Cancel Dataset info pop_ne with the new dataset? RespWrong been saved. What do you to ry (set=yes; unset=create a /Users/timmullen/Docume	s', data in EEG.icaact will be processed. If 'Sources' OK wset() Edit description Browse want to do with the old dataset? a new dataset) ents/WORK/C Browse

#### Model Order Selection

4

0	) 💮	EE	GLAB	12.0.0.0	b		
File	Edit	Tools	Plot	Study	Datasets	Help	
	<b>#1: Re</b> Filename Channels Frames p	Chan Filter Re-re Inter Rejec	ge san the da ference polate t conti	npling ra ita ce electrod nuous d	es ata by eye	•	
1	Epochs Events Sampling	Extra Remo	ct epo ove bas	chs seline			
1	Epoch st Epoch en	Run I Remo	CA ove cor	nponent	S		
	Channel ICA weig Dataset	Autor Autor Rejec	matic o matic o t data	hannel i epoch re epochs	rejection jection	•	
		Clear	Line	using iC	A		
		SIFT					
		Locat Peak	e dipo detect	les using ion using	g DIPFIT 2.) g EEG toolb	k ►	ľ
		FMRI Locat	B Tool e dipo	s les using	J LORETA	•	

#### Model Order Selection Assistant :- A 🔲 📑 🖬 Modeling Parameters Segmentation VAR ModelingApproach Vieira-Morf Algorithm WindowLength 0.35 0.03 WindowStepSize TaperFunction rectwin NormalizeData $\overline{\checkmark}$ Detrend DetrendingMethod constant $\checkmark$ SetArgDirectMode ModelOrderRange [1 30] $\checkmark$ Downdate InformationCriteria sbc; aic; fpe; hq Miscellaneous RuninParallel V PlotResults OptimalModelSelectionMethod min 90 PercentileLimits VerbosityLevel 2 Data Selection WindowSamplePercent 80 Algorithm Vieira-Morf Algorithm: Vieira-Morf × ¥ Description: Cancel OK Help ► ing and validation • Model Order Selection Fit AMVAR Model Validate model ►

►



#### 0 0

4

#### Checking MVAR parameters

Some warnings were generated (see below), Continue?

\_\_\_\_\_

\_\_\_\_\_\_

MVAR PARAMETER SUMMARY FOR CONDITION: RespWrong

WARNING: Two model orders specified [1 30]

I assume you are providing a [min max] range for model order selection.

I will use p=(30) for the remaining checks...

WARNING: Ratio of number of parameters to datapoints is 0.174.

If using an unconstrained (unregularized) model fitting apprach: For best results, ratio of number of parameters to datapoints should be < 0.1. I recommend using window length of at least 0.610 sec

OK: Time-Frequency Product is 993.712. This should be greater than p=30

OK: Given your model order of p=30, a maximum of p/2=15.0 frequency components (spectral peaks) can be estimated for each pair of variables







0	0	EE	GLAB	/12.0.0.0	b		
File	Edit	Tools	Plot	Study	Datasets	Help	
Fi Ch Fr	llename nannels cames p	Chan Filter Re-re Inter Rejec	ge sar the da eferen polate t conti	npling ra ata ce electrod inuous d	es ata by eye	Þ	
Epochs Events Sampling Epoch st Epoch en		Extra Remo	ct epo ove ba	chs seline			
		Run I Remo	CA ove co	mponent	ts		
Ch	annel A weig	Auto Auto	matic o matic o t data	channel epoch re	rejection jection		
De	itaset	Rejec	t data	using IC	A	•	
		Clear	Line				
		SIFT				- •	Simulation
		Locat Peak	e dipo detect	les usin ion usin	g DIPFIT 2.x g EEG toolb	x ►	✓ Pre-process Model fitting Connectivity
		FMRI Locat	B Tool e dipo	s les usin	g LORETA	•	Statistics Visualization
							нер

	A↓	
	Modeling Parameters	
ſ		
	Algorithm	Vieira-Morf
	ModelOrder	14
	WindowLength	0.35
1	WindowStepSize	0.03
	TaperFunction	rectwin
1	EpochTimeLimits	0
	WindowSamplePercent	100
	Window Preprocessing	
1	NormalizeData	
T	Detrend	
	DetrendingMethod	constant
	Miscellaneous	
•	Timer	
	SetArgDirectMode	$\checkmark$
,	VerbosityLevel	2
	Help	Cancel OK



#### 0 0 Checking MVAR parameters \_\_\_\_\_\_ MVAR PARAMETER SUMMARY FOR CONDITION: RespWrong \_\_\_\_\_ OK: Ratio of number of parameters to datapoints is 0.081. OK: Time-Frequency Product is 993.712. This should be greater than p=14 OK: Given your model order of p=14, a maximum of p/2=7.0 frequency components (spectral peaks) can be estimated for each pair of variables Cancel Ok 00 Progress Fitting VAR[14] model (Vieira-Morf)... (23%) 47 secs x



Simulation ✓ Pre-processing	٠	
Model fitting and validation	•	✓ Model Order Selection
Connectivity		✓ Fit AMVAR Model
Statistics	►	Validate model
Visualization	×	
Help		







e Calculate Connectivity I	Measures		
1 2 I I I I I I I I I I I I I I I I I I			
Connectivity Estimation			
ConnectivityMeasures	nDTF; dDTF08; nPDC; S	DTE	
▼ Options			
SquaredModulus			
ConvertSpectrumToDecibels			
Frequencies	1:40	dDTF08	
▼ Miscellaneous		ffDTF	
VerbosityLevel	2	PDC	
ConnectivityMeasures		M nPDC	
Connectivitymeasures	-	GPDC	
select measures to estimate.	<b>m</b>	PDCF	
Measures are categorized as follows:		RPDC	
DIRECTED TRANSFER FUNCTION MEAS			
DTE: Directed Transfer Function	OKES		
DTF: Directed Trainer Function		Con	
dDTE: Direct DTE		iCoh	
dDTE09: Direct DTE (with full causal)	normalization)	pCoh	
ffDTE: Eull_frequency DTE	normanzation)	📃 mCoh	
+ PARTIAL DIRECTED COMERENCE MEAS		<b>✓</b> S	
PDC: Partial Directed Coherence	UKES I		
nPDC: Normalized PDC			
CPDC: Ceneralized Partial Directed (	oberence	Cancel	ОК
PDCE: Partial Directed Coherence Fa	ctor		
RPDC: Renormalized Partial Directed	Coherence		
+ GRANGER-GEWEKE CAUSALITY MEASU	RES		
GGC: Granger-Geweke Causality			
+ SPECTRAL COHERENCE MEASURES			
Coh: Complex Coherence			
iCoh: Imaginary Coherence			
pCoh: Partial Coherence			
mCoh: Multiple Coherence	•		
+ SPECTRAL DENSITY MEASURES	×		
S: Complex Spectral Density	Y		
		2	
Help Cancel	ОК		
Progress		-	
Estimating connectivity for RespWrong	(14%) 33 sec	s	
	>	٢	

#### Visualization: Time-Frequency Grid



8

0	00	Time Frequency Grid Options
:	. ≙↓ . 📼 . ➡‡ ₽:	
	DisplayProperties	
▼	MatrixLayout	Partial
	UpperTriangle	dDTF08
	UT_ColorLimits	100
	LowerTriangle	dDTF08
	LT_ColorLimits	100
	Diagonal	S
	D_ColorLimits	100
	AllColorLimits	99.7
	TimesToPlot	[-0.826171875 1.060
	FrequenciesToPlot	[1:40]
	PlotContour	
	PlottingOrder	0
	SourceMarginPlot	dipole
	NodeLabels	0
	EventMarkers	{{0, 'r', ':', 2}}
	FrequencyScale	linear
	Colormap	[0 0 0.50666666666
▼	Thresholding	
▼	Thresholding	Simple
	PercentileThres	nold [97.5 3]
	AbsoluteThresh	old []
▼	DataProcessing	
	Baseline	[-1 -0.25]
	Smooth2D	
▼	Miscellaneous	
	DipolePlottingOptic	ons
▼	FrequencyMarker	5
	FrequencyMarkers	[3 7 15]
	FrequencyMarkerC	olor [0.7 0.7 0.7]
•	TextAndFont	
Ra	seline	
Ti	me range of basel	ine [Min Max] (sec) Will subtract baseline from
62	ch noint. Leave h	ank for no baseline
a	en ponte ceave bi	and for no busefine.
_		

Help

Cancel

ОК



Frequency (Hz)







Frequency (Hz)

#### Visualization: Causal BrainMovie3D



\varTheta 🔿 🔿 BrainMovie3D Cont	rol Panel
File	
Load Config #L	
Save Config #S	
Datarrocessing	
ConnectivityMethod	dDTF08
MovieTimeRange	[-0.826171875 1.0
FrequenciesToCollapse	1:15
FreqCollapseMethod	max 👻
TimeResamplingFactor	0
SubtractConditions	
Baseline	0
DisplayProperties	
ShowNodeLabels	
NodeLabels	12345678
NodesToExclude	
EdgeColorMapping	PeakFreq
EdgeSizeMapping	Connectivity
NodeColorMapping	Outflow
NodeSizeMapping	Power
FooterPanelDisplaySpec	ICA_ERPenvelope
ICs	1; 2; 3; 4; 5; 6; 7; 8
BackProjectToChans	A1; A2; A6; A7; A8; 👻
FooterPanelDisplaySpec	
Configure footer panel displayed at the	ne bottom of the 🛛 🔼
figure. If 'off', don't render footer. If '	'ICA ERP Envelope'.
then display the ERP envelope of back	projected <b>T</b>
- Preview BrainMovie	
Select a time point to image	(click to refresh)
0.926172	
-0.020172 -0.0058593	0 1.0005
Help Cancel	

#### Visualization: Causal BrainMovie3D



Bra	inMovie3D Con	trol Panel
File		
• Ai i en i n* n*		
2* : = : * * * *		
DataProcessing		IDTERA
ConnectivityMethod		dD1F08
Movie LimeRange		[-0.8261/18/5 1.0
Frequencies I oCollap	ose	1:15
FreqCollapseMethod		max
TimeResamplingFac	tor	0
SubtractConditions		
Baseline DisplayBromenties		U
Showblodel abels		
Nodel abels		12345678
NodesToExclude		12343078
EdgeColorManning		PeakFreg
EdgeSizeManning		Connectivity
NodeColorManning		Outflow
NodeSizeManning		Power
FooterPanelDisplayS	Dec	ICA ERPenvelope
ICs		1: 2: 3: 4: 5: 6: 7: 8
BackProjectToCha	ans	A1: A2: A6: A7: A8:
PlotMode		all; envelope
EnvelopeColor		[1 0 0]
BrainMovieOptions		
ImageSize		[800 800]
Visibility		on
ShowCameraMen	u l	
RotationPath3D		
InitialView		[122 36]
MakeCompass		
ProjectGraphOnM	IRI	off
Theme		
theme		classic
Layers		-
▶ Scalp		
Skull		
Configure footer pane igure. If 'off', don't r hen display the ERP of Proview BrainMovie	<b>pec</b> el displayed at t render footer. If envelope of bacl	he bottom of the 'ICA_ERP_Envelope', kprojected
Select	t a time point to image	e (click to refresh)
-0.826172	-0.005859	38 1.06055
Hab		

#### Visualization: Causal BrainMovie3D







1. Explore changing some of the Time-Frequency Grid parameters. Try plotting the TF-Grid with logarithmic frequency spacing (option: FrequencyScale). Change the SourceMarginPlot to "topoplot" to see your ICA topographic plots.

2. Explore different parameters for the BrainMovie3D. What is different between delta (1-3 Hz) and theta (3-7 Hz) band connectivity?

3. Recompute connectivity for the RespWrong condition, selecting the Coherence (Coh) and Partial Coherence (pCoh) methods in addition to the original nPDC, nDTF, dDTF08, and S methods. Create a Time-Frequency Grid laying out Coherence (Coh) on the UpperTriangle, Partial Coherence (pCoh), on the LowerTriangle and the ERSP (S) on the diagonal. Use a baseline of [-1 -0.25]. What is different between coherence and partial coherence? Create another Time-Frequency Grid with dDTF08 on the Upper and Lower Triangles. What is different between coherence and dDTF (Granger-Causality)?

4.Redo the entire pipeline (Steps 1-9) for the RespCorrect condition (located in same /Data folder as RespWrong). Select both conditions in EEGLAB (Datasets-->Select Multiple Datasets). Create a Time-Frequency Grid. Choose to the plot the difference RespWrong-RespCorrect (option: PlotConditionDifference->ConditionOrder) with the dDTF08 on the Upper and Lower Triangle and ERSP on the diagonal.

5. Advanced Users: Try executing the previous pipeline entirely from the command line. Consult <sift\_root>/scripts/ScriptingExample\_1\_0b.m for guidance.

Visualization of condition differences

#### Select RespWrong and RespCorrect datasets



## Visualization of condition differences



😝 🔿 🌕 Time I	Frequency Grid Options
DisplayProperties	_
PlotConditionDifference	
ConditionOrder	RespWrong-RespCorr
MatrixLayout	Partial
UpperTriangle	dDTF08
LowerTriangle	dDTF08
Diagonal	S
ColorLimits	99.7
TimesToPlot	[-0.80078125 1.03125]
FrequenciesToPlot	[2:40]
PlotContour	
PlottingOrder	0
SourceMarginPlot	dipole
NodeLabels	{'8', '11', '13', '19', '20
EventMarkers	{{0, 'r', ':', 2}}
FrequencyScale	linear
Colormap	jet(300)
▼ Thresholding	
▼ Thresholding	Simple
PercentileThreshold	[97.5 3]
AbsoluteThreshold	0
▼ DataProcessing	
Baseline	[-1 -0.25]
Smooth2D	
▼ Miscellaneous	
DipolePlottingOptions	
▶ FrequencyMarkers	
▶ TextAndFont	
ConditionOrder	
Order in which to take dif	fference.
Help	Cancel OK







