

**BrainVoyager™ QX**

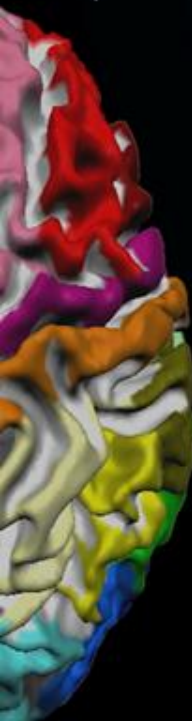


*The brain imaging analysis  
and visualization tool for Windows*

Version 1.10

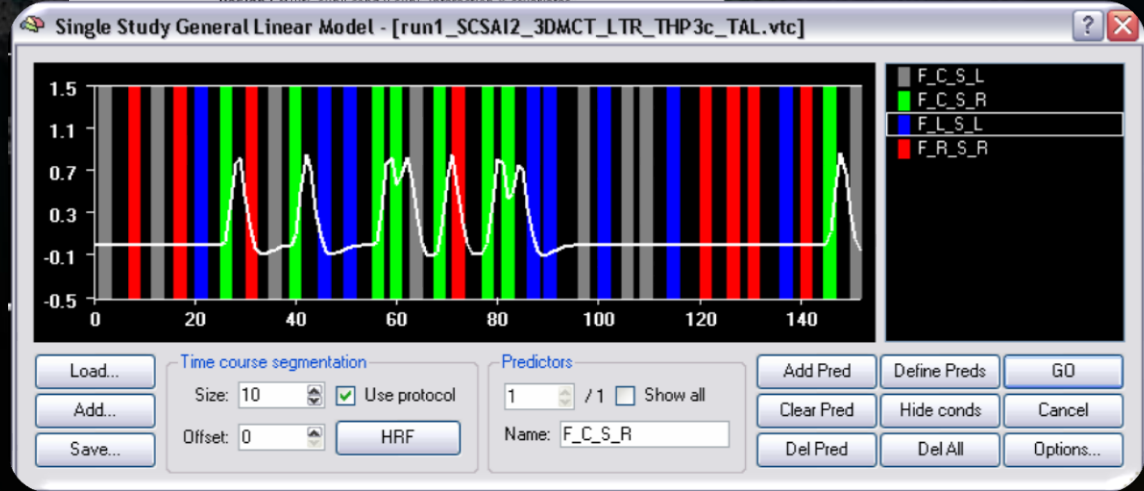
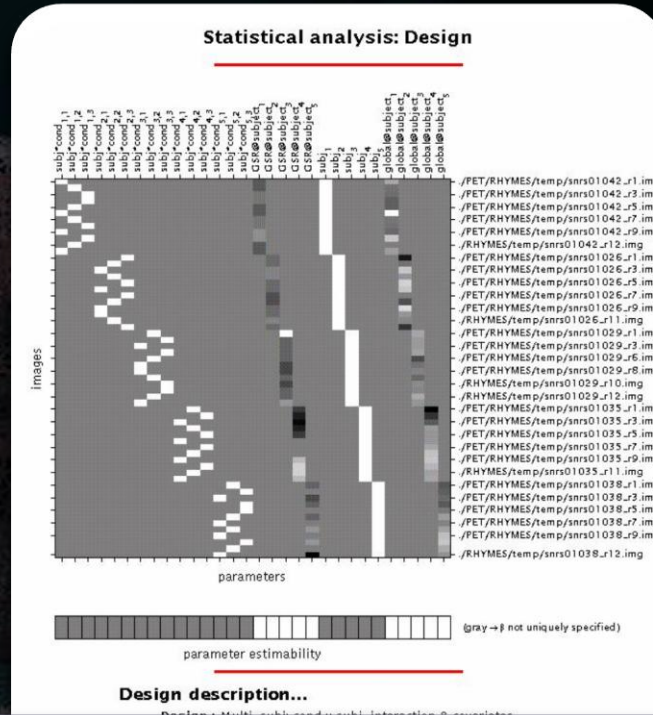
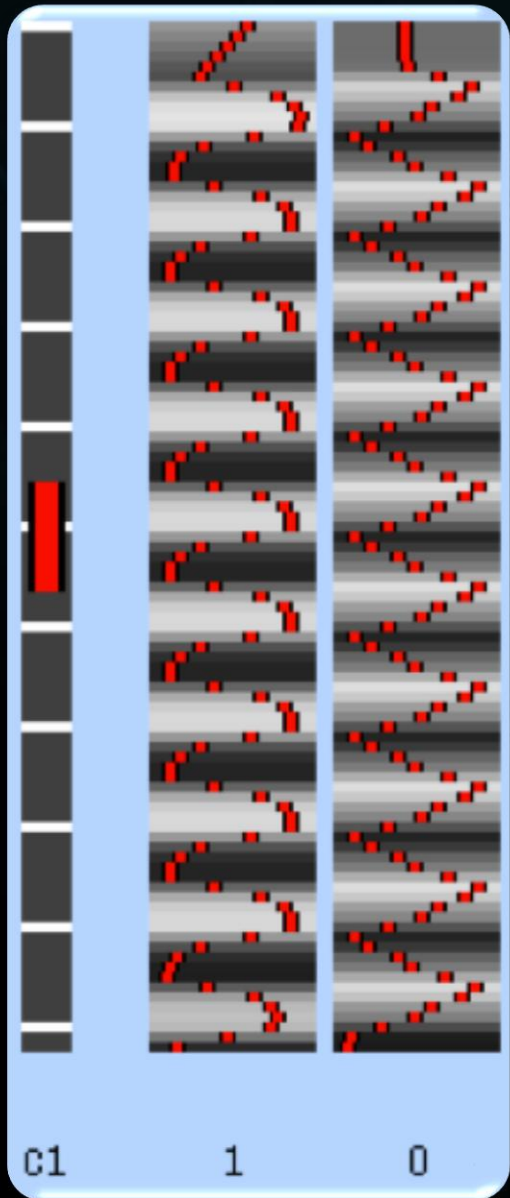


Copyright © 2001-2008 Rainer Goebel

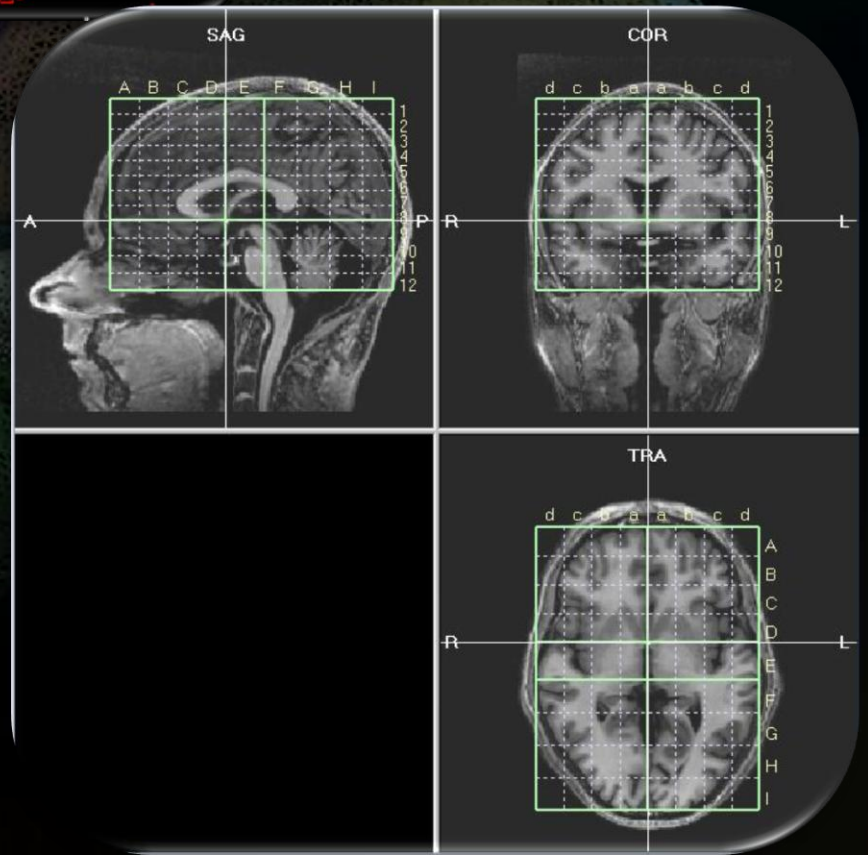
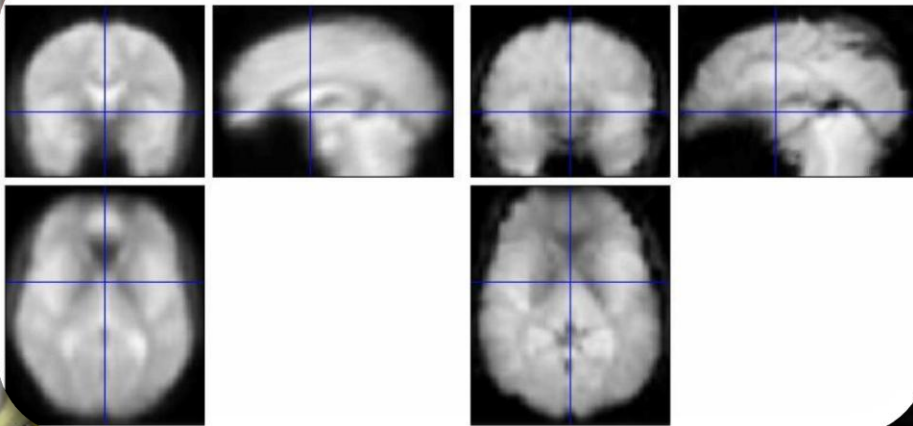
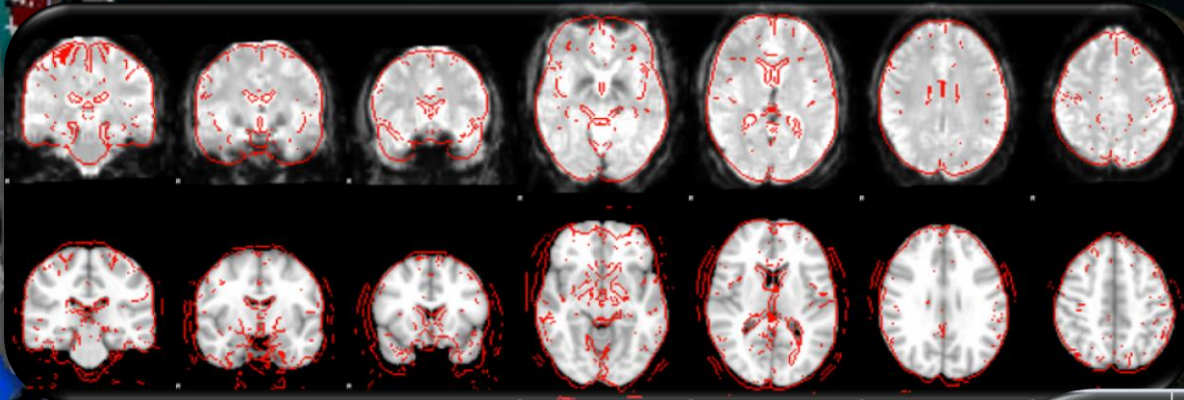


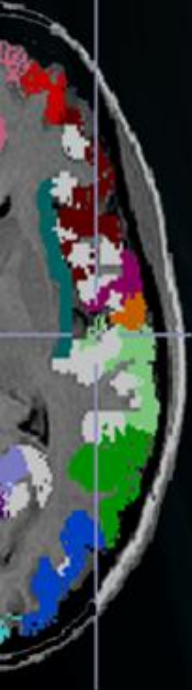
**Matt Wall**

# Modelling



# Spatial Normalisation





	<b>BV</b>	<b>SPM</b>	<b>FSL</b>
<b>Platform</b>	All	All	Unix
<b>Cost</b>	\$\$\$	Free (\$)	Free
<b>Interface</b>	GUI/script	GUI/Matlab	GUI/Shell
<b>Norm.</b>	Talairach	MNI	MNI
<b>Documentation</b>	Good(ish)	Improving	Non-existent
<b>Speed</b>	V. Fast	Slow(ish)	Fast
<b>Visualisation</b>	Great	OK (add-ons)	Good
<b>Advanced Features</b>	Built-in	Add-on Toolboxes	DIY
<b>Development</b>	Agile	Cathedral	KISS/WIS

# BV: Interface

The screenshot displays the BrainVoyager QX software interface. The main window shows a 3D volume rendering of a brain with three orthogonal views: SAG (Sagittal), COR (Coronal), and TRA (Transverse). A 3D Volume Tools dialog box is open, showing Talairach coordinates (X: 0, Y: 0, Z: 0) and buttons for Close, Full Dialog, Link VMRs, and Surf Module. The left sidebar shows a file tree with categories like Recently opened FMR's, DMR's, VMR's, VTC's, and SRF's. The bottom status bar displays: Voxel: x = 128 y = 128 z = 3 Intensity = 10.

BrainVoyager QX

File Analysis Options Volumes Meshes Scene DTI EEG-MEG Plugins Scripts View Window Help

Project Wizard New Project Open Save Files Pane Log Pane Info Pane Preferences Full Screen User's Guide Edit Scripts

Recent Files

AyaS\_MDEFT\_IC1\_TAL2.vmr

3D Volume Tools

Talairach coords

X: 0

Y: 0

Z: 0

Close

Full Dialog >

Link VMRs

Surf Module

Script Editor - bvqx\_v1.9.qsa

```
File Edit
```

```
New_v12.qsa New_v13_Part1.qsa New_v13_Part2.qsa New_v16.qsa New_v19.qsa
```

```
Defined Functions
```

```
StartUpScript()
Welcome_To_Scripting()
Open_VMR()
Invert_VMR_Intensities()
Create_FMR_Project()
Create_VMR_Project()
Create_AMR_Project()
Preprocess_FMR()
MotionCorrection()
Close_Active_Document()
CheckDoc(Doc)
Move_Window()
Welcome_Dialog()
MotionCorrectionISA()
OpenVMRAndLinkVTC()
LoadVMRAndSRF()
ChangeViewpoint()
CreateVTCFile()
CreateVTCFileInVMRSpace()
MakeProtocol()
CreateDesignMatrix()
OverlayContrasts()
CreateMultiStudyDesignMatrix()
TestLinkAMR()
TestAutoIsoVoxelAndToSag()
TestNewSliceTiming()
TestRenameDicom()
TestCreateProjectDMR()
```

```
// New commands v19:
// - RenameDicomFilesInDirectory(directory)
// - CreateProjectDMR() and CreateProjectMosaicDMR() sup
// - BrowseDirectory() and BrowseFile() to get folder/F
// these convenience functions block processing and st

function TestRenameDicom()
{
    var bvqx = Application.BrainVoyagerQX;
    strFolder = bvqx.BrowseDirectory("Select Directory");
    bvqx.RenameDicomFilesInDirectory(strFolder);
}

function TestCreateProjectDMR()
{
    var bvqx = Application.BrainVoyagerQX;
    strFile = bvqx.BrowseFile("Select First DICOM File");
    if(strFile == "")
        return;
    var docDMR = bvqx.CreateProjectMosaicDMR("DICOM", str
    docDMR.SaveAs("Test.dmr");
    !!!
}
```

Max files shown: 7

```
// BrainVoyager QX started on Wed 9. Feb 06:48:56 2011
// Code can be used as basis for scripts (macro recording)
// Information is placed in comments ("//")
// Use mouse selection and the context menu to copy text

BrainVoyagerQX.OpenDocument("I:/MRIdata/ref_anatomies/as_mdeft/AyaS_MDEFT_IC1_TAL2.vmr");
```

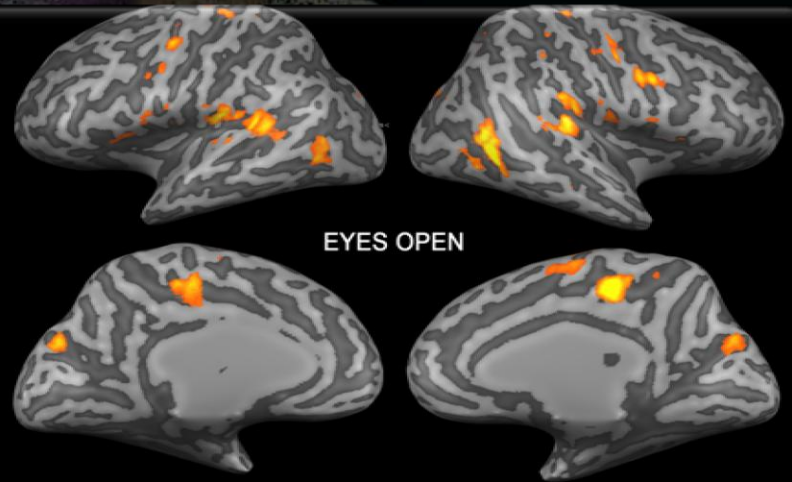
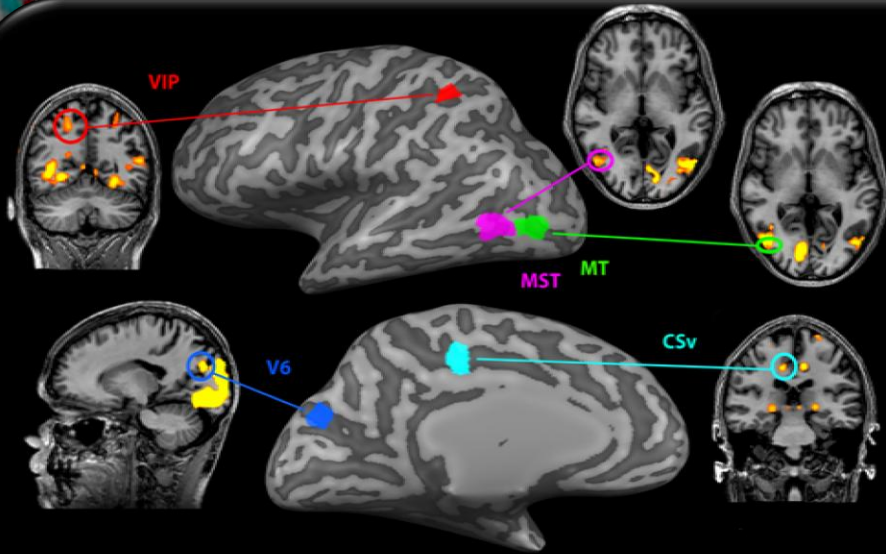
Voxel: x = 128 y = 128 z = 3 Intensity = 10

# BV Key Features

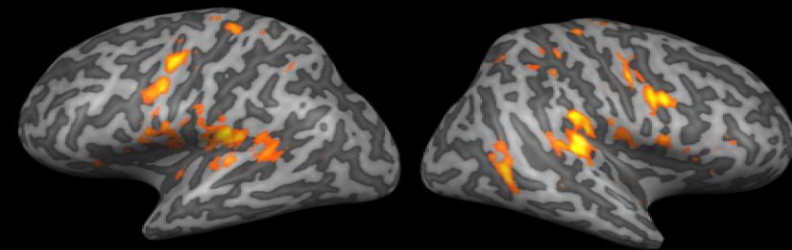
- Modalities: (f)MRI, DTI, EEG, MEG, TMS Navigation
- Extremely fast – highly optimized (multi-core support)
- Automated cortical segmentation, reconstruction, flattening
- Model (GLM) and data (ICA) based analyses in volume and surface spaces
- Advanced ROI/time-course tools
- Connectivity Analyses (GCM), MVPA analyses.
- Proprietary file formats
- Movie Studio!



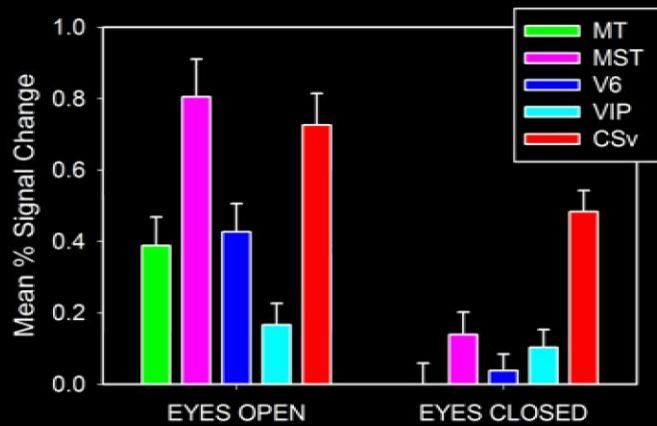
# ROI Analyses



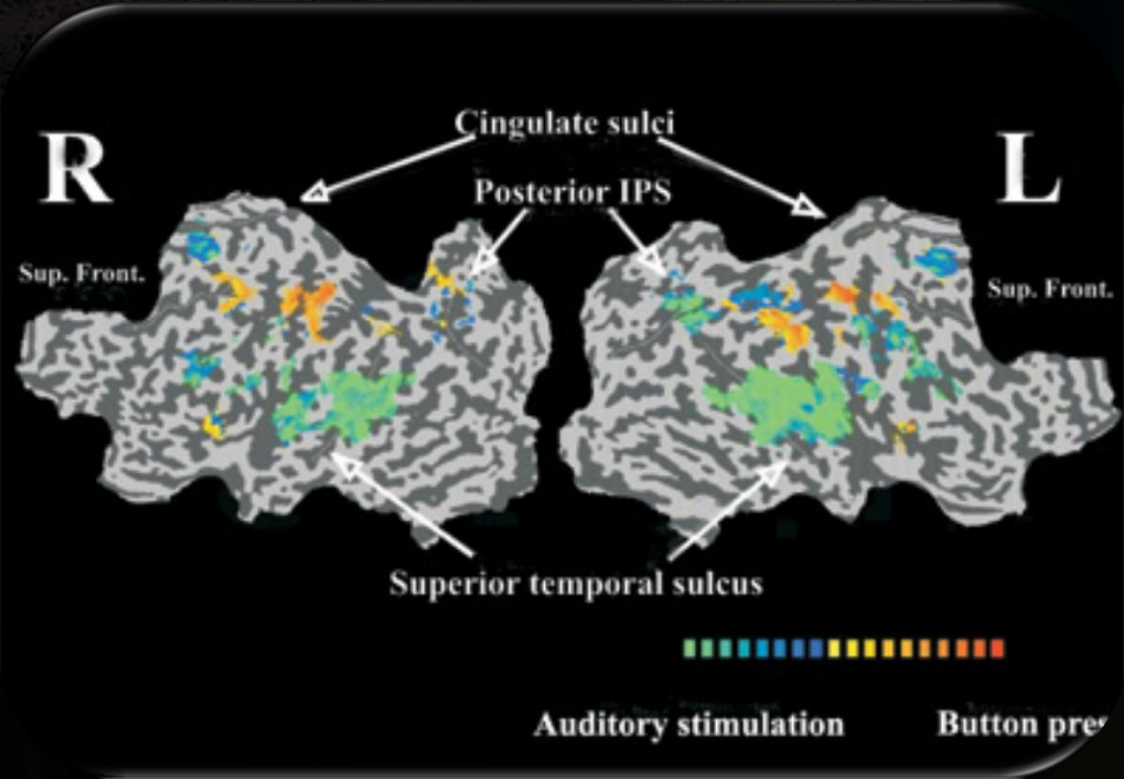
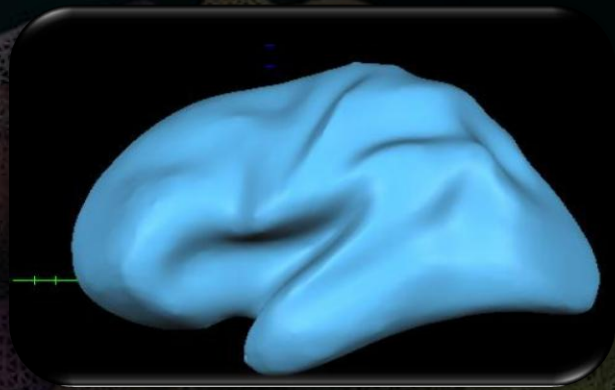
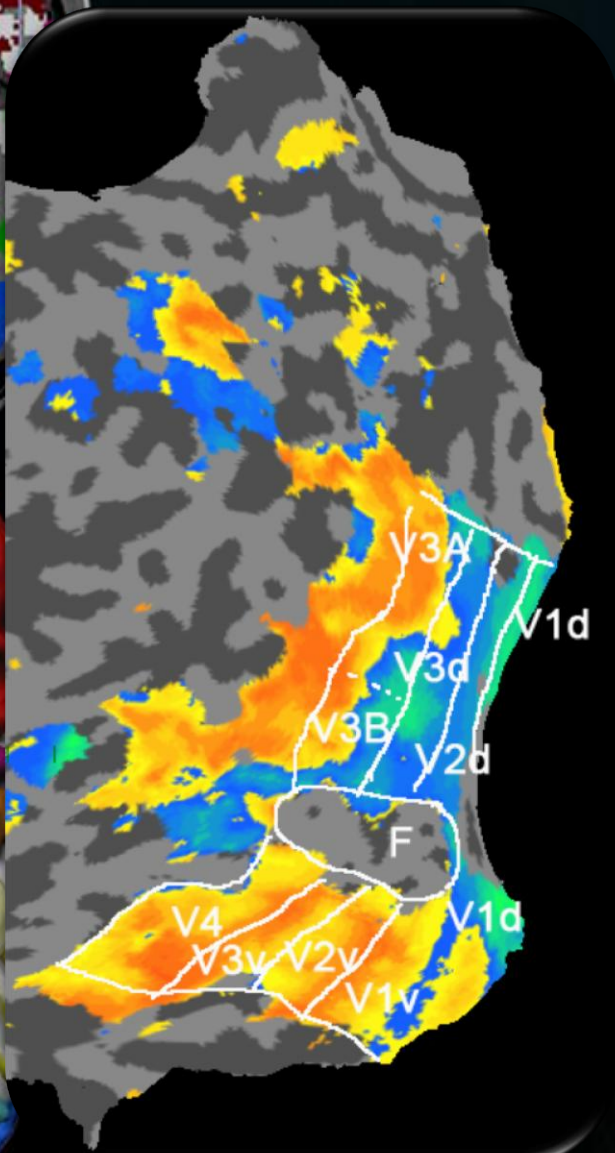
EYES OPEN



EYES CLOSED

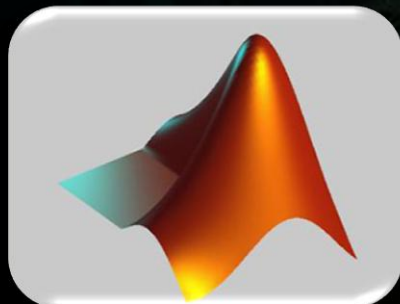
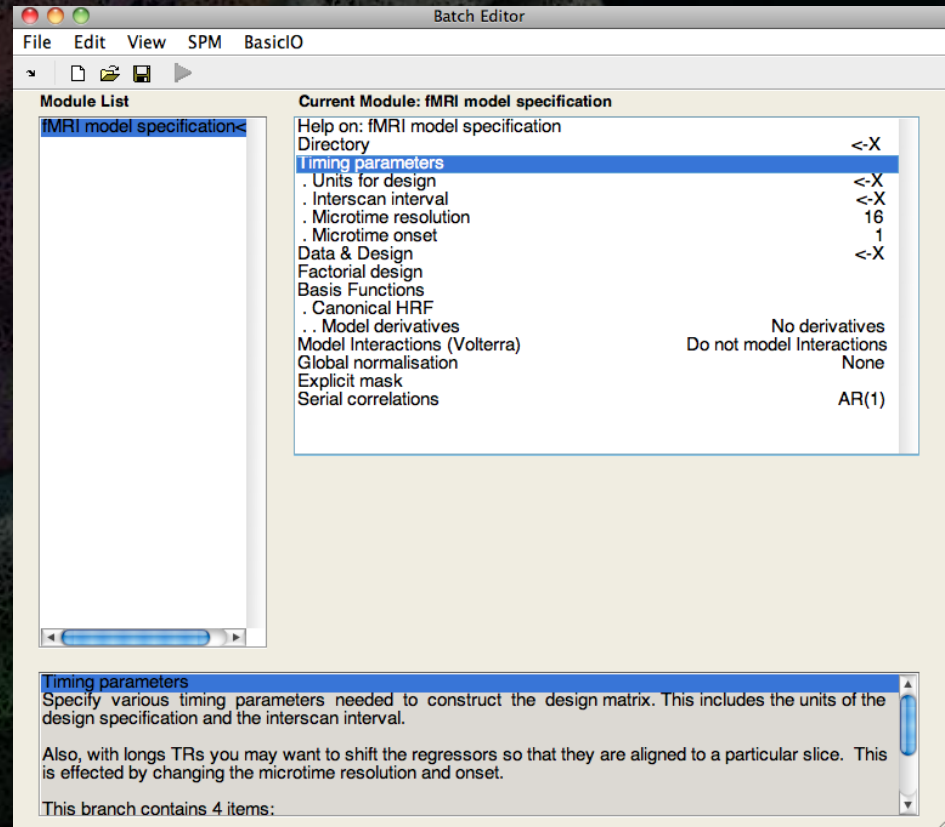
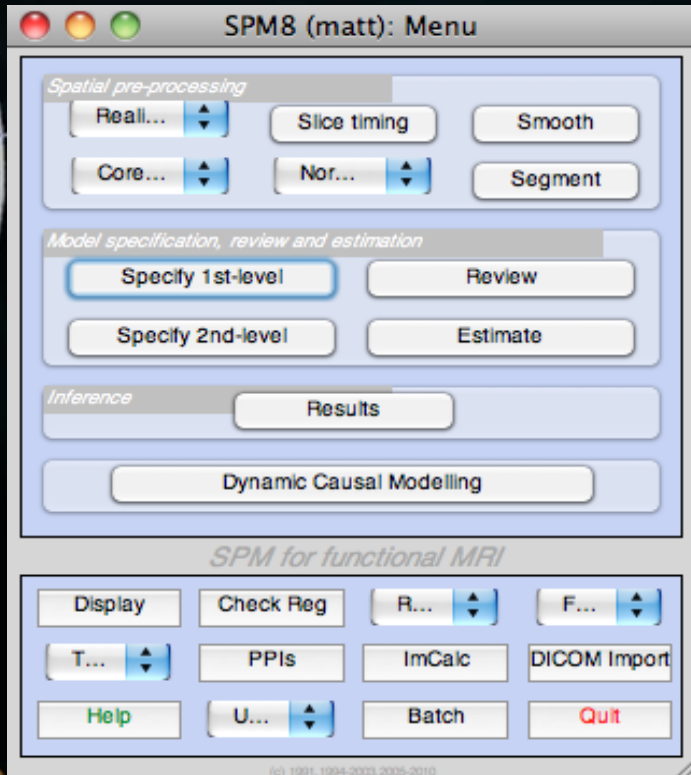


# Cortical Inflation/Flattening





# SPM8 Interface

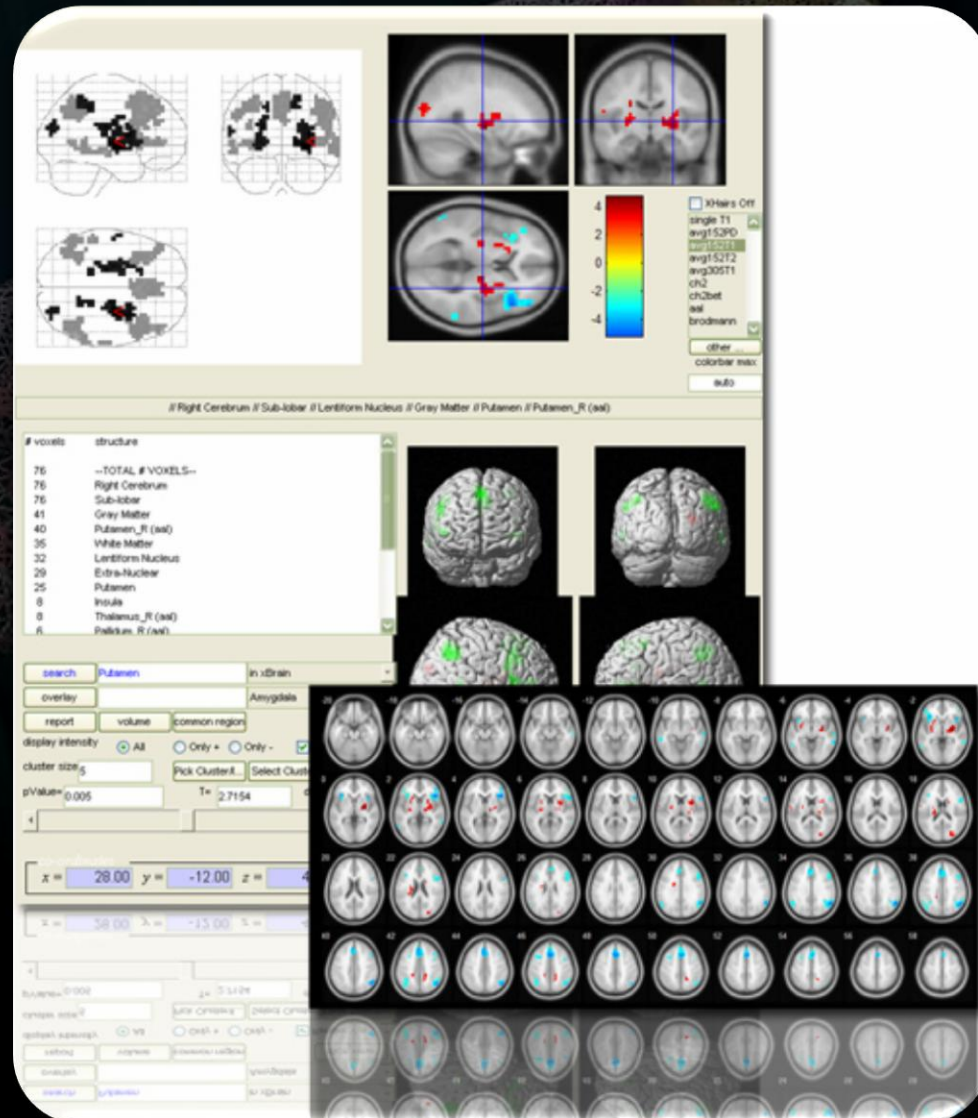


# SPM Key Features

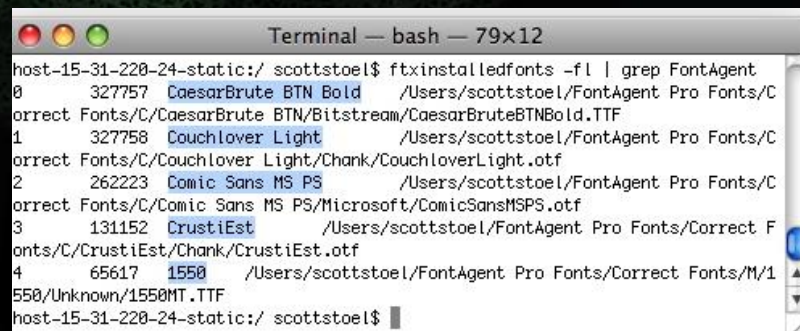
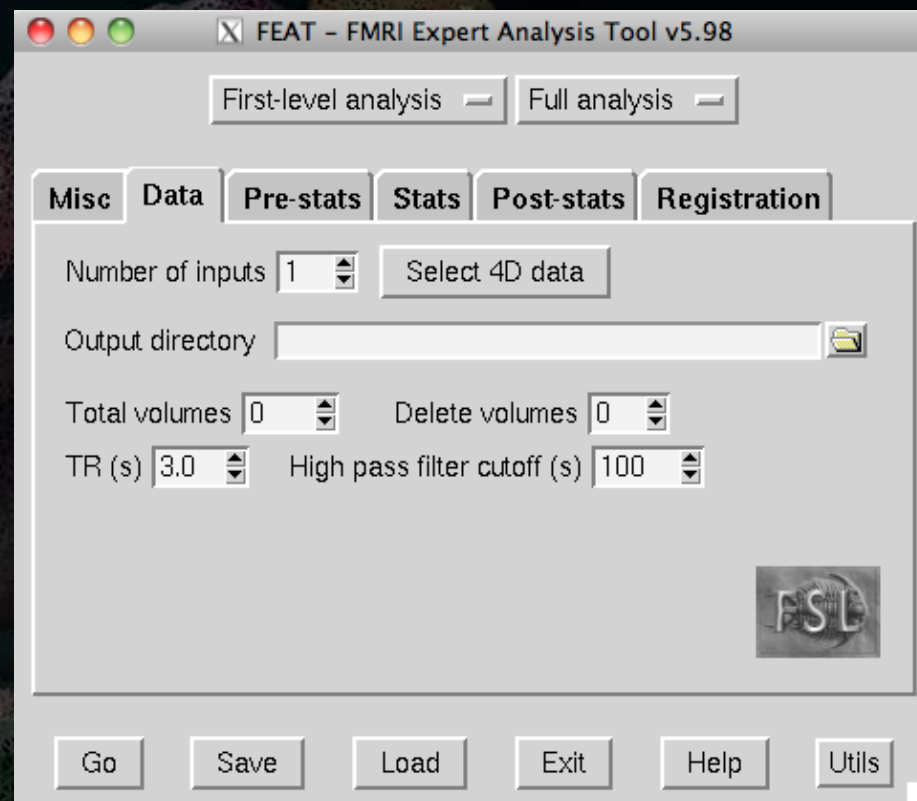
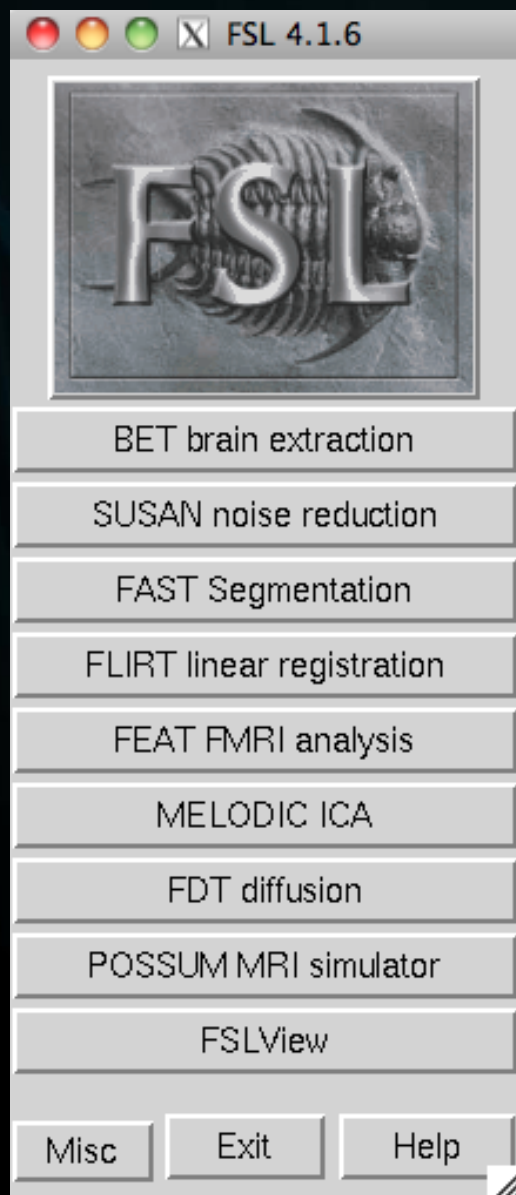
- Modalities: fMRI, PET, SPECT, EEG, MEG
- Built-in Batching Tool
- In-line help system
- ROI/time-course analyses (using MarsBar)
- Hundreds of add-ons available
- Connectivity Analyses (DCM)
- Innovative methods (Multivariate Bayes, Canonical Variates analysis, Topological FDR... Etc.)
- Open file formats



# XJView for SPM



# FSL Interface



# FSL Key Features

- Modalities: (f)MRI, DTI
- Very clean interface
- Fast (runs native on Unix)
- Stand-alone viewer program (FSLView)
- Suite of tools for low-level data manipulation
- Easy connectivity analyses (P-ICA)
- Surface-based features (using FreeSurfer)
- Open file formats



# FSLView

The screenshot displays the FSLView application window. The main view is titled "Ortho view" and shows three orthogonal slices of a brain MRI volume: a coronal slice (top-left), a sagittal slice (top-right), and an axial slice (bottom-left). The slices are labeled with anatomical directions: S (Superior), I (Inferior), R (Right), L (Left), P (Posterior), and A (Anterior). The interface includes a toolbar with various manipulation tools and a status bar at the bottom showing the coordinate space as MNI\_152.

An "Overlay Information Dialog" is open in the bottom-right corner, displaying the following information:

- Basic image information**
  - Name: avg152T1\_brain
  - Filename: /usr/local/fsl/data/standard/avg152T1\_brain
  - Voxels: 91 x 109 x 91
  - Dimensions: 2 x 2 x 2 mm
  - Volumes: 1
  - Data type: Signed short (16 bpp)
  - Image type: Unknown
- Lookup table options**
  - Greyscale (selected)
  - Greyscale (unchecked)
- DTI display options**
  - Display as: None
  - Modulation: None

The dialog also includes a "Help" button and a "Close" button.

At the bottom of the main window, the coordinate space is set to MNI\_152. The current slice coordinates are X: 45, Y: 54, Z: 45. The volume is 0, and the intensity is 5391.

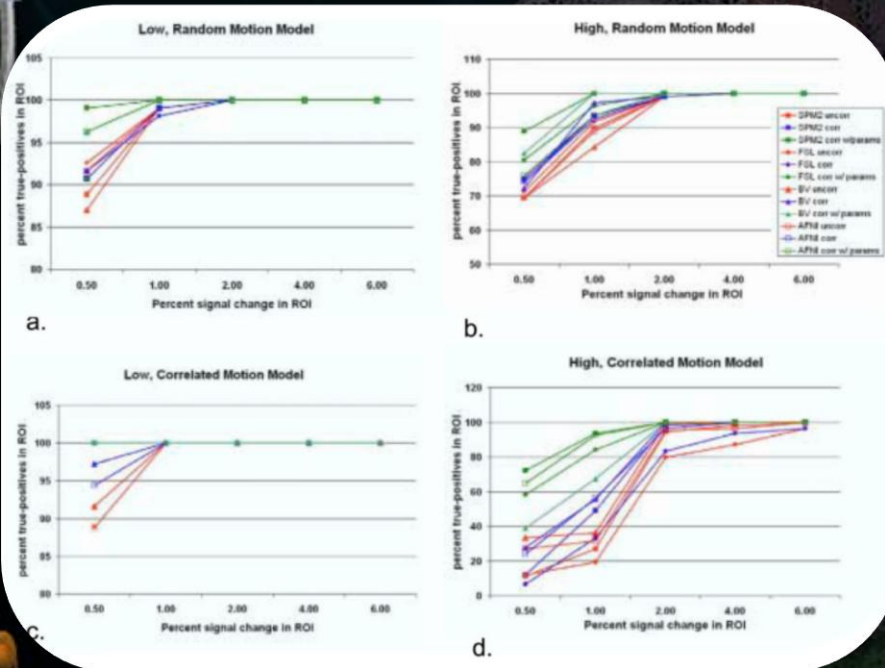
# FSL Tools

- **fsl2ascii** - convert image files to ASCII text file (or files if data is 4D).
- **fslcc** - run cross-correlations between every volume in one 4D data set with every volume in another (for investigating similarities in ICA).
- **fslchfiletype** - used to change the file type of an image (e.g. from ANALYZE\_GZ to NIFTI). The first argument is the desired file type (or given then the input file is converted in place. This in place conversion removes the original files: e.g. for an Analyze file called stdimg the an image with the same basename and different filetypes (e.g. stdimg.nii.gz and stdimg.hdr and stdimg.img) creates many problems for
- **fslcomplex** - a utility that allows 3D or 4D complex image files to be split or constructed from corresponding real components (either C first and last 3D volumes to be processed when the input is 4D (default is to do all volumes).
- **fslcpgeom** - copy certain parts of the header information (image dimensions, voxel dimensions, voxel dimensions units string, image o properly. Copying from different files will result in loss of information or potentially incorrect settings.
- **fslcreatehd** - creates a new image header along with a zero intensity data image. There are two forms of input: one takes a list of mini version is: x/y/z/tsize for image dimensions, x/y/zvoxsize for voxel dimensions (eg in mm), tr in seconds for time between volumes (for 3D type (the commonest are: 1=binary, 2=unsigned char, 4=signed short, 8=signed int, 16=float). Note that this is *different* from the previous
- **fsledithd** - allows the header information in and image to be edited in a text-based xml-style format (like the output of `fslhd -x` but with specified by the second argument.
- **fslfft** - outputs the Fast-Fourier Transform (or inverse) for a complex input volume.
- **fslhd** - report every field of an Analyze or Nifti header (note that the fields are different although some are common, e.g. pixdims). The o internally in FSL programs and are sometimes different from the raw values stored in the file to avoid incorrect settings (e.g. dimN has a
- **fslinfo** - report a basic subset of an Analyze or Nifti header.
- **fslinterleave** - interleave two inputs to form a combined image.

...and many more!

# Comparison of fMRI statistical software packages and strategies for analysis of images containing random and stimulus-correlated motion

Victoria L. Morgan, Ph.D.<sup>1</sup>, Benoit M. Dawant, Ph.D.<sup>1,2</sup>, Yong Li, M.S.<sup>2</sup>, and David R. Pickens, Ph.D.<sup>1</sup>



- 2007, *Computerized medical imaging and graphics*

- Compared SPM, BV, FSL and AFNI

	Friedman P	UNCORR mean rank	CORR mean rank	CORR WITH PARAMS mean rank
SPM2	0.002	1.40	2.00*	2.60**
AFNI	0.014	1.45	1.95*	2.60**
BV	0.393	1.70	2.10	2.20
FSL	0.368	1.75	1.95	2.30



# Functional Imaging Analysis Contest

- Special issue of *Human Brain Mapping* (27)

## Dataset:

- Experiment 1: subjects heard the same sentence 2-4 times (E-R design, ITI=14.4s)
- Experiment 2
  - Block Design – 6 sentences to a block, same/different sentences or same/different speaker
  - E-R design – one sentence presented every 3333ms (?). Same conditions.

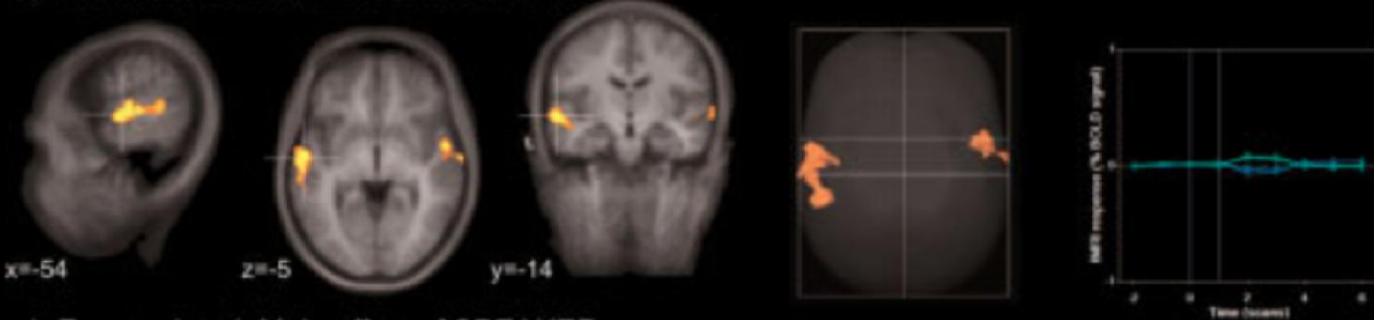


# FIAC: BV

a) Block: Main effect of SENTENCE



b) Event-related: Main effect of SENTENCE



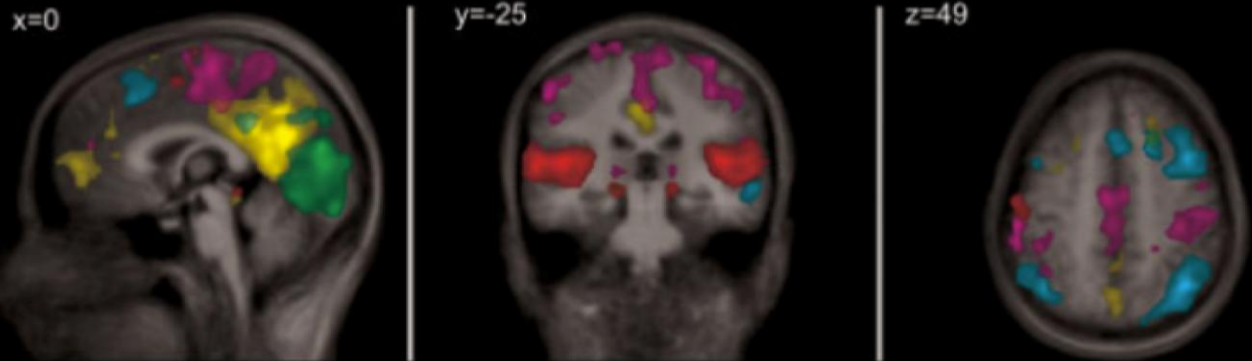
c) Event-related: Main effect of SPEAKER



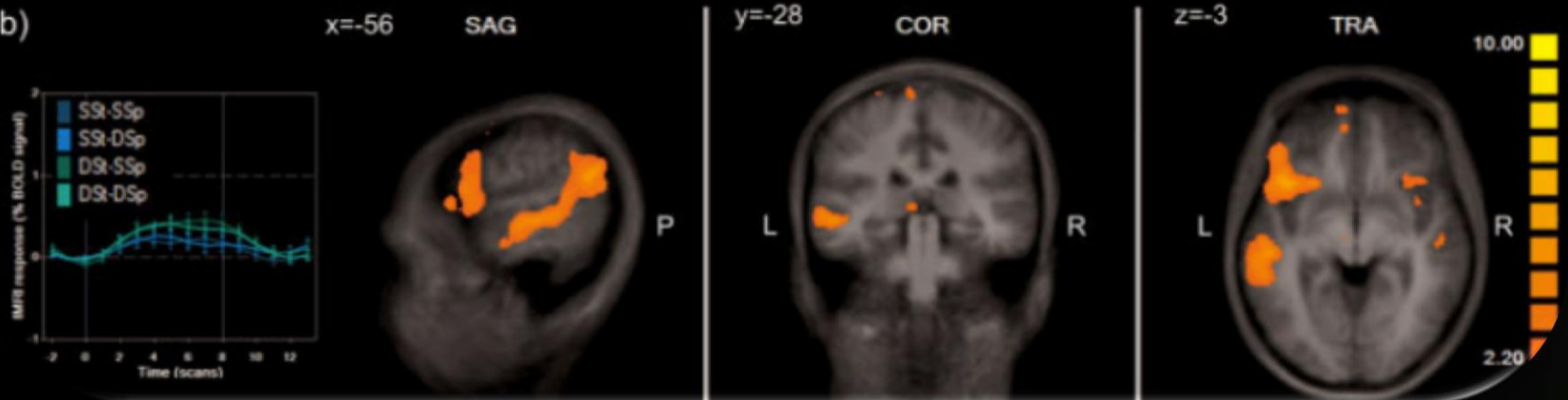
# FIAC: BV

## Self-organizing Group ICA

- Auditory
- Parieto-frontal
- Parieto-cingulate
- Occipital
- Sensory-motor

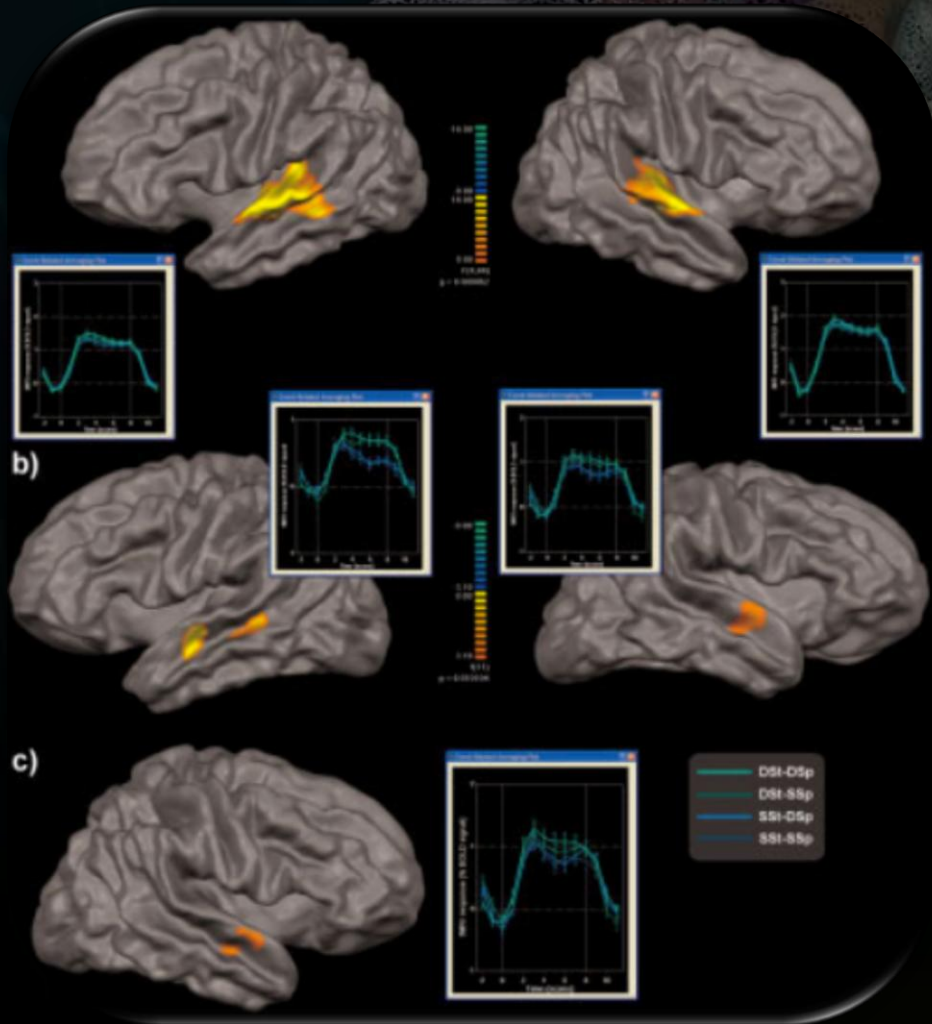
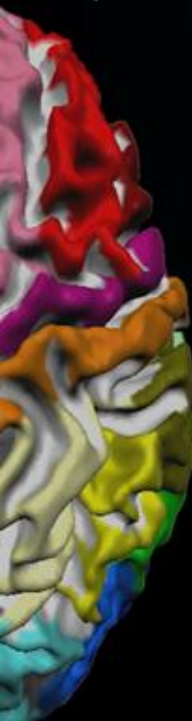
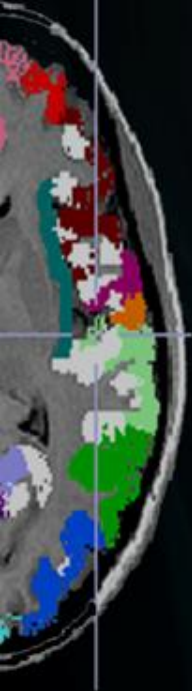


b)



Temporo-frontal component (speaker effect)

# FIAC: BV



All Stimuli

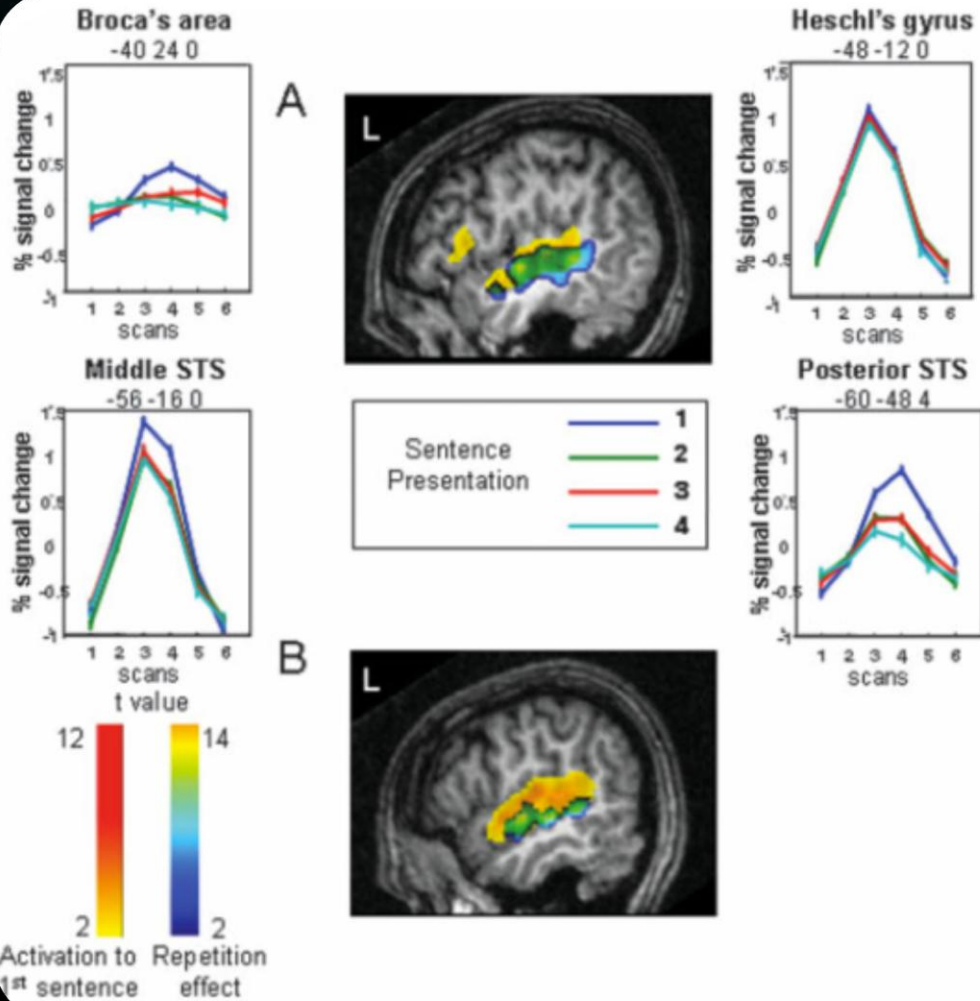
Sentence Repetition

Speaker Repetition

# FIAC: SPM

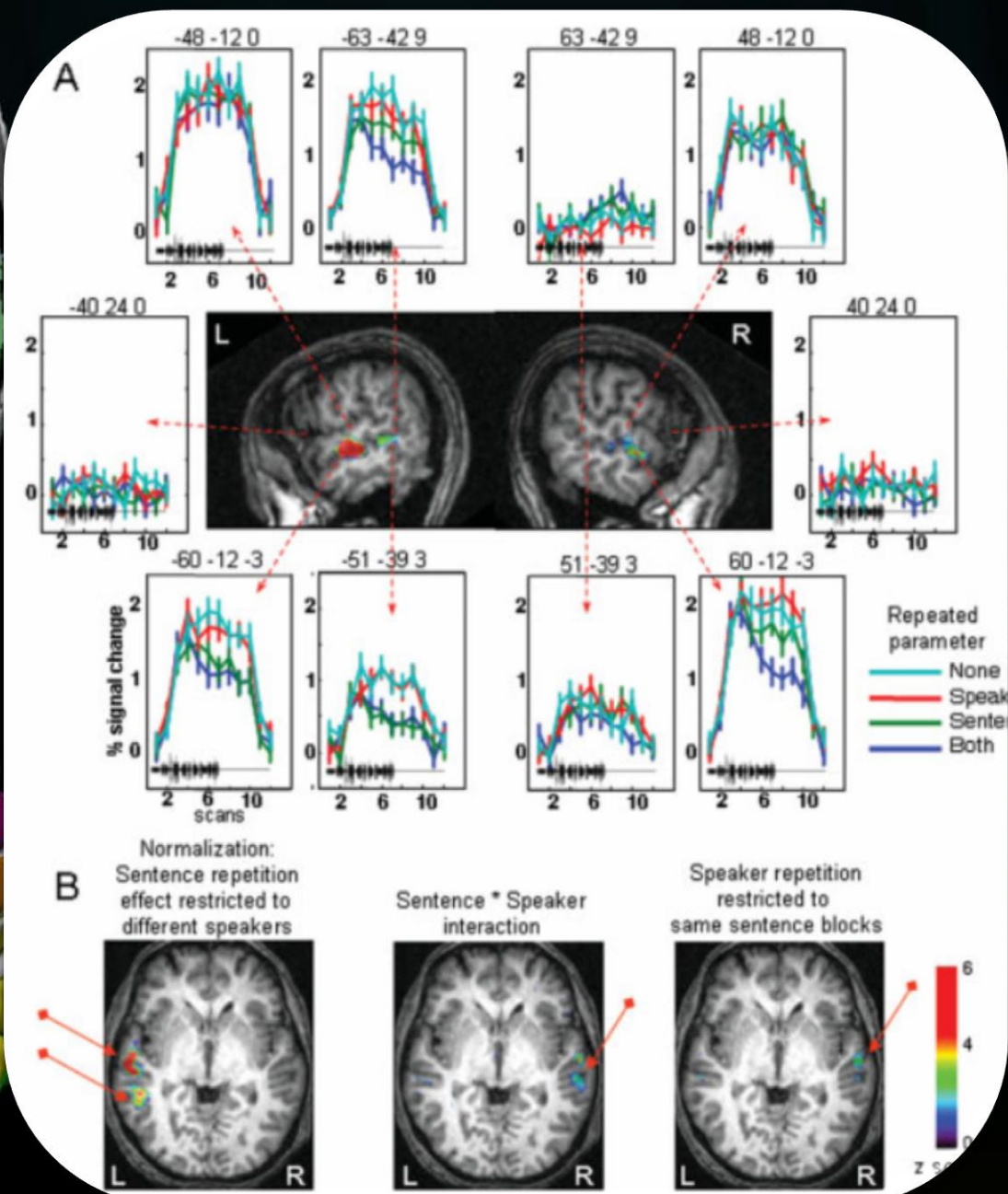
Experiment 1

Experiment 2

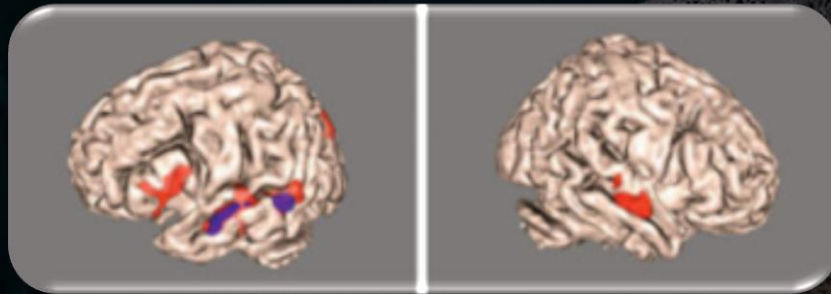


# FIAC: SPM

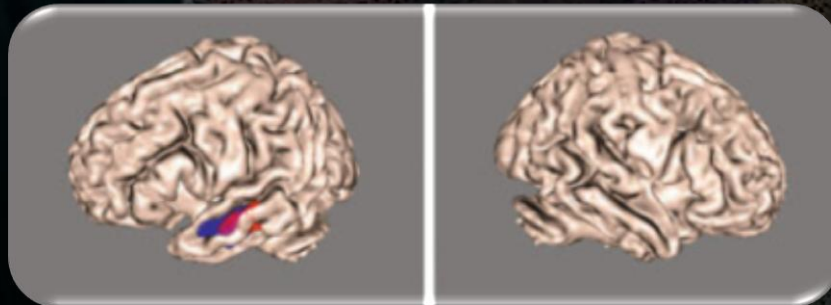
## Experiment 2



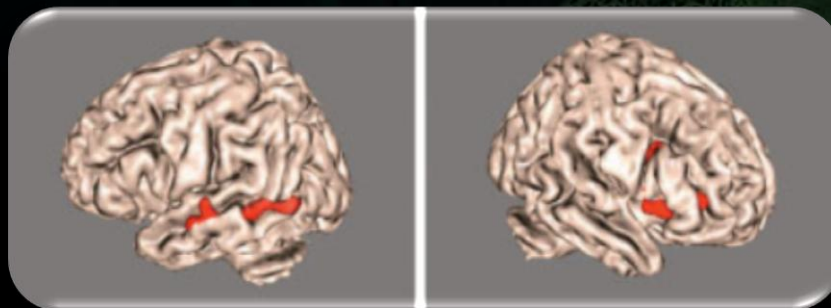
# FIAC: FSL



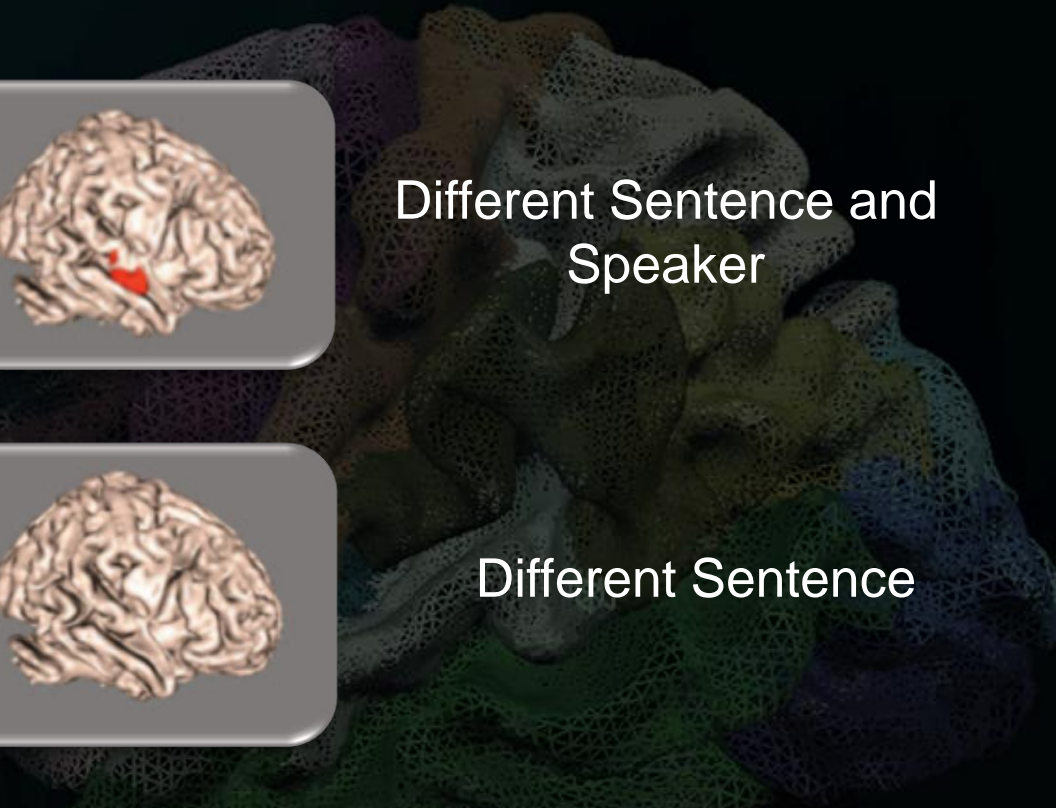
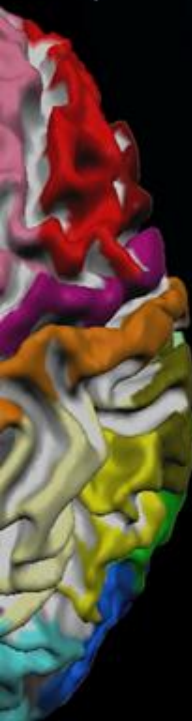
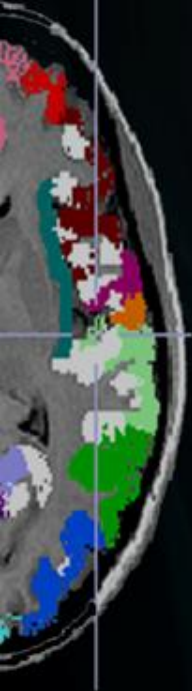
Different Sentence and  
Speaker



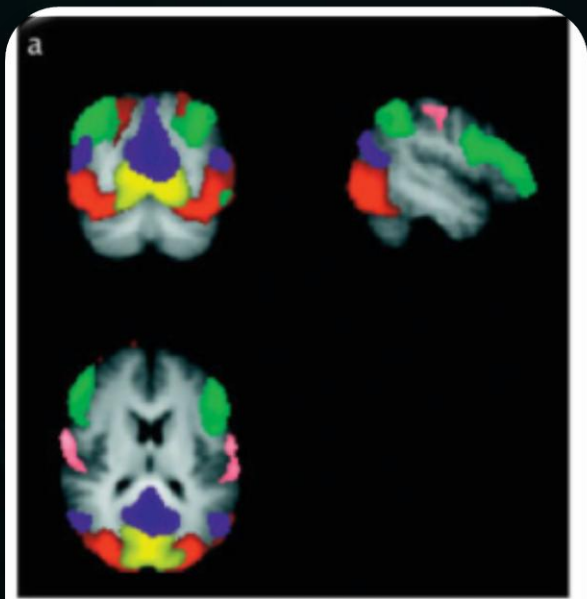
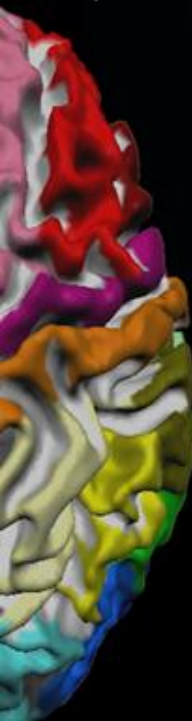
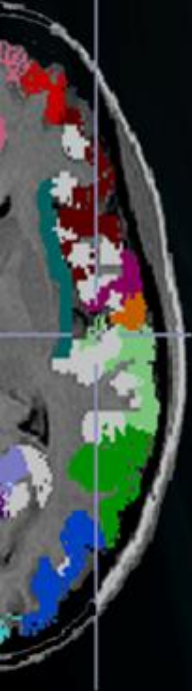
Different Sentence



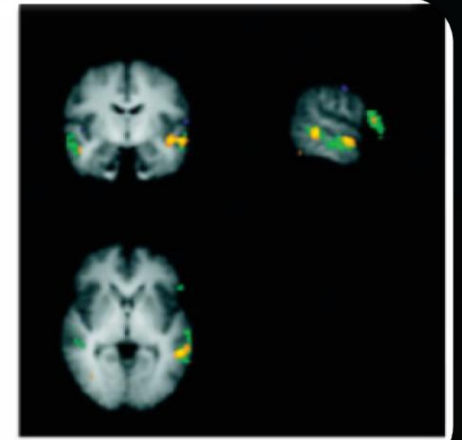
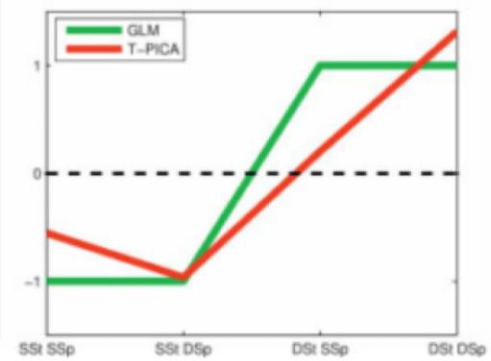
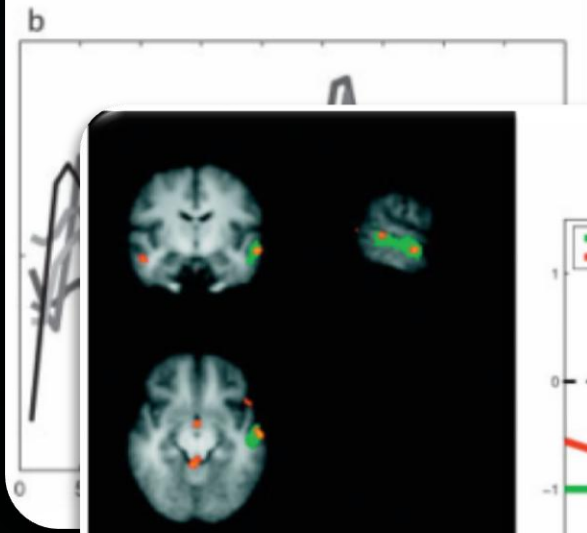
Different Speaker



# FIAC: FSL



ICA, P-ICA analyses





# FIAC: Summary

**TABLE III. Summary of results for the block data group analysis for each contribution**

	Main effect of all vs. rest	Main effect of sentence	Main effect of speaker	Interaction effect	Notes: general	Notes: specific to methods
Aston et al., Phiwave	Large activity in temporal lobes bilat. Signif. not computed	Left temporal gyrus Significance not computed	Weak signals in bilat. temporal gyri, significance not computed	ventral visual stream, SMA, ventral and medial prefrontal	Excluded subjects 8 for spikes, 0 5 and 11 for lack of fieldmaps.	Applied wavelet transform for greater MSE estimates. Results are not quantified in terms of type I error.
Beckmann et al., FSL <b>FSL</b>	HG bilat., planum temporale, planum polare, Lat. Sup. temp. STS, MTG	Left Ant STS (simple main FX for DSp)	NS Contrast 13: Right Broca and left post. STS/MTG Mixture model: DStSSp < DStDSp: HG Bilat	Right Broca and left post. STS/MTG	Results suggest that both effects are processed in a single system without asymmetries for content vs. voice processing	3 ways mixed effects model. Estimation of the session effects. Gaussian assumption for cluster test. Show improvements with H1 modeling and HRF estimation.
Dehaene- <b>SPM2</b> et al., SPM2	Bilateral temporal	Left temporal	NS	NS	Analysis of hemispheric asymmetries	First sentence modeled separately.
Goebel et al., Brain-Voyager <b>BV</b>	Bilateral temporal	Left Ant STG	NS	Left n Right temporal-occipital	Excluded subj 5, 7, 8, 12; ica + clustering : left STG and IFG for suppress of SStSSp; Performed a within block analyses.	Control of false positive based on simulations that require assumptions (Forman et al., 95)



Best For....	Software
Beginners	BV (FSL)
Unix People	FSL
Matlab People	SPM
Group Analyses	SPM/FSL
Single-Subject /ROI Analyses	BV
Surface-based Analyses	BV
Model-Free Analyses	FSL
Connectivity/R-S	FSL? (SPM)
MVPA	BV/SPM
Pretty pictures	BV