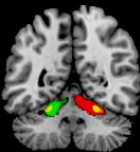


SPM8 for Basic and Clinical Investigators

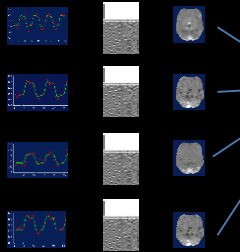
Second Level Design and Analysis



Summary Statistics Approach

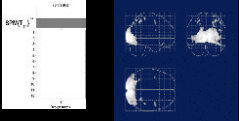
FIRST LEVEL

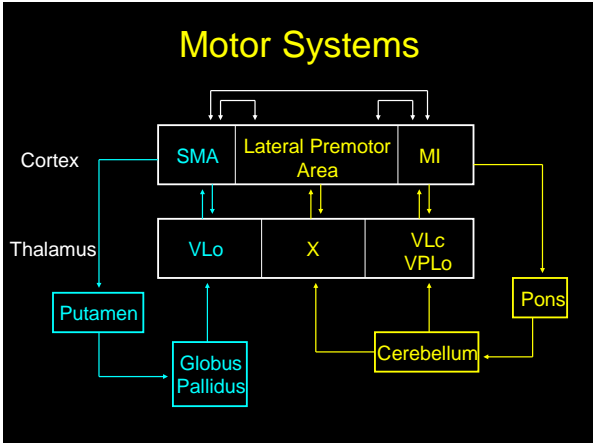
Data
Design Matrix
Contrast Image



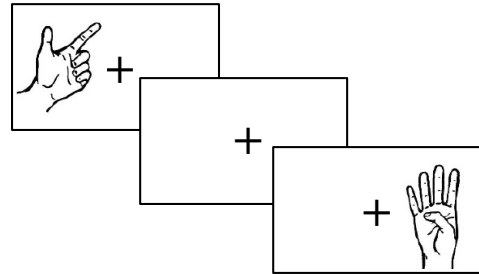
SECOND LEVEL

SPM(t)



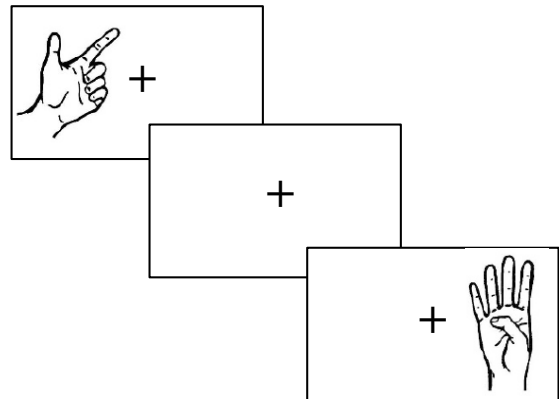


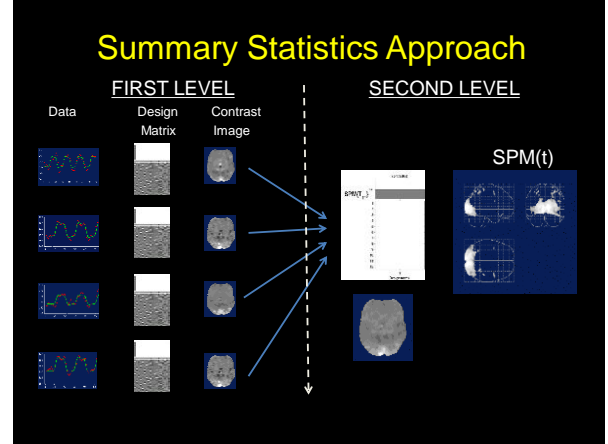
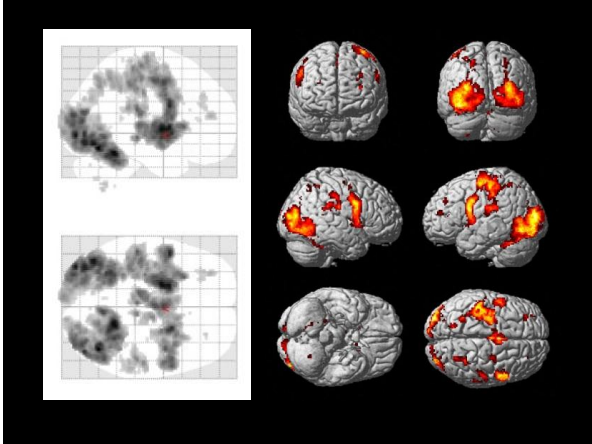
Gesture Imitation: First Level



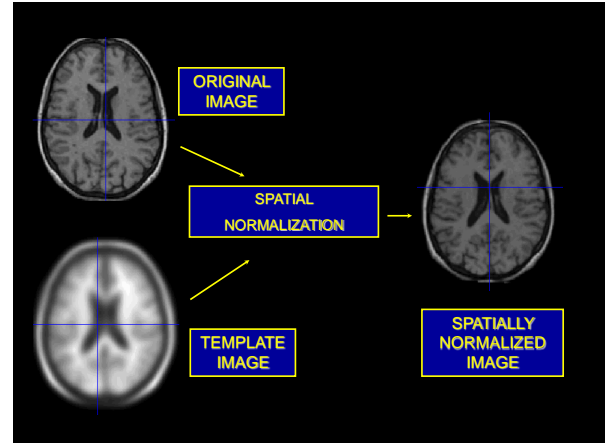
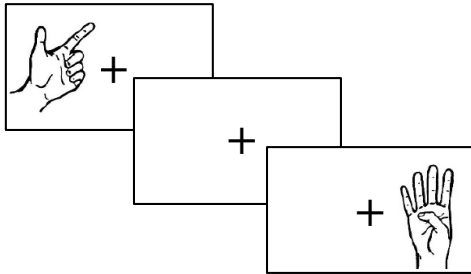
Gesture imitation

- Single subject – multiple session design
- Fixed length epoch timing
- Univariate estimation
- HRF + time derivative basis function
- Task contrasts
- Task conjunctions



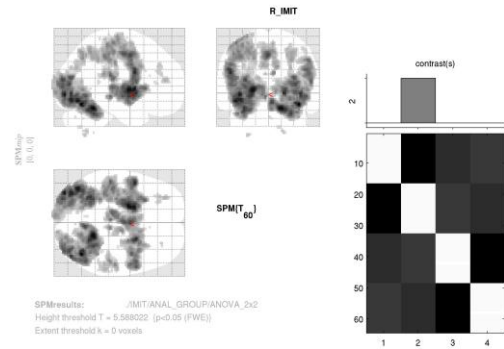
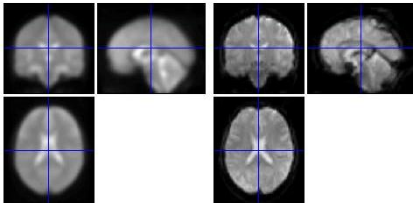


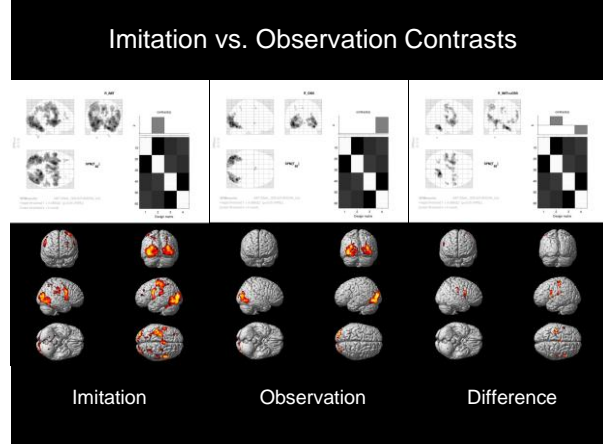
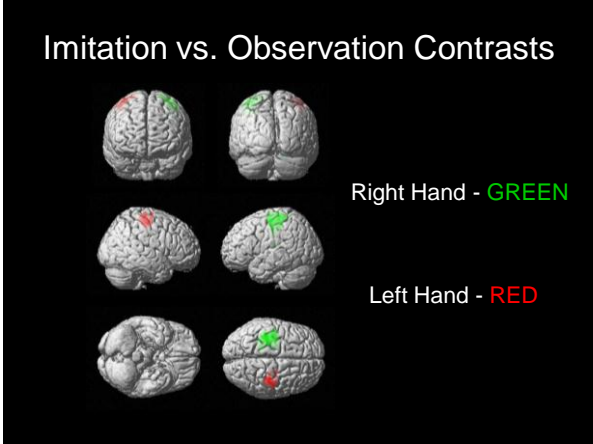
Gesture Imitation: Second Level



Linear (affine) component
 $X1 = 1.092 \times X - 0.090 \times Y - 0.028 \times Z + 0.970$
 $Y1 = 0.142 \times X + 1.172 \times Y + 0.312 \times Z - 14.643$
 $Z1 = -0.028 \times X - 0.358 \times Y + 1.235 \times Z - 16.524$

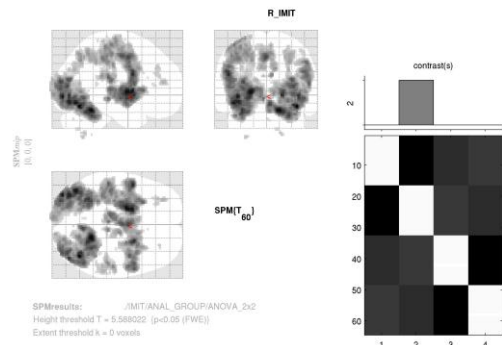
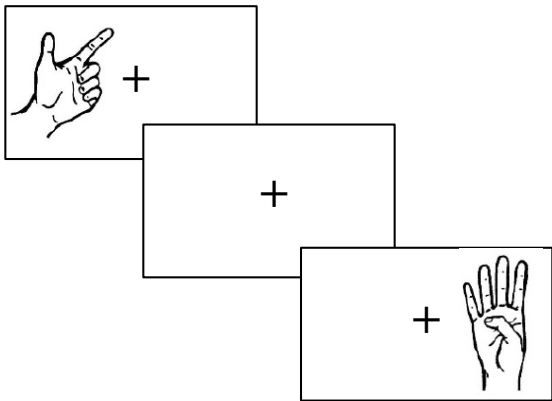
16 nonlinear iterations
 7 x 9 x 7 basis functions

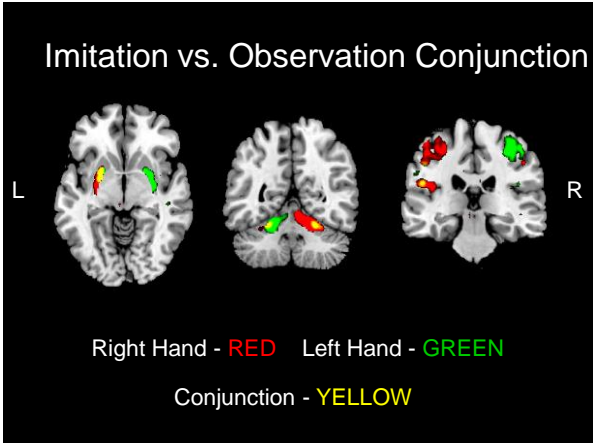
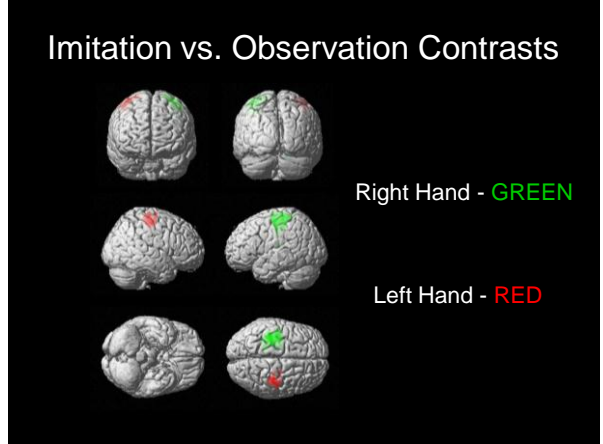
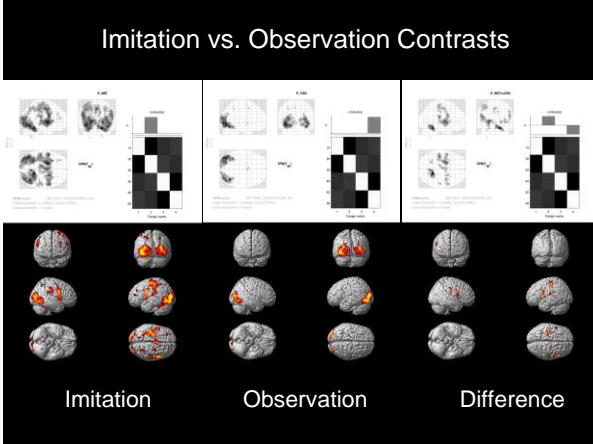




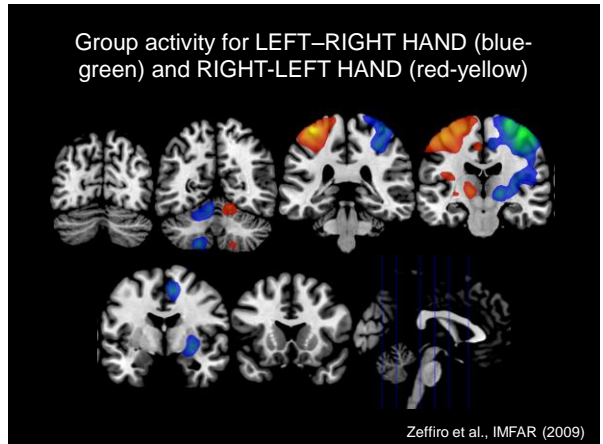
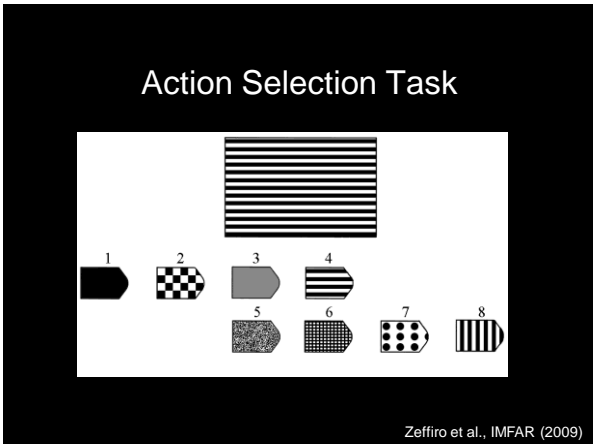
- ### Functional Neuroimaging Experimental Design Types
- Categorical
 - contrast
 - conjunction
 - Covariate
 - parametric function
 - empirical function
 - Factorial

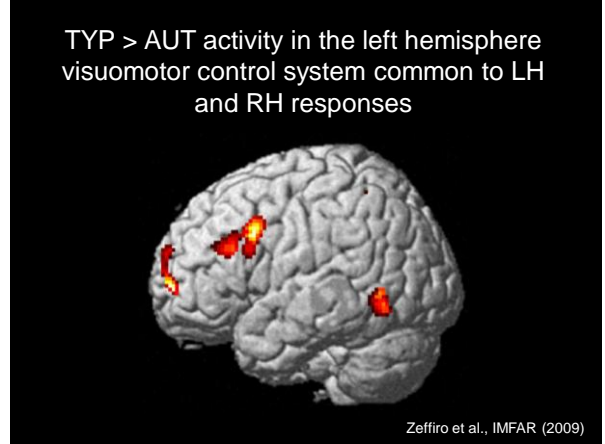
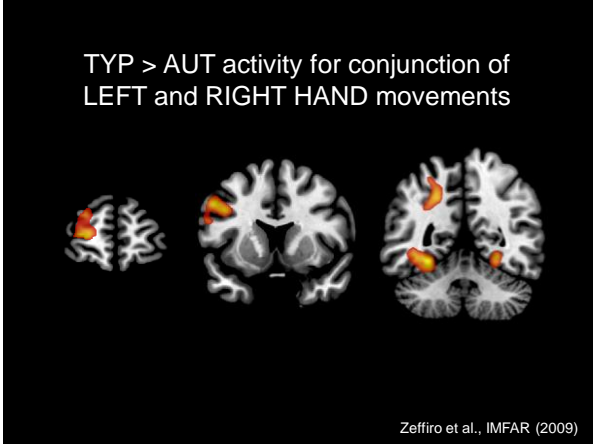
- ### Gesture Imitation
- Task contrasts
 - Task conjunctions
 - Within group factors



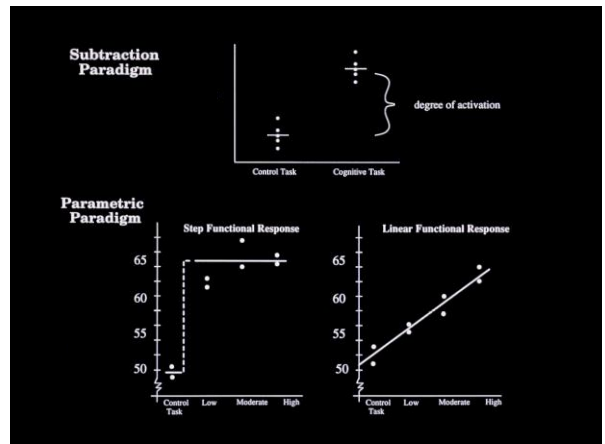
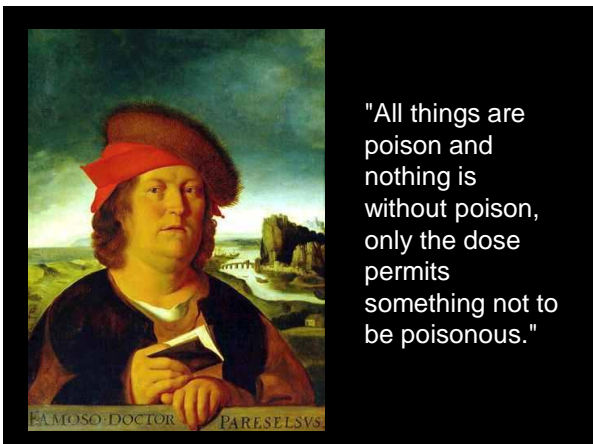
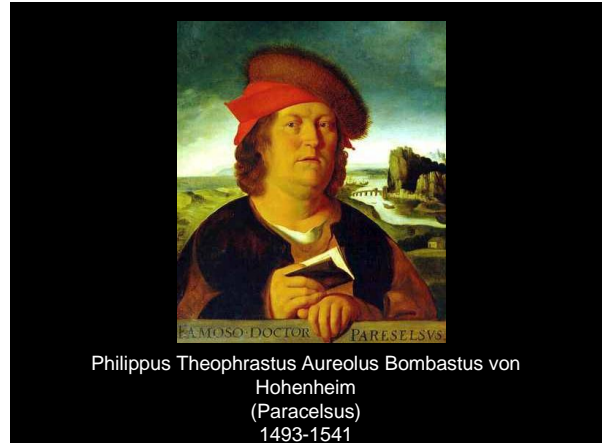


- ### Action Selection
- Task contrasts
 - Task conjunctions
 - Between group factors
- Zeffiro et al., IMFAR (2009)



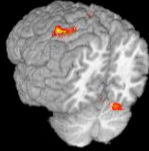


- ### Functional Neuroimaging Experimental Design Types
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Variable Movement Rate

- Task contrasts
- Empirical covariate function
- Within group factors

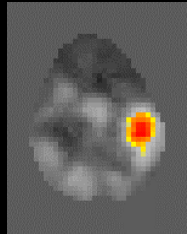


Agnew et al., Neuroimage (2004)

Participants

- 12 participants (5 male, 7 female)
- Average age: 27.6 , Range: 18 - 39
- Right hand preference (EI>80)
- Screened for history of learning disabilities, neurological and psychiatric disorders

Agnew et al., Neuroimage (2004)

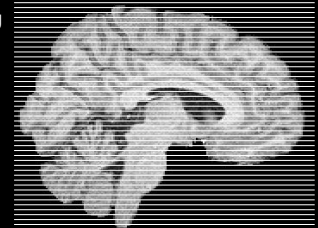


time →

Agnew et al., Neuroimage (2004)

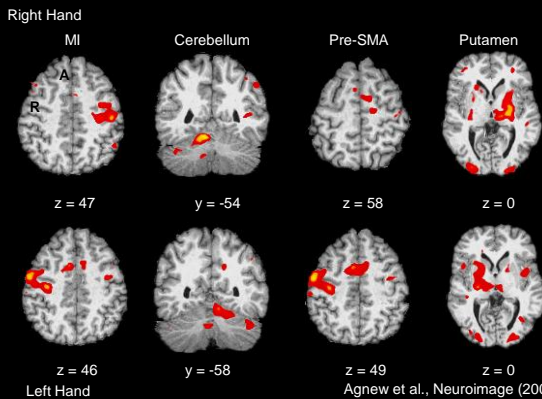
Data Acquisition Details

- BOLD contrast using echo planar imaging
- 1.5 T system
- CP head coil
- 46 axial slices per volume
- 3.6 mm³ voxels

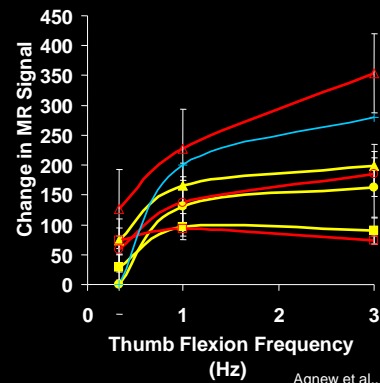


Agnew et al., Neuroimage (2004)

Thumb Flexion vs. Fixation Contrasts

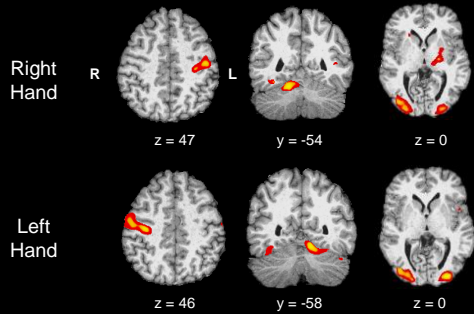


Agnew et al., Neuroimage (2004)



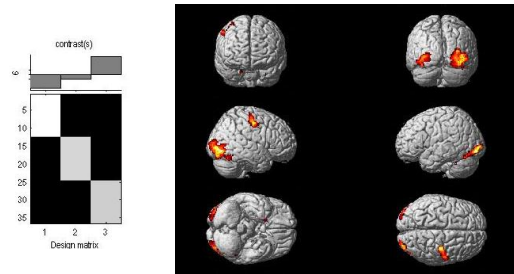
Agnew et al., Neuroimage (2004)

Rate-Related Activity Correlations



Agnew et al., Neuroimage (2004)

Left Hand Rate-Related Activity Correlations

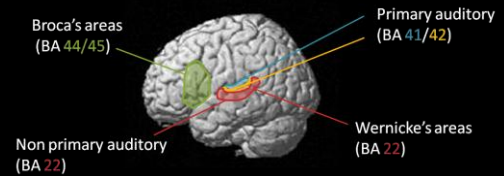


Agnew et al., Neuroimage (2004)

Spectral and Temporal Sound Processing

- Task contrasts
- Parametric covariate function
- Within group factors
- Between group factors

- Investigation of simple, spectrally and temporally complex sound processing in autism.
- Analysis restricted to auditory and language-related cortical areas.



Samson et al., Neuropsychologia (2011)

		Frequency Modulation (FM, 5Hz)				Spectral Complexity
Carrier Signals		No FM	FM 25 %	FM 50 %	FM 100 %	
Number of Spectral Elements	1	Pure Tone (300 Hz)	Condition 1	Condition 2	Condition 3	Condition 4
	4	Harmonic Tone (300, 600, 900, 1200 Hz)	Condition 5	Condition 6	Condition 7	Condition 8

Temporal Complexity

- Low FM: most important for speech recognition (Houtgast and Steeneken, 1985)
- Controlled listening task : detect modulated vs. unmodulated sounds

Samson et al., Neuropsychologia (2011)

Spectral complexity No significant between-group differences

Temporal complexity $p_{\text{unconnected}} < 0.001; k = 25 \text{ voxels}$ TYP > No LD > LD

Non primary auditory areas (BA 22)

Samson et al., Neuropsychologia (2011)

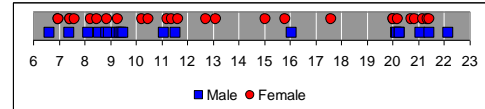
Reading Acquisition

- Task contrasts
- Empirical covariate function
- Within group factors

Turkeltaub et al., Nature Neuroscience (2003)

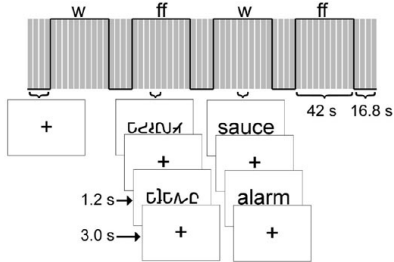
Participants

- 47 participants (20 male, 27 female)
 - age 6.7 → 22.2 (mean= 13.6)
 - right handed
 - no learning disabilities
 - no neurological disorders

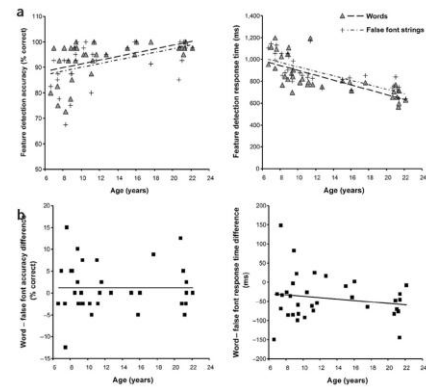


Turkeltaub et al., Nature Neuroscience (2003)

Implicit Reading Task

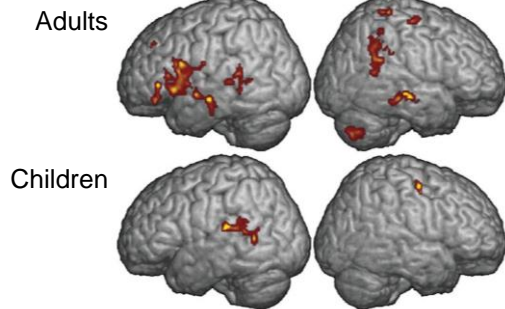


Turkeltaub et al., Nature Neuroscience (2003)

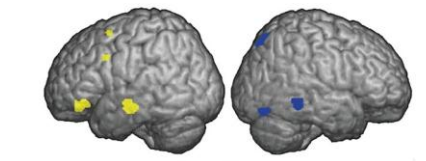


Turkeltaub et al., Nature Neuroscience (2003)

Word vs. False Font Contrast



Turkeltaub et al., Nature Neuroscience (2003)



	Brodmann area	Volume (mm ³)	Cluster <i>r</i>	Peak <i>Z</i>	<i>x</i>	<i>y</i>	<i>z</i>
Positive							
Left							
Middle temporal gyrus	21	1,168	0.72	5.47	-51	-12	-11
Inferior frontal gyrus	47	1,008	0.86	4.31	-51	38	-17
				4.16	-46	32	-12
Superior frontal gyrus	6	240	0.80	4.13	-20	10	51
Cingulate gyrus	31	455	0.58	3.98	-2	-45	28
Inferior frontal sulcus	44/9	264	0.80	3.85	-34	13	27
Negative							
Right							
Inferior temporal sulcus	21/37	416	-0.64	-4.69	65	-39	-10
Precuneus	7	376	-0.59	-4.02	8	-73	48
Fusiform gyrus	19	264	-0.59	-4.00	48	-74	-13

Turkeltaub et al., Nature Neuroscience (2003)

Functional Neuroimaging Experimental Design Types

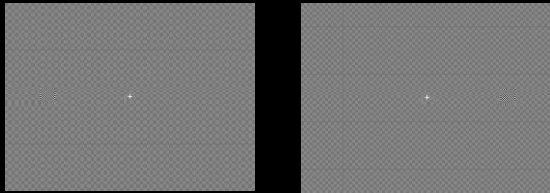
- Categorical
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Interhemispheric Information Transfer

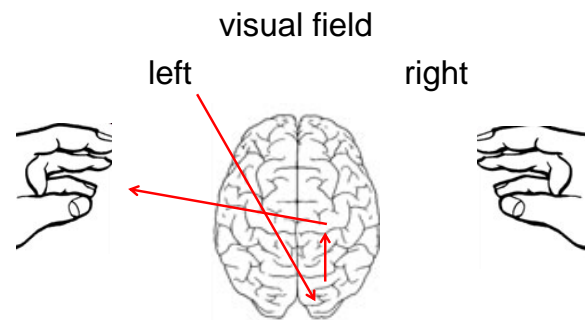
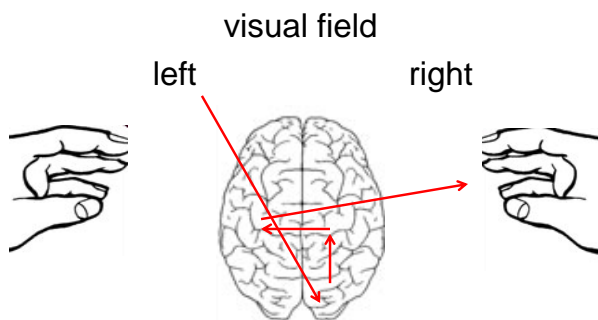
- Task contrasts
- Factorial design
- Within group factors

Zeffiro et al., OHBM (2007)

left and right visual field stimuli

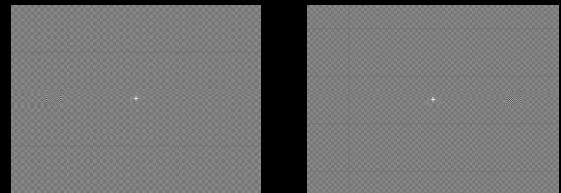


Zeffiro et al., OHBM (2007)

uncrossed -> no inter-hemispheric transfer

crossed -> inter-hemispheric transfer

Left and Right Visual Field Stimuli



Zeffiro et al., OHBM (2007)

Factorial Design

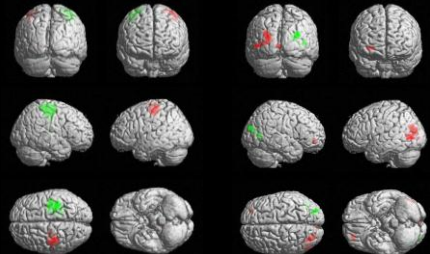
HAND

FIELD

	LEFT	RIGHT
LEFT	LH_LVF	RH_LVF
RIGHT	LH_RVF	RH_RVF

Zeffiro et al., OHBM (2007)

Main Effect of HAND and FIELD

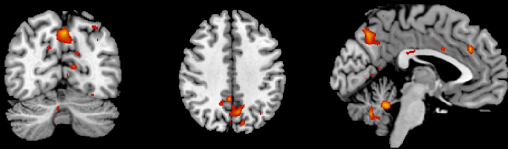


GREEN: LHvsRH
 RED: RVFvsLVF
 GREEN: LVFvsRVF

Critical threshold $p < .05$ FWE correction

Zeffiro et al., OHBM (2007)

Interaction of HAND and FIELD (Crossed – Uncrossed Difference)



RED: $(LH_RVF + RH_LVF) - (LH_LVF + RH_RVF)$

Critical threshold $p < .001$ uncorrected

Zeffiro et al., OHBM (2007)

Functional Neuroimaging Experimental Design Types

- Categorical
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