EXPERIMENTAL DESIGN & RESTING STATE

Methods & Models for fMRI Analysis 2016

Practical Session

University of Zurich[UZH]

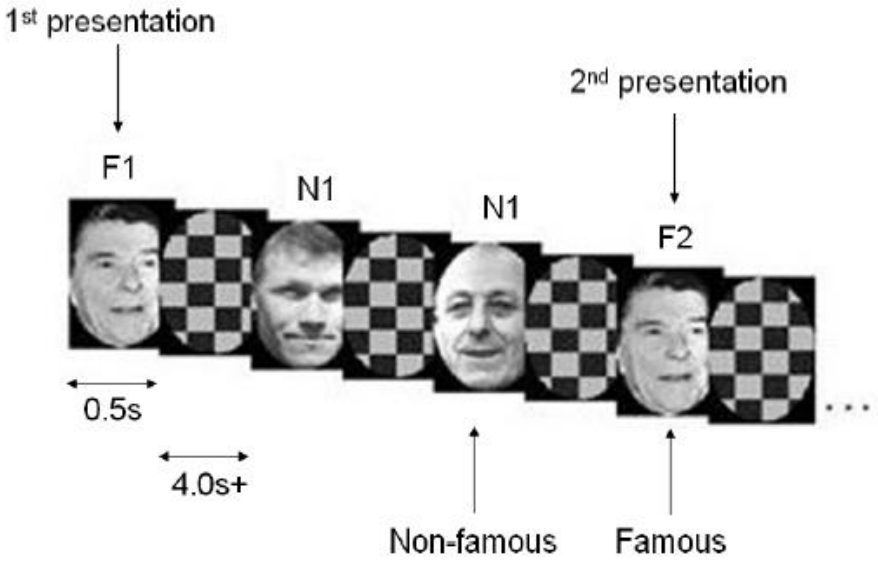
ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Sandra Iglesias

Translational Neuromodeling Unit

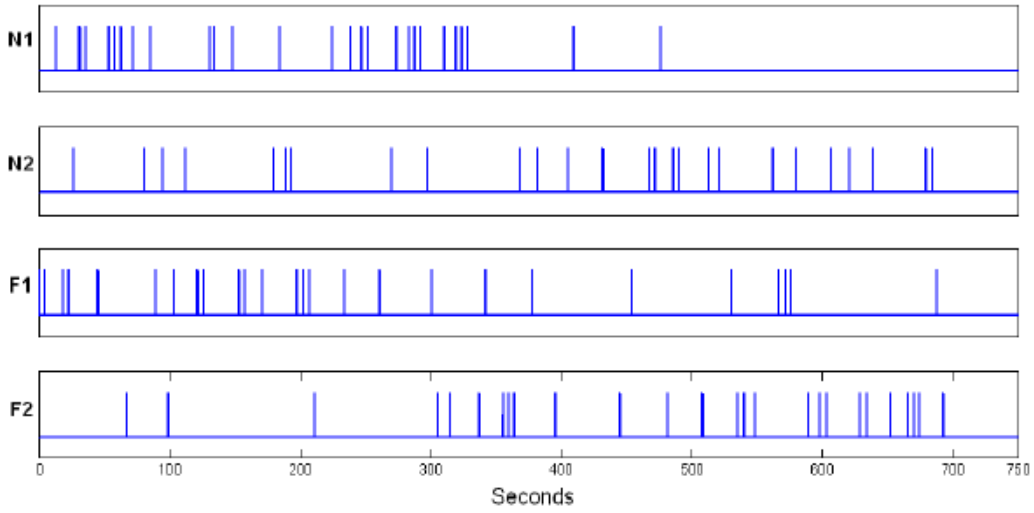
Example Dataset Conjunction



Face repetition paradigm: There were 2 presentations of 26 Famous and 26 Non-famous Greyscale photographs, for 0.5s each, randomly intermixed.

The minimal Stimulus Onset Asynchrony (SOA)=4.5s, with probability 2/3 (i.e. 1/3 null events). The subject made one of two right finger key presses denoting whether or not the subject thought the face was famous.

http://www.fil.ion.ucl.ac.uk/spm/data/face_rep/

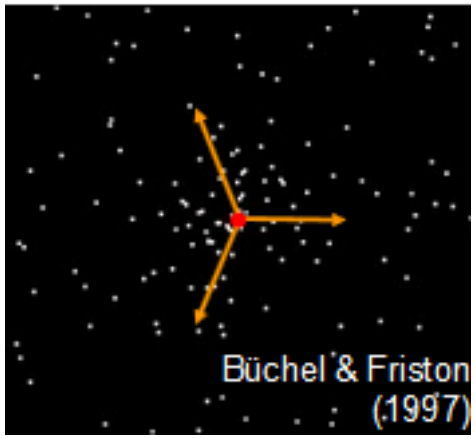


Stimulus

Repetition	Nonfamous	Famous
1	N1	F1
2	N2	F2

Example Dataset PPI

Radially moving dots



Conditions:
- Stationary
- Motion and attention ("detect changes")
- Motion without attention

http://www.fil.ion.ucl.ac.uk/spm/data/attention/

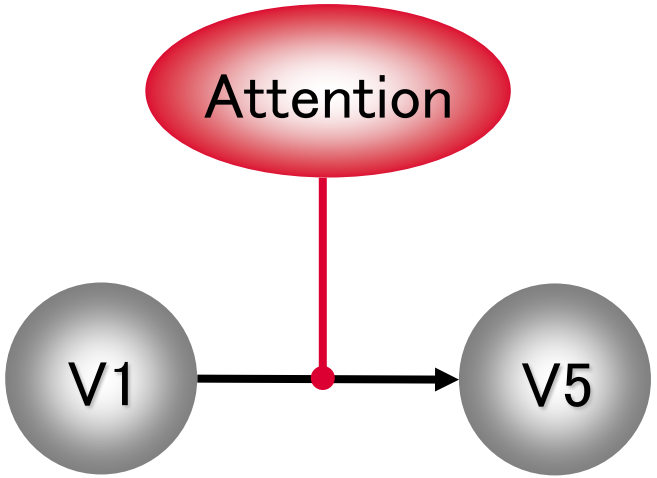
	Run 1										Run 2									
Condition	M	F	A	F	N	F	A	F	N	S	M	F	A	F	N	F	A	F	N	S
Volumes	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Time (s)	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32

	Run 3 (counterbalanced)										Run 4 (counterbalanced)									
Condition	M	F	N	F	A	F	N	F	A	S	M	F	N	F	A	F	N	F	A	S
Volumes	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Time (s)	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32

Example Dataset PPI

Radially moving dots

<u>Conditions</u>:
- Stationary
- Motion and attention ("detect changes")
- Motion without attention

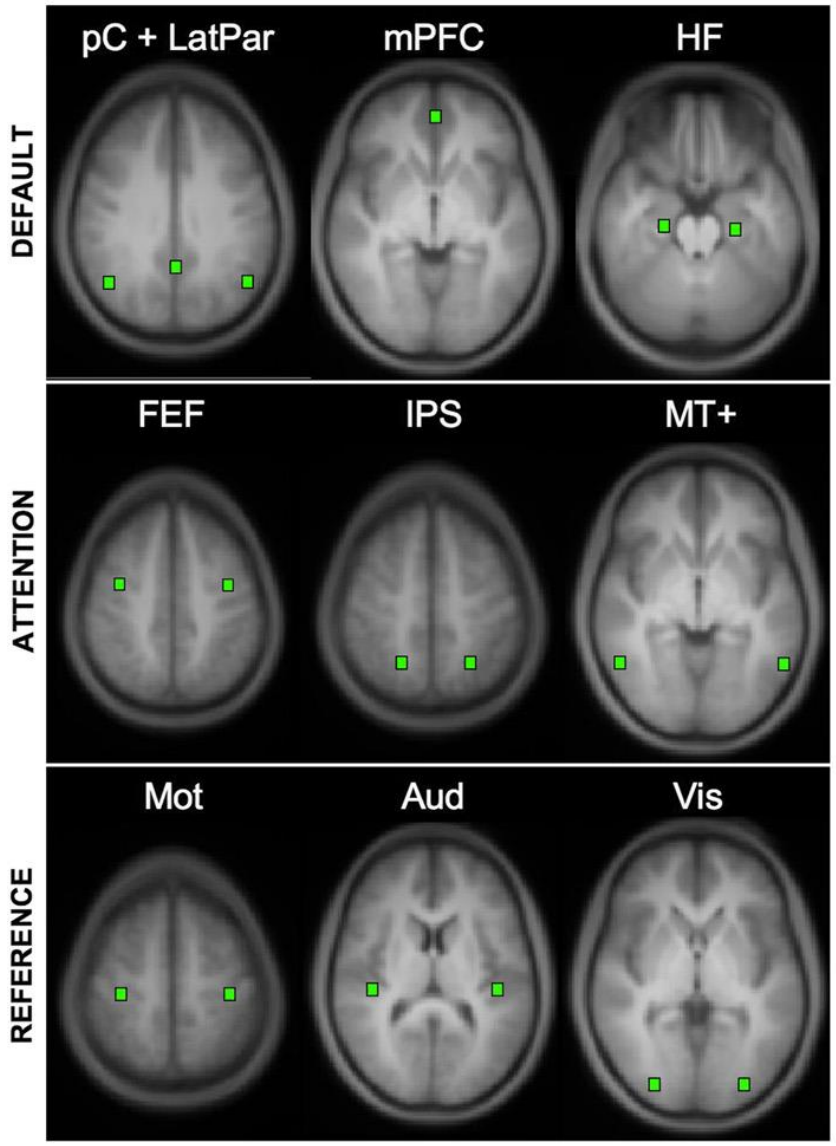


$$y = (T_A - T_B)\,\beta_1 + V1\beta_2 + (T_A - T_B)\,V1\beta_3 + e$$

- $(T_A - T_B)\,\beta_1$ ← main effect of task
- $V1\beta_2$ ← V1 time series ≈ main effect of stim. type
- $(T_A - T_B)\,V1\beta_3$ ← psycho-physiological interaction

Resting state

A

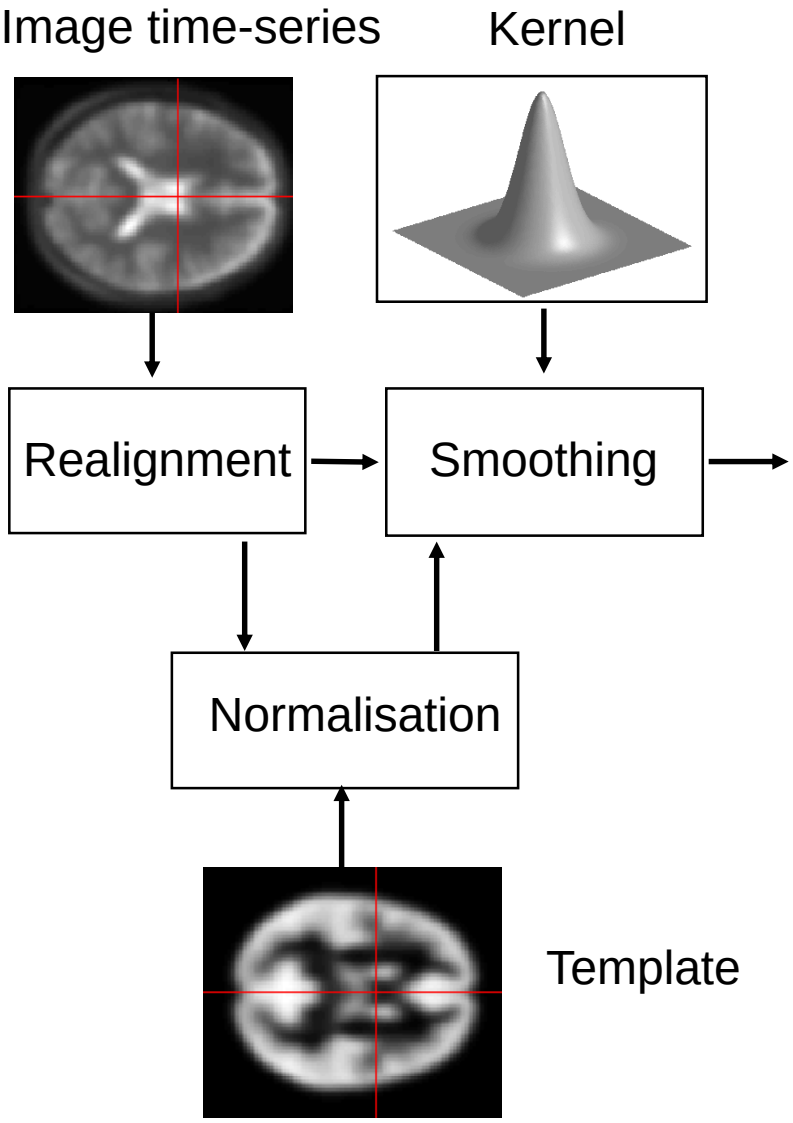


B

Area	Abbreviation	L/R	MNI coordinates X	Y	Z
Posterior cingulate cortex	pC	med	0	-53	26
Lateral parietal cortex	LatPar	L	-48	-62	36
		R	46	-62	32
Medial prefrontal cortex	mPFC	med	0	52	-6
Hippocampal formation	HF	L	-24	-22	-20
		R	24	-20	-22
Frontal eye field	FEF	L	-38	-4	48
		R	40	-4	48
Intraparietal cortex	IPS	L	-24	-58	52
		R	22	-58	54
Middle temporal area	MT+	L	-56	-60	-2
		R	54	-58	-4
Motor cortex	Mot	L	-36	-25	57
		R	36	-25	57
Auditory cortex	Aud	L	-43	-26	12
		R	43	-26	12
Visual cortex	Vis	L	-30	-88	0
		R	30	-88	0

Van Dijk, 2010, *J Neurophysiol*

Preprocessing



Analogous to task-related BOLD fMRI data preprocessing

- Removal of confounding signals, such as respiratory, pulsatile, or cardiovascular noise (e.g. PhysIO Toolbox; RETROICOR).
- Account for white matter and cerebrospinal fluid signals

Resting state fMRI dataset:
http://www.fil.ion.ucl.ac.uk/spm/data/spDCM/

Different seed coordinates:

CSF:	[16 -34 16]
WM:	[-28 -24 30]
PCC_1 :	[-2 -40 38]
PCC_2:	[-2 -36 37]
PCC_3:	[0 -53 26]
Intraparietal cortex:	[-24 -58 52]
Auditory cortex:	[43 -26 12]

Results: Seed based correlation analysis

PCC_1
[-2 -40 38]

PCC_2
[-2 -36 37]

PCC_3
[0 -53 26]