

Methods & models for fMRI data analysis – HS 2017

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Dario Schöbi
Klaas Enno Stephan
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Translational Neuromodeling Unit



Universität
Zürich^{UZH}



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Changes to M&M structure based on last year's feedback:

- **Scanning of own experiments and analysis of own data.**
- **Introductory lecture: "Why is fMRI important for medicine?"**
- **No exam for students only involved in first half of course
→ Presentation of results of own analysis.**
- **Mathematical background for all students:** Introduction to linear algebra, t-test, correlation, basics of probability theory
- **Mathematical background for others:** probability theory, bayes theorem, marginal probability

19.09.	Lecture (4h) ETH/UZH students only: Introduction to basic probability theory and Bayes with hands-on examples (<i>Eduardo Aponte</i>)	Econ / ETH
26.09	<p>Tutorial (2h): ETH/UZH - Scanning own experiment (<i>Sandra Iglesias & Jakob Heinzle</i>)</p> <p>MED: Intro to basic math med (linear algebra, matrix, correlation, ttest) (<i>Dario Schöbi</i>)</p> <p>Lecture(2h): Why is fMRI important for medicine? (<i>Klaas Enno Stephan</i>)</p>	UZH Med & Econ / ETH
03.10.	<p>Tutorial (2h): MED - Scanning own experiment (<i>Sandra Iglesias & Jakob Heinzle</i>)</p> <p>ETH/UZH: Intro to basic math med (linear algebra, matrix, correlation, ttest) (<i>Dario Schöbi</i>)</p> <p>Lecture(2h): Foundations of functional MRI: neurophysiology and physics (<i>Jakob Heinzle</i>)</p>	
10.10.	<p>Lecture (2h):Introduction to Spatial preprocessing of fMRI images (<i>Lars Kasper</i>)</p> <p>Tutorial (2h): Preprocessing of own data</p>	
17.10.	<p>Lecture (2h): The General Linear Model for fMRI analyses (<i>Frederike Petzschner</i>)</p> <p>Tutorial (2h): Analysis of own data (GLM)</p>	
24.10.	<p>Lecture (2h): Classical (frequentist) inference and multiple comparison correction (<i>Klaas Enno Stephan</i>)</p> <p>Tutorial (2h): Analysis of own data (1st level)</p>	
31.10.	<p>Lecture (2h): Experimental design and Resting State Analysis (<i>Sandra Iglesias, Sara Tomiello</i>)</p> <p>Tutorial (2h): Comparison of different designs from scanning</p>	
07.11.	<p>Lecture (2h): Event-related fMRI and design efficiency (<i>Jakob Heinzle</i>)</p> <p>Tutorial (2h): Short presentation of results of analysis of own data (MED)</p>	

14.11.	Lecture (2h): Group level analysis (<i>Sandra Iglesias</i>) Tutorial (2h):
21.11.	Lecture (2h): Noise models in fMRI and noise correction (<i>Lars Kasper</i>) Tutorial (2h): PhysIO (own data)
28.11.	Lecture (2h): Bayesian inference and Bayesian model selection (<i>Klaas Enno Stephan</i>) Tutorial (2h): BMA and BMS
05.12.	Lecture (2h): Computational Neuroimaging (model-based fMRI) (<i>Andreea Diaconescu</i>)
12.12.	Lecture (2h): Introduction to Dynamic Causal Modelling (<i>Stefan Frässle</i>) Tutorial (2h): DCM analysis (own data or attention to motion?)
19.12.	Exam (10:00-11:30)

FAQs

Course homepage:

<https://www.tnu.ethz.ch/en/teaching/hs-2017/methodsandmodels.html>

Credits: 6 points (ETH), 3 points (UNI, Neuroeconomics), Testat (MED)

Attendance requirements: 11/13 presentations

Contact: Sandra Iglesias - iglesias@biomed.ee.ethz.ch
Jakob Heinzle - heinzle@biomed.ee.ethz.ch

!!! Check the rules of the program you have signed up for !!!

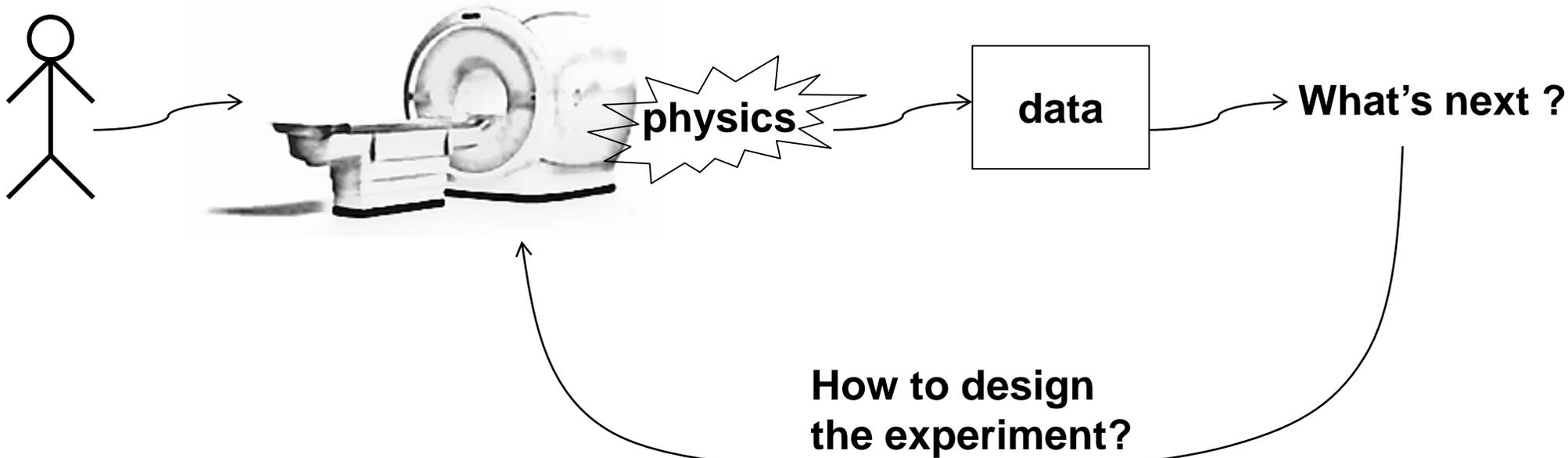
UZH students are enrolled for the course through the Department of economics → Enrolment for course = sign up for exam!!! Withdraw your official enrolment if you do not want to take the exam!

Exam

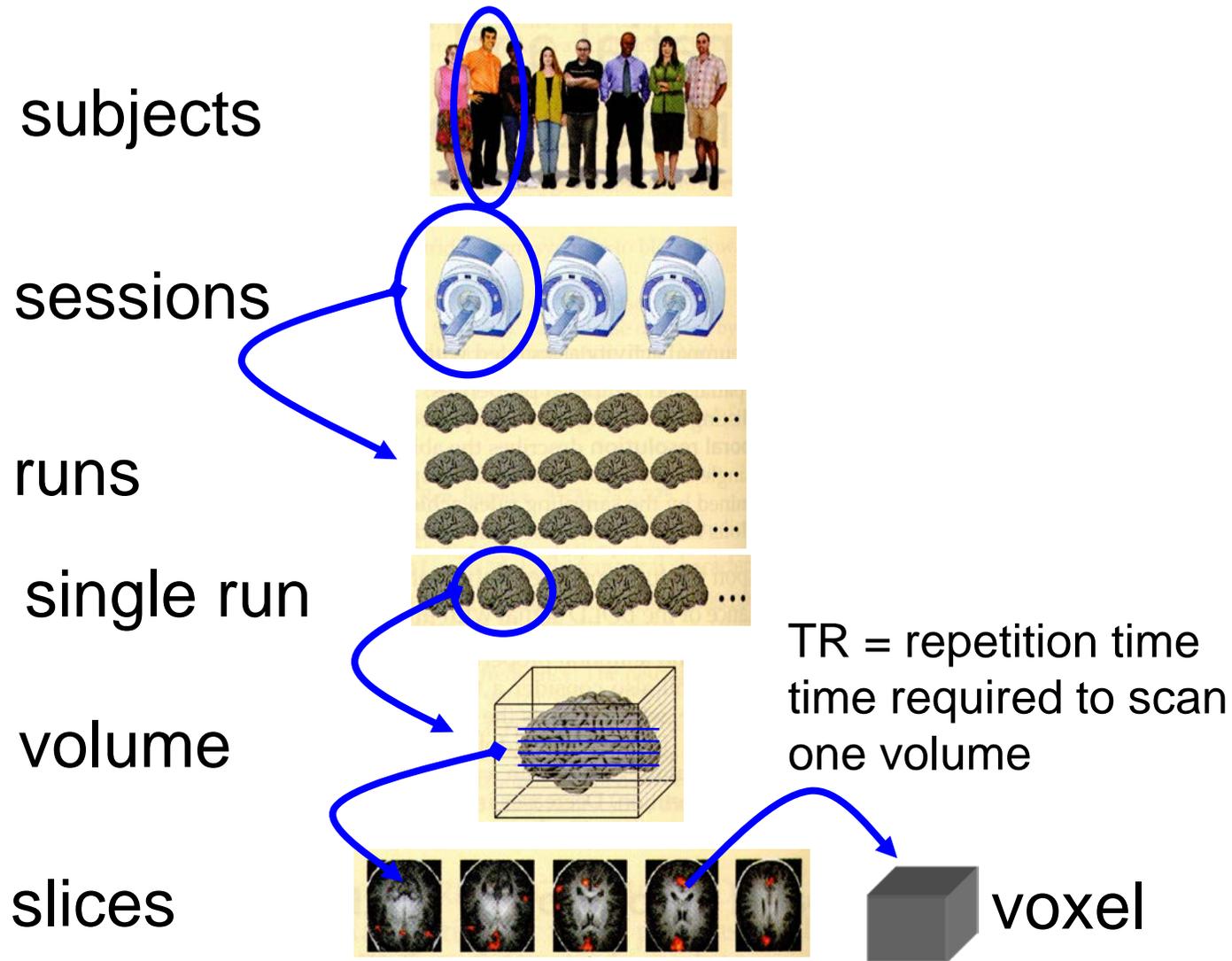
- Exam for medical and UZH students (first half of course):
 - 07.11.2017: 10:15 – 12:00
 - Presentation and hand in of own SPM analysis
 - Pass is required to get credit points
- Exam for ETH students:
 - 19.12.2017: 10:00– 11:30
 - (36 MC questions, 90 min time)
 - Pass is required to get credit points

!!! Check the rules of the program you have signed up for !!!

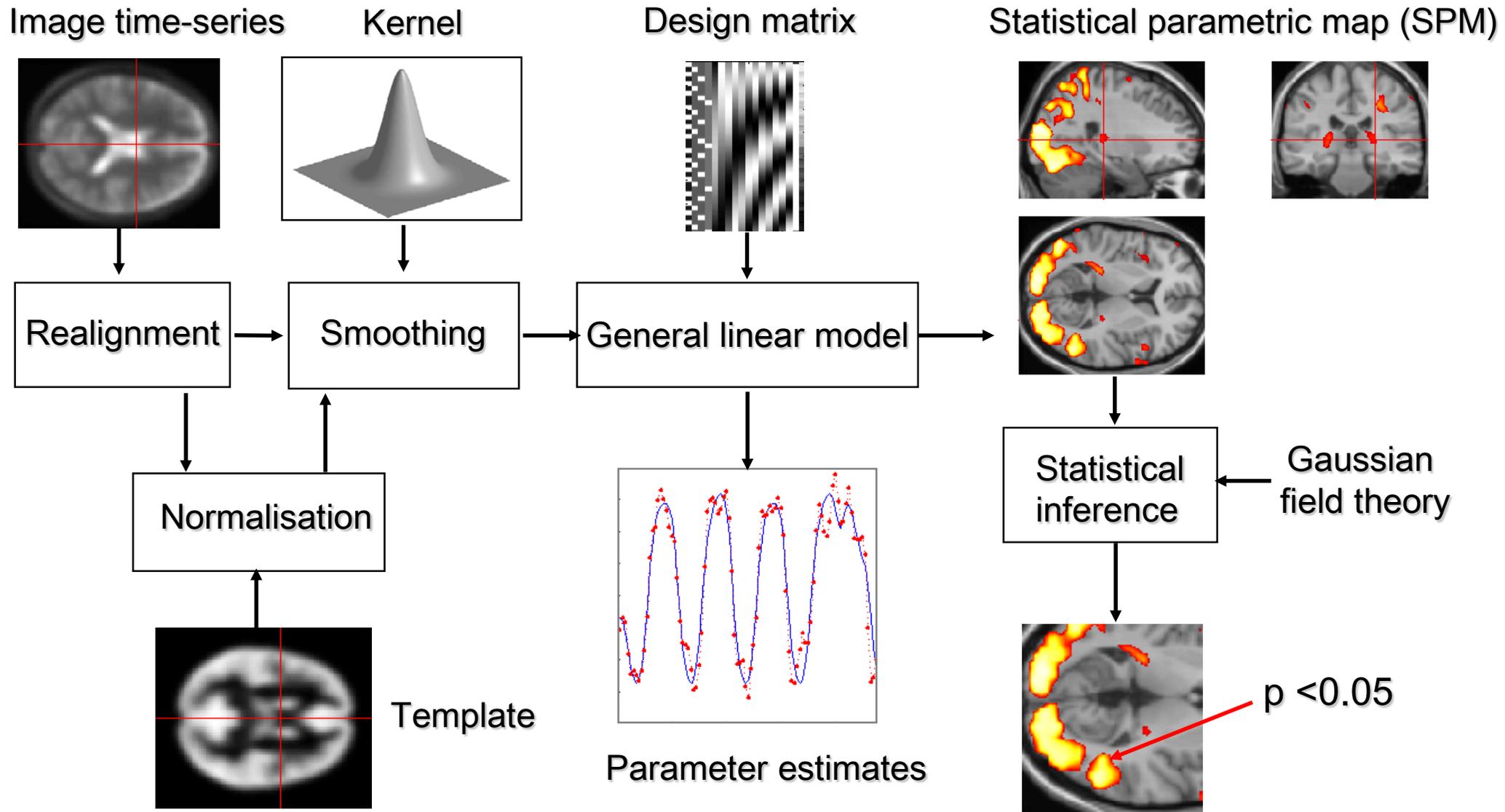
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Terminology of fMRI

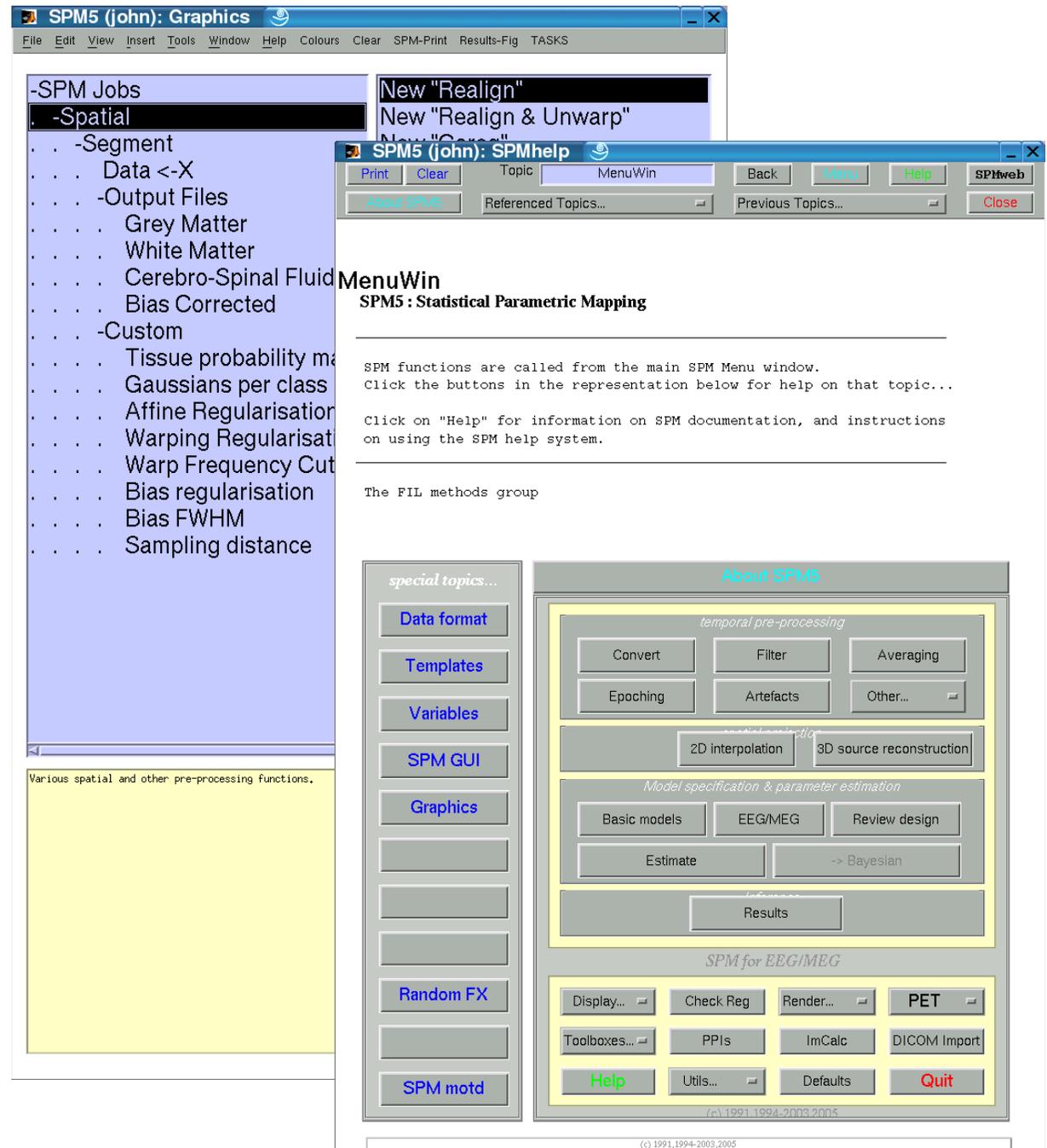


Statistical Parametric Mapping (SPM)



SPM12

- the history
- the program
- the spirit



SPM online bibliography

<http://www.fil.ion.ucl.ac.uk/spm/>

Publications about 'RFT' - Netscape

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Publications about 'RFT'

Thesis

1. [A.P. Holmes](#). **Statistical Issues in Functional Brain Mapping**. PhD thesis, University of Glasgow, December 1994. Keyword(s): [RFT](#), [PET](#), [GLM](#). [[bibtex-entry](#)]

Articles in journal or book chapters

1. D. Pantazis, [T.E. Nichols](#), S. Baillet, and R.M. Leahy. **A comparison of random field theory and permutation methods for the statistical analysis of MEG data.** *NeuroImage*, 25:383-394, 2005. Keyword(s): [RFT](#), [MEG](#), [nonparametric](#). [[bibtex-entry](#)]
2. S. Hayasaka, K.L. Phan, I. Liberzon, [K.J. Worsley](#), and [T.E. Nichols](#). **Non-Stationary Cluster Size Inference with Random Field and Permutation Methods.** *NeuroImage*, 22:676-687, 2004. Keyword(s): [Cluster](#), [RFT](#), [nonparametric](#). [[bibtex-entry](#)]
3. M. Brett, [W.D. Penny](#), and [S.J. Kiebel](#). **Introduction to Random field theory.** In R.S.J. Frackowiak, K.J. Friston, C. Frith, R. Dolan, K.J. Friston, C.J. Price, S. Zeki, J. Ashburner, and W.D. Penny, editors, *Human Brain Function*. Academic Press, 2nd edition, 2003. Keyword(s): [introduction](#), [RFT](#). [[bibtex-entry](#)]
4. [T.E. Nichols](#) and [A.P. Holmes](#). **Nonparametric approaches.** In

SPM web site



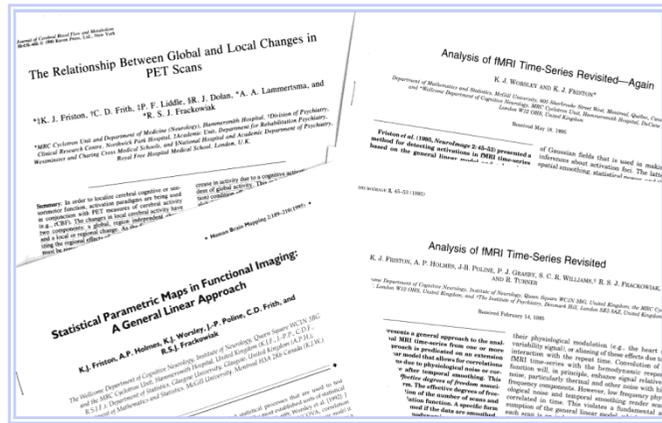
- Introduction to SPM
- SPM distribution: SPM99, SPM2, SPM5, SPM8, SPM12
- Documentation & Bibliography
- SPM email discussion list
- SPM short course
- Example data sets
- SPM extensions



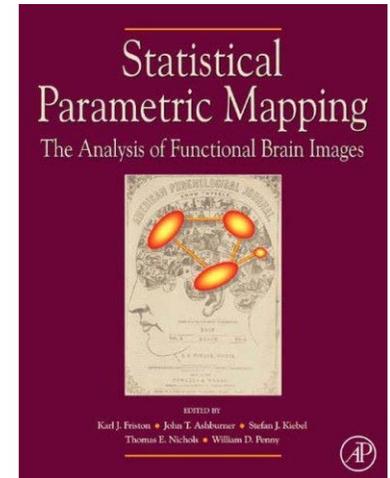
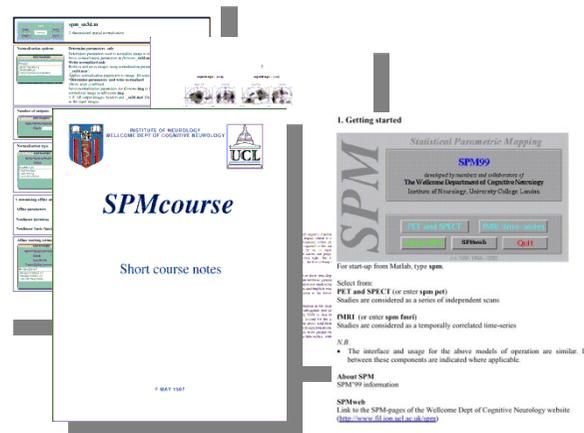
<http://www.fil.ion.ucl.ac.uk/spm/>

SPM documentation

peer reviewed literature



SPM course notes,
SPM book & SPM manual



online help &
function descriptions



algorithm descriptions,
code annotations,
pseudo-code

