

Methods & models for fMRI data analysis – HS 2018

Andreea Diaconescu
Stefan Frässle
Samuel Harrison
Jakob Heinze
Sandra Iglesias

Lars Kasper
Frederike Petzschner
Klaas Enno Stephan
Sara Tomiello



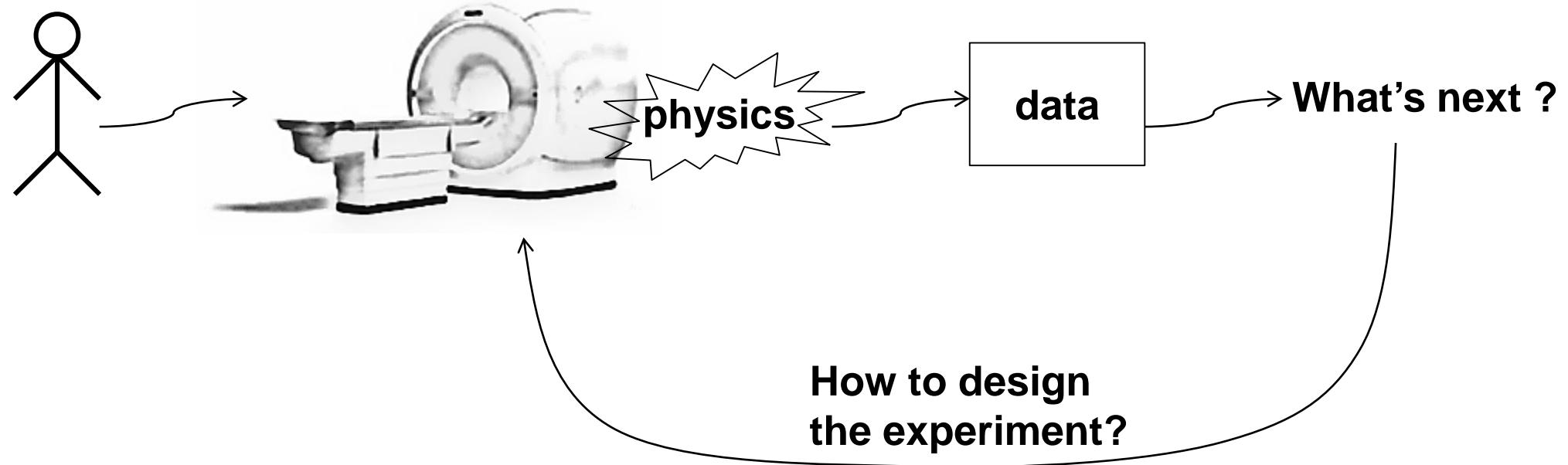
Translational Neuromodeling Unit



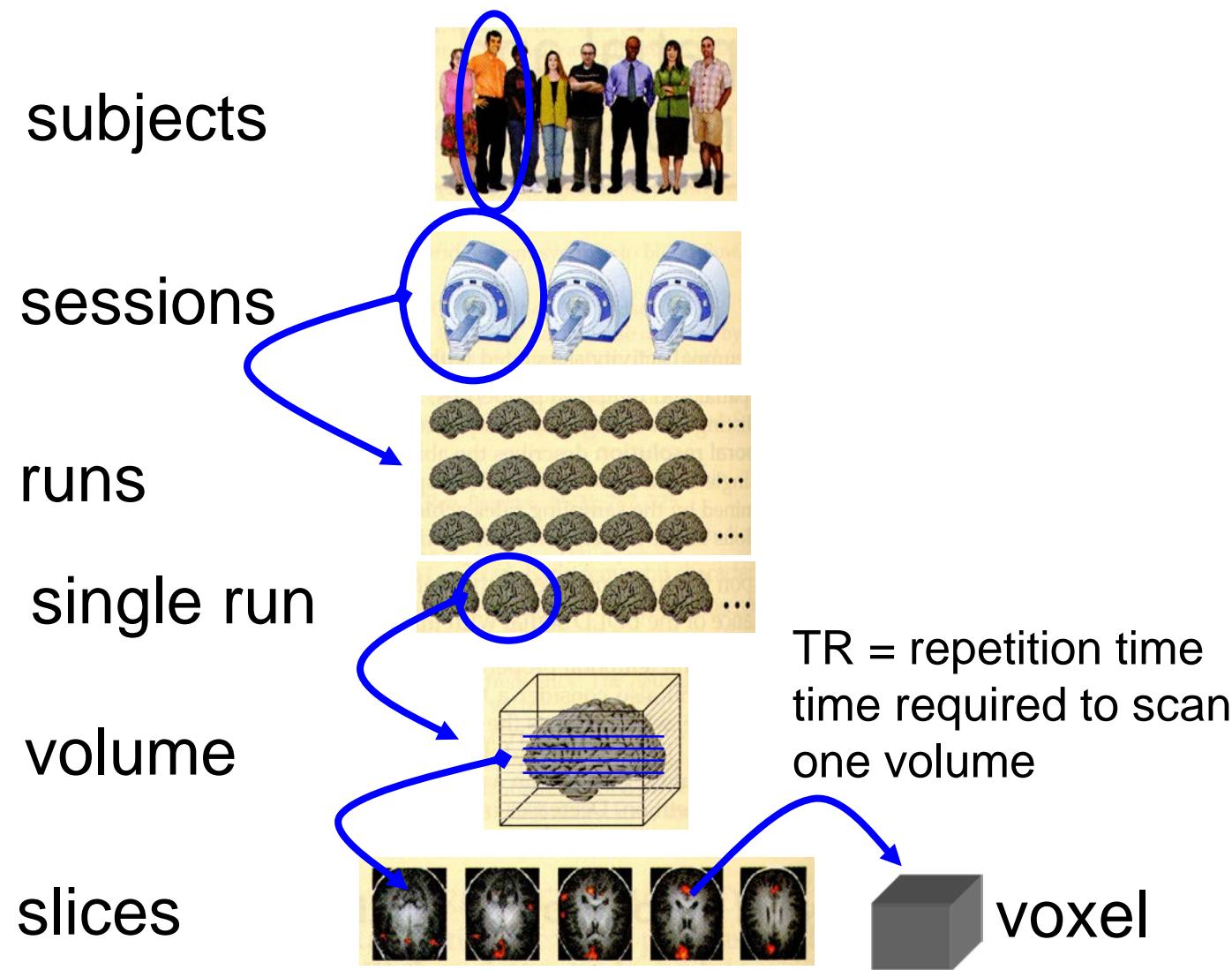
Universität
Zürich^{UZH}

ETH

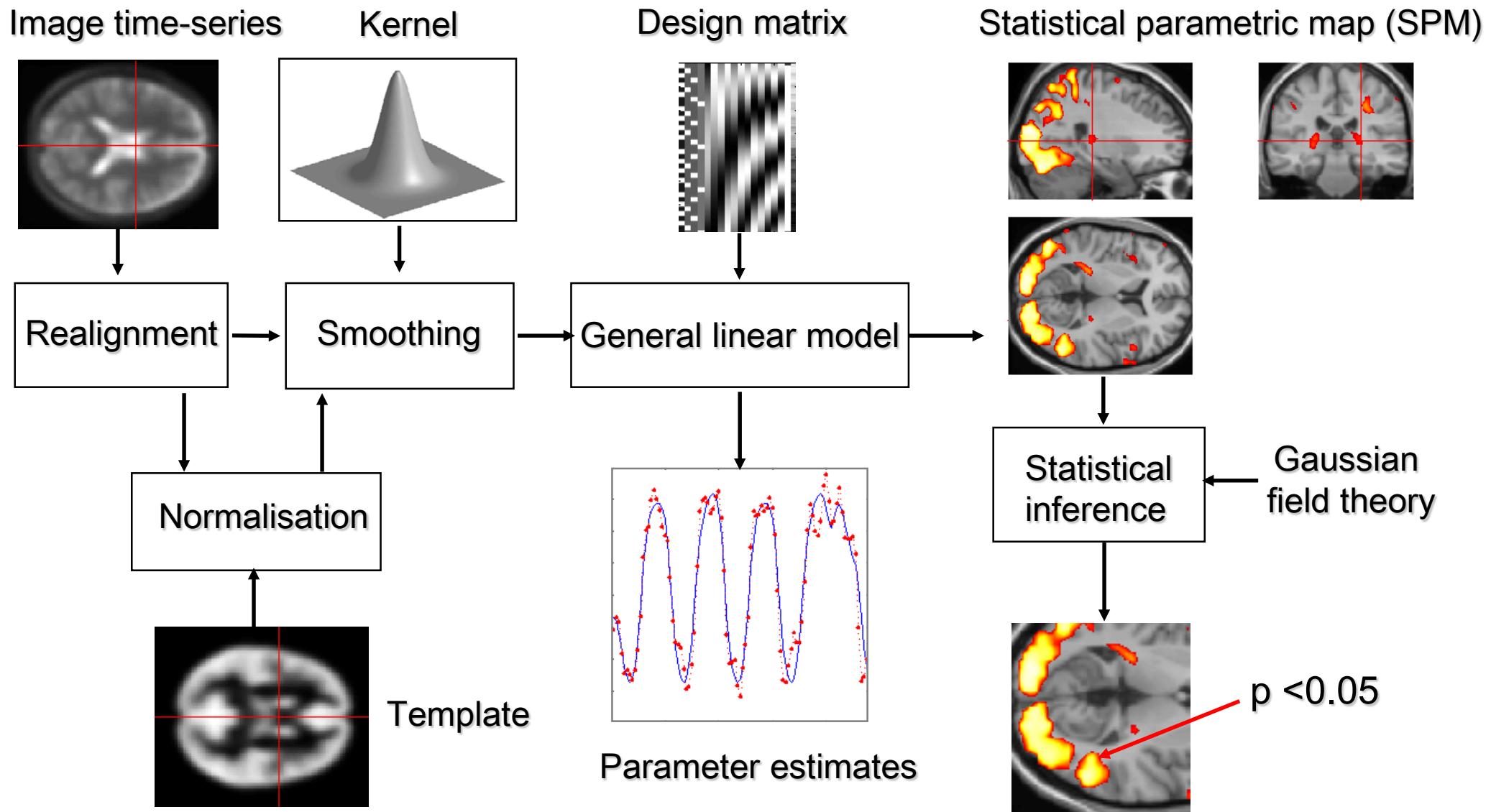
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich



Terminology of fMRI



Statistical Parametric Mapping (SPM)



Part 1 - Modul Mantelstudium

| | | |
|--------|---|----------------------|
| 25.09 | <p>Lecture(2h): Foundations of functional MRI: neurophysiology and physics (<i>Jakob Heinze</i>)</p> <p>Tutorial(2h): Setting up Matlab and SPM on own computers (<i>Jakob Heinze</i>)</p> | UZH Med & Econ / ETH |
| 02.10. | <p>Lecture(2h): Why is fMRI important for medicine? (<i>Klaas Enno Stephan</i>)</p> <p>Tutorial(2h): Basic functions of SPM (<i>Jakob Heinze</i>)</p> | |
| 09.10. | <p>Tutorial (2h): UZH/ETH: Scanning of own Experiment (<i>Sandra Iglesias</i>), MED: Running an SPM batch analysis (<i>Stefan Frässle</i>)</p> <p>Lecture (2h): Introduction to Spatial preprocessing of fMRI images (<i>Samuel Harrison</i>)</p> | |
| 16.10. | <p>Tutorial (2h): MED: Scanning of own Experiment (<i>Sandra Iglesias</i>), UZH/ETH: Running an SPM batch analysis (<i>Jakob Heinze</i>)</p> <p>Lecture (2h): The General Linear Model for fMRI analyses (<i>Frederike Petzschner</i>)</p> | |
| 23.10. | <p>Lecture (2h): Classical (frequentist) inference and multiple comparison correction (<i>Klaas Enno Stephan</i>)</p> <p>Tutorial (2h): Analysis of own data</p> | |
| 30.10. | <p>Lecture (2h): Experimental design and Resting State Analysis (<i>Sandra Iglesias, Sara Tomiello</i>)</p> <p>Tutorial (2h): Analysis of own data and preparation of presentation</p> | |
| 06.11. | <p>Lecture (2h): Event-related fMRI and design efficiency (<i>Jakob Heinze</i>)</p> <p>Tutorial (2h): Short presentation of results of analysis of own data (MED)</p> | |

Part 2 – ETH/UZH

| | | |
|--------|---|-----|
| 13.11. | Lecture (2h): Group level analysis (<i>Sandra Iglesias</i>) Tutorial (2h): | ETH |
| 20.11. | Lecture (2h): Noise models in fMRI and noise correction (<i>Lars Kasper</i>) Tutorial (2h): PhysIO | |
| 27.11. | Lecture (2h): Bayesian inference and Bayesian model selection (<i>Klaas Enno Stephan</i>) Tutorial (2h): BMA and BMS | |
| 04.12. | Lecture (2h): Computational Neuroimaging (model-based fMRI) (<i>Andreea Diaconescu</i>) | |
| 11.12. | Lecture (2h): Introduction to Dynamic Causal Modelling (<i>Stefan Frässle</i>) Tutorial (2h): DCM analysis | |
| 18.12. | Exam (08:15-09:45) | |

FAQs

Course homepage:

<https://www.tnu.ethz.ch/en/teaching/hs-2018/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 Heinze - 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

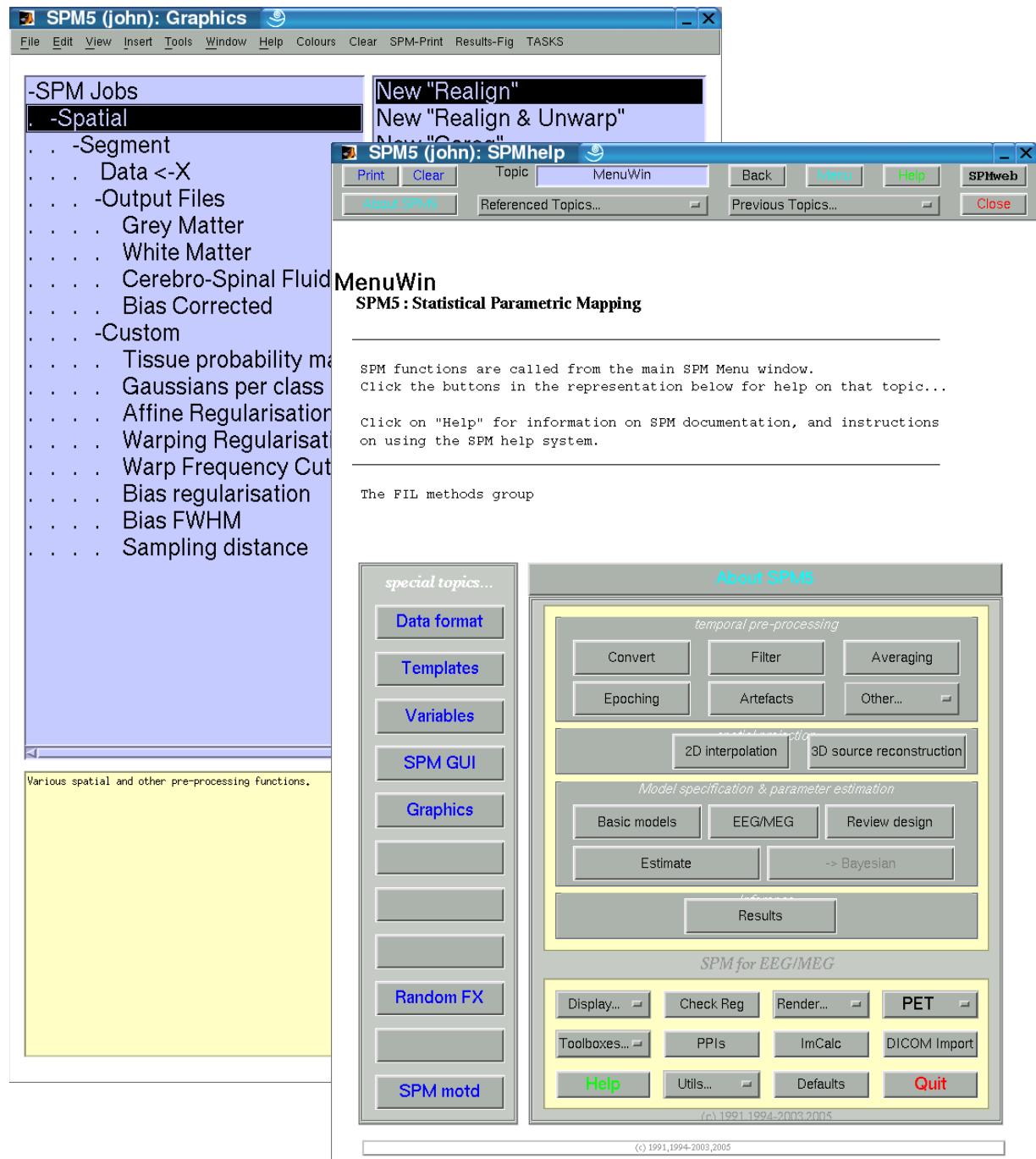
- “Exam” for medical students (first half of course):
 - 06.11.2017: 10:15 – 12:00
 - Presentation and hand in of own SPM analysis
 - Pass is required to get credit points
- Exam for other students:
 - 18.12.2017: 08:15– 09:45
 - (36 MC questions, 90 min time)
 - Pass is required to get credit points

!!! 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!

SPM12

- the history
- the program
- the spirit



SPM online bibliography

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

The screenshot shows a Netscape browser window with the title "Publications about 'RFT' - Netscape". The address bar displays the URL <http://www.fil.ion.ucl.ac.uk/spm/doc/biblio/Keyword/RFT.html>. The menu bar includes File, Edit, View, Go, Bookmarks, Tools, Window, and Help. The toolbar includes Back, Forward, Reload, Stop, Print, Home, and various links like Neuro, ML-Stats, Journals, Technical, Imaging, Software, Conferences, World, Me, and a Netscape logo. A search bar at the top right contains the text "Enter Search Terms" with a "Search" button and other options like "Highlight", "Pop-Up Block Off", and "Form Fill".

On the left side of the page, there is a vertical sidebar with a purple header "SPM Menu:" containing links: Introduction, Software, Documentation (which is highlighted), Courses, Email list, Data sets, and Extensions. Below this is another purple header "This page:" containing a link to Bibliography.

The main content area has a purple header "Publications about 'RFT'" followed by a section titled "Thesis" containing one item:

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

The main content area also features a sidebar with four grayscale brain scan images.

Below the "Thesis" section is a purple header "Articles in journal or book chapters" followed by a list of publications:

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



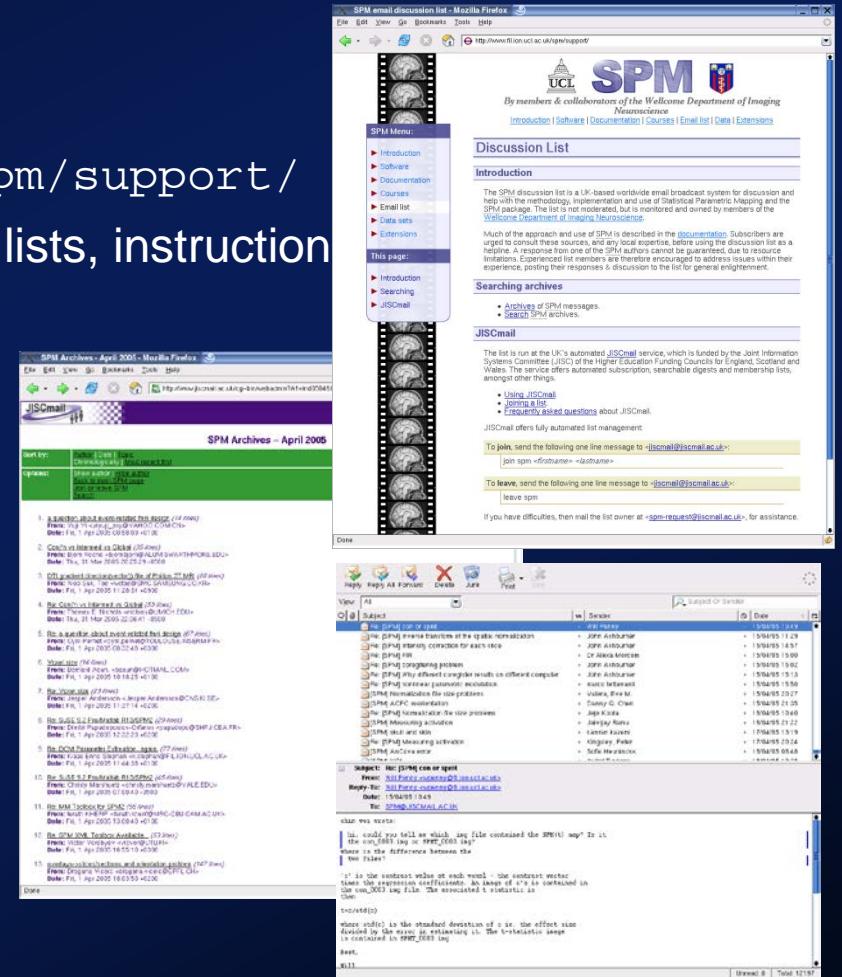
- **Introduction to SPM**
- **SPM distribution:
SPM99, SPM2, SPM5,
SPM8, SPM12**
- **Documentation &
Bibliography**
- **SPM email discussion list**
- **SPM short course**
- **Example data sets**
- **SPM extensions**



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

SPM email list

- spm@jiscmail.ac.uk
 - Web home page
 - <http://www.filion.ucl.ac.uk/spm/support/>
 - Archives, archive searches, membership lists, instructions
 - Subscribe
 - <http://www.jiscmail.ac.uk/>
 - email jiscmail@jiscmail.ac.uk
 - join *spm Firstname Lastname*
 - Participate & learn
 - email spm@jiscmail.ac.uk
 - Monitored by SPMauthors
 - Usage queries, theoretical discussions, bug reports, patches, techniques, &c...

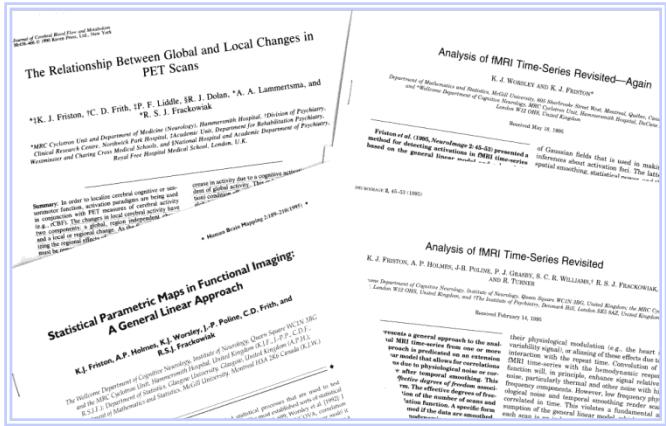


<http://www.filion.ucl.ac.uk/spm/support/>

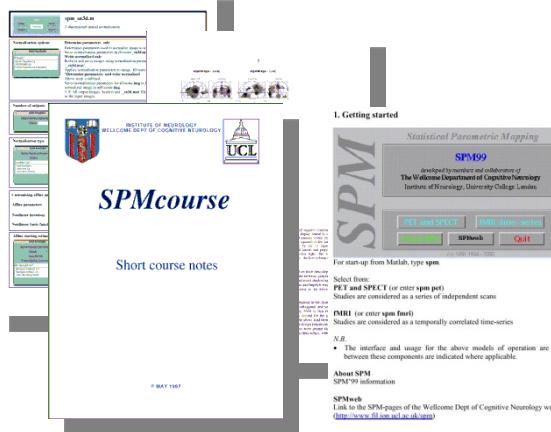
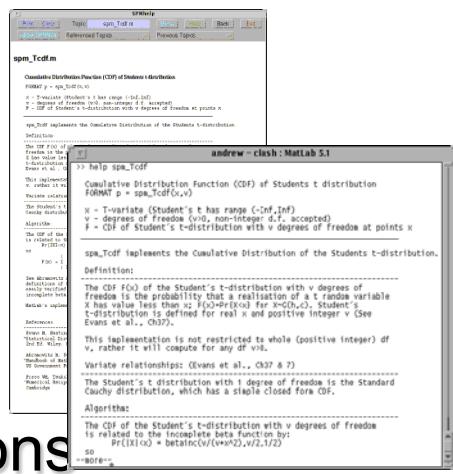
spm@jiscmail.ac.uk

SPM documentation

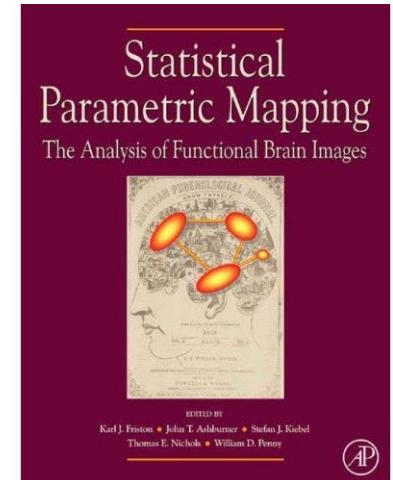
peer reviewed literature



online help & function descriptions



SPM course notes, SPM book & SPM manual



algorithm descriptions
code annotations,
pseudo-code