Report on ERNI-HSF funded Workshop

Recent Advances in Magnetic Resonance Imaging and Lesion Reconstruction Techniques for Understanding Human Brain Function

21st – 22nd April 2008, Budapest, Hungary.

Venue: Hungarian Academy of Sciences, Budapest, Hungary.

Organising committee:

Stephen Jackson
School of Psychology, University of Nottingham, Nottingham, UK.
Masud Husain
Institute of Cognitive Neuroscience, University College London, London, UK.
Hans-Otto Karnath
Centre of Neurology & Hertie-Institute for Clinical Brain Research, Tuebingen, Germany.
Zoltan Vidnyanszky
MR Research Centre, Semmelweis University, Budapest, Hungary.

Meeting Background:

The workshop "Recent advances in Magnetic Resonance Imaging and Lesion Reconstruction Techniques for Understanding Human Brain Function" is one event in a series of scientific workshops conducted by European Research Network for Investigating Human Sensorimotor Function in Health and Disease, ERNI-HSF. The purpose of the workshop was to discuss the concept of lesion mapping taking into account the analytical and technical methods used to do this and also to look at the relationship between brain and behaviour and to assess and analyze the functional neuroimaging data related to lesion analysis. The primary aims for the meeting were to disseminate scientific findings, stimulate research on lesion analysis using MRI, and to promote discussion and collaboration between researchers at all levels. An attractive aspect of holding a relatively small scientific workshop is that it allows for in depth discussions and promotes the exchange of ideas within a specific field.

Scientific content of Budapest Workshop

The MRI and lesion reconstruction analysis techniques workshop attracted a large number of lively and enthusiastic participants that included both established scientists and postdoctoral and postgraduate researchers. A full description of the presentations is outlined below.

The workshop started with a Welcome and overview of the ESF European Research Network Programme Investigating Human Sensorimotor Function in Health and Disease [ERNI-HSF] given by Professor Stephen Jackson. The topics for the oral presentations

over the two day workshop included: the challenges for lesion mapping; the analytical and technical methods for lesion identification and lesion-symptom mapping; the clinical relevance of analyzing the anatomical and functional neuroimaging data in both normal people and patients with brain lesion; and the challenges fronted in moving toward establishing a European Neuropsychological database to support large-scale lesion reconstruction studies of human sensorimotor function. Lesion mapping methods can draw the contributions of specific brain areas to brain functions by looking at the behavioural consequences of the lesion. Moreover, lesion mapping allows us to look at the compensatory mechanisms that take place between brain areas after a lesion.

One of the highlights of the meeting was the opening lecture in which Professor Masud Husain from the University College London gave an introduction and overview of the challenges for lesion mapping. This lecture provided an outline of why we map lesions, how to map lesions, problems associated with lesion mapping and the analysis techniques available to perform mapped lesions. This was an excellent introduction to the general theme of the meeting and the topics to be covered.

One theme that emerged within the papers at the current Budapest MRI and lesion reconstruction Workshop concerned the technical and statistical analysis of lesion data. This theme also surfaced in the very interesting discussion of several papers that reported different techniques for the various preprocessing steps taken before applying statistical tests. Dr John Ashburner presented the processes involved with image registration and tissue segmentation and also introduced the DARTEL image registration model in SPM5. Following on from this Dr Jenny Crinion's lecture titled "Spatial normalization of lesioned Brains using SPM5: Performance evaluation and impact on fMRI analyses" presented a new unified segmentation method of normalization in SPM5. Another new method, the enaxiomorphic method of normalization, was also discussed by Dr Parashkev Nachev who presented data comparing this method with the Cost Function Masking method and the SPM standard method of normalization.

After lunch Dr Thomas Bruhn gave an informative introduction to the European Science Foundation. This lecture was then followed by Dr Daniel Kimberg who contributed to the theme of the analytical and technical issues faced in lesion analysis and highlighted the importance of power and spatial coherence in voxel-based lesion symptom mapping. Discussion of the first days lectures and many of the issues raised into the evening over a traditional Hungarian meal held at the Bock Bistro.

The second day of lectures began with Professor Hans-Otto Karnath presenting some of the strategies in lesion behaviour analysis. Several papers were presented which used different techniques and approaches in combining lesion analysis. One method presented used normalized perfusion MRI data to supplement structural CT and MRI scan data. Dr Chris Rorden also gave a lecture outlining the processes involved in performing lesion behavior statistics. He also presented the various types of statistics which could be performed on lesion data and highlighted the considerations to be made when using them. It was also demonstrated how these analysis techniques are implemented using the software MRIcroN.

Dr Alex Leff gave an introduction to lesion identification using the unified segmentation normalization models and also presented data using the automated fuzzy clustering method of lesion identification. This procedure can identify voxels where activation in a given subject is far from the mean activation of the group or population and should also help to compute the total volume of the lesion and make it possible to trace precisely the borders between intact and damaged tissue. This new automated procedure demonstrates the recent progression and advancement in the techniques available for lesion identification.

The final lecture of the meeting was given by Dr Simon Eickhoff whose presentation was entitled "Integrated analysis of lesions and their effects in an anatomically defined framework". This lecture gave an introduction to probabilistic cytoarchitectonic mapping, how these maps are produced, how to use them in the SPM anatomy toolbox and how to localize lesions and analyze their effects. The SPM anatomy toolbox was developed for the integration of cytoarchitectonic probabilistic maps of human cerebral cortex into the SPM software package which allows for the analysis of the correlation between structure and function.

The meeting ended on the Tuesday with a discussion session "Establishing a European Neuropsychological database to support large-scale lesion reconstruction studies of human sensorimotor function" led by Dr Chris Dijkerman and Dr Rob McIntosh. This session attracted a great deal of discussion with the key aim to create a database of lesion reconstruction studies which would pool data from different centres and be available to all European scientists. This would increase the amount of lesion reconstruction data available to researchers which would contribute to the understanding of lesion effects. Several key scientific and practical issues were raised during the discussion with the general consensus emerging on several realistic achievable goals for the progress of the database.

Programme of events:

Monday 21st April: Hungarian Academy of Sciences

9.00-9.40:	**Registration** - **Hungarian Academy of Sciences**
9.40-10.10:	Prof. Stephen Jackson (Chair ERNI-HSF Steering Committee) - ***"Welcome and overview of the ESF European Research Network Programme Investigating Human Sensorimotor Function in Health and Disease [ERNI-HSF]"***
10.10-10.55:	Prof. Masud Husain – ***"Challenges for lesion mapping"***
11.00-11.45:	Dr John Ashburner - ***"Image Registration and Tissue Segmentation"***
11.50-12.15	**Tea/coffee - Hungarian Academy of Sciences**
12.15-13.00:	Dr Jenny Crinion - ***"Spatial Normalization of lesioned brains using SPM5: performance evaluation and impact on fMRI analyses."***
13.00-14.00	**Lunch - Hungarian Academy of Sciences**
14.00-14.45:	Dr Thomas Bruhn (Scientific Officer: European Science Foundation)
14.50-15.35:	Dr Daniel Kimberg - ***"Spatial coherence and power in voxel-based lesion-behavior mapping"***
15.40-16.10:	**Tea/coffee - Hungarian Academy of Sciences**
16.10-17.00:	Dr Parashkev Nachev - ***"Barking up the wrong tree: the problem with mass univariate analysis in lesion-function brain mapping."***

Tuesday 22nd April: Hungarian Academy of Sciences

9.30-10.15: Prof Otto Karnath - ***"Strategies in lesion-symptom analysis"***

10.20-11.05: Dr Chris Rorden – "***Lesion Behaviour Statistics"***

11.10-11.40: **Tea/Coffee - Hungarian Academy of Sciences**

11.45-12.30: Dr Alex Leff - ***"Lesion identification using unified segmentation-normalisation models and fuzzy clustering"***

12.30-13.15: Dr Simon Eickhoff - ***"Integrated analysis of lesions and their effects in an anatomically defined framework"***

13.15-14.15: **Lunch - Hungarian Academy of Sciences**

14.15-16.30: Dr Chris Dijkerman and Dr Rob McIntosh - ***"Discussion Session: Establishing a European Neuropsychological database to support large-scale lesion reconstruction studies of human sensorimotor function"***

16.30: Workshop ends

Speakers:

Dr Daniel Kimberg
Center for Functional Neuroimaging, University of Pennsylvania, USA
Dr Rob McIntosh
Psychology, University of Edinburgh, UK
Dr Chris Dijkerman
Experimental Psychology, Helmholtz Institute, Utrecht University, The Netherlands
Dr Simon Eickhoff
Institute of Neurosciences and Biophysics, Forschungszentrum Jülich, Germany
Dr Alex Leff
Functional Imaging Laboratory, University College London, UK
Dr Parashkev Nachev
Institute of Cognitive Neuroscience, University College London, UK
Professor Chris Rorden
Neuroimaging Laboratory, University of South Carolina, Columbia, USA
Dr Jenny Crinion
Functional Imaging Laboratory, University College London, UK
Professor Stephen Jackson
School of Psychology, University of Nottingham, Nottingham, UK
Professor Masud Husain
Institute of Cognitive Neuroscience, University College London, London, UK
Dr John Ashburner
Functional Imaging Laboratory, University College London, London, UK
Dr Thomas Bruhn
European Science Foundation
Professor Hans-Otto Karnath
Centre of Neurology & Hertie-Institute for Clinical Brain Research, Tuebingen, Germany

Workshop Attendees:

Zoltan Vidnyanszky, MR Research Centre, Semmelweis University, Budapest
Professor Edward de Haan, Faculty of Social and Behavioural Sciences, University of Amsterdam
Martha Turner, Institute of Cognitive Neuroscience, University College London
Gyula Kotek, Diagnostic Center, University of Pécs, Hungary
Krisztian Toth, University of Pécs, Hungary
Csaba Szalay, Institute of Physiology, Pécs University Medical School, Hungary
Stephanie Rossit, Department of Psychology, University of Glasgow
JeYoung Jung, School of Psychology, University of Nottingham
Lajos Kozak, MR Research Centre, Semmelweis University, Budapest
Adrian Danek, Neurologische Klinik, Ludwig-Maximilians-Universität, Munich
Mark Molner, Institute of Psychology, Hungarian Academy of Sciences, Budapest
Artin Atabaki, Hertie-Institute for Clinical Brain Research, Tuebingen
Gioia Negri, Cognitive Neuropsychology and NeuroImaging, S.I.S.S.A - I.S.A.S, Trieste
László Négyessy, Hungarian Academy of Sciences, Budapest
Liuba Papeo, Cognitive Neuropsychology and NeuroImaging, S.I.S.S.A - I.S.A.S, Trieste
Alessandro Grecucci, Cognitive Neuropsychology and NeuroImaging, S.I.S.S.A - I.S.A.S, Trieste
Jessica Jackson, Department of Neuropsychology, National Hospital for Neurology and Neurosurgery, London
Bianca de Haan, Centre of Neurology, Hertie-Institute for Clinical Brain Research, Tuebingen
Gary Green, York Neuroimaging Centre, University of York
Lawrie McKay, Department of Psychology, University of Glasgow
Mihály Aradi, Department of Neurosurgery, Univ. Of Pécs, Hungary
Martine van Zandvoort, Utrecht University, The Netherlands
Dr. Barsi Péter, MR Research Centre, Semmelweis University
Réka Horvath, University of Pécs, Hungary
Geert Jan Biessels, Utrecht University, The Netherlands
Dr. Nyakas Csaba, Research Institute for Sport Sciences and Neuropsychopharmacological Research Laboratory, Semmelweis University
Marc Himmelbach, Centre of Neurology, Hertie-Institute for Clinical Brain Research, Tuebingen
Amy Parkinson, School of Psychology, University of Nottingham
Turki Abualait, School of Psychology, University of Nottingham
Luca Ticini, Centre of Neurology, Hertie-Institute for Clinical Brain Research, Tuebingen
Bigna Lenggenhager, Laboratory of Cognitive Neuroscience, Swiss Federal Institute of Technology

Locally Registered Attendees:

Tamás Kincses

Péter Halász

Ervin Berényi

Lilla Tóth

József Jánszky

Attila Scwarcz

Gyorgy Rásonyi

Rita Jakus

Csaba Borbély

Anna Kelemen

Dániel Fabó

Bence Gunda

István Kóbor

Viktor Gál

Zsuzsa Kalmár
István Gyuricza

Nándor Kolos Pintér

Edina Varga

Erika Vörös

László Dézsi

Csaba Rajkai

László Simon

Annamária Noszek

Katalin Köves

Mária Kassay

János Kiss

László Simon

Anita Deak

Mátyás Káplár

Orsolya Minik

Loránd Erőss