KEYNOTE ABSTRACTS

KEY004: Hubs In Brain Structure And Function

Keynote Speaker: **Professor Olaf Sporns**, Indiana University, USA

Overview

Recent years have seen significant advances in mapping structural and functional brain connectivity across several species, including humans. One persistent finding has been the presence of highly connected and/or highly central brain regions, so-called network hubs. This talk will focus on the structural and functional roles of network hubs in the human brain. I will discuss how hubs are defined and detected in structural and functional network data, and what predictions network models make about their contribution to signaling and communication processes. I will end by reviewing recent work on how brain hubs are linked into "cores" or "rich clubs" and what this type of network architecture can tell us about integrative brain function.

KEY005: Imaging And Stimulating Adaptive Brain Plasticity

Keynote Speaker: **Professor Heidi Johansen-Berg**, University of Oxford, UK

Overview

Animal studies show that the adult brain shows remarkable plasticity in response to learning or recovery from injury. Non-invasive brain imaging techniques can be used to detect systems-level structural and functional plasticity in the human brain. This talk will focus on how brain imaging has allowed us to monitor healthy brains learning new motor skills, to assess how brains recover after damage, such as stroke, and how they adapt to change, such as limb amputation.

Although imaging is useful to detect such adaptations, many brain imaging measures are non-specific and do not allow us to pinpoint the underlying cellular changes that are driving observed effects. The talk will also discuss studies in animal models in which both imaging and histological approaches can be used to shed light on the underlying biological drivers for structural plasticity detected using MRI.

Finally, the talk will discuss how brain stimulation can be used to manipulate brain remodelling. For example, using transcranial direct current stimulation (tDCS) to the motor cortex we can speed people's learning of a new task, alter their brain chemistry, or improve function in stroke patients. FMRI identifies changes in cortical activity that may mediate these functional benefits. In future, imaging could be used to guide individually targeted brain stimulation to enhance adaptive brain plasticity.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S07: Understanding High-Level Vision, Attention And Decision Making By Means Of Frequency-Tagging EEG

Chair & Speaker: **Bruno Rossion**, University of Louvain, Belgium
Professor Jason Mattingley, The University of Queensland, Australia
Bruno van Swinderen, Queensland Brain Institute, Australia
Redmond O'Connell, Trinity College Dublin, Ireland

Overview

Periodic visual stimulation leads to periodic brain responses measured by the electroencephalogram (EEG), the so-called "steady-state visual evoked potentials" (SSVEPs, Regan, 1966). This approach has many advantages over other cognitive neuroscience methods, in particular its objectivity (i.e., the signal is measured at a frequency known by the experimenter), its high signal-to-noise ratio, and the possibility to record from different visual stimuli presented concurrently ("frequency-tagging"). Yet, this approach remains underestimated in cognitive neuroscience, having been so far essentially confined to the study of low-level visual stimuli. The four speakers of this symposium (Mattingley, Rossion, van Swinderen, and O'Connell) have all performed a series of independent studies using the frequency-tagging EEG technique over recent years. Their presentations will illustrate how this approach can capture various key aspects of visual perception (including perceptual integration), selective attention and perceptual decision making, both in healthy humans and clinical populations as well in the simplest animal brains such as bees and flies.

S07 001: Objective Evidence For Perceptual Integration By Means Of Frequency-Tagging EEG

Bruno Rossion, University of Louvain, Belgium

The human face is often considered as the quintessential whole, or Gestalt. However, objective evidence that the whole of a face is more than the sum of its parts is still lacking. In a series of studies, we have used a paradigm based on periodic visual stimulation of whole faces (Rossion & Boremanse, 2011) and frequency-tagging (Regan & Heron, 1969) to investigate the mechanisms of perceptual integration in the human brain. During EEG recording, the left and right halves of a face, or its top and bottom halves, were contrast-modulated with different frequencies (f1: 5.87 Hz; f2: 7.14 Hz) so that the responses to each of the two halves presented simultaneously could be distinguished objectively. In general, these part-based responses were located over low-level visual areas and remained unchanged following spatial misalignment or separation of the face parts, or inversion of the whole face. Most importantly, there were intermodulation components (IMs: f1-f2: 1.26 Hz; f1+f2= 13.01 Hz) over the right occipito-temporal hemisphere, reflecting the nonlinear interaction of the two input frequencies. The magnitude of the IM components decreased substantially and specifically with spatial misalignment/separation of the face parts, or with face inversion. These IMs constitute an objective trace of a unified face representation in the human brain, demonstrating that the whole of a face is more than the sum of its parts and opening an avenue for the study of perceptual integration in the human brain.

Biography

Bruno Rossion is director of research at the National Research Fund in Belgium, University of Louvain. He has authored over 100 scientific publications in international peer-reviewed journals on the topic of face perception, using a diversity of approaches: behavioral measures (psychophysics), human electrophysiology (ERPs, EEG), neuroimaging (PET, fMRI), eye movements, single-case studies of brain-damage patients (prosopagnosia), behavioral and EEG studies of infants and children, and human intracerebral recordings and electrical stimulations (http://face-categorization-lab.webnode.com//). Over the past few years, he has developed an approach based on periodic visual stimulation to understand individual face discrimination and perceptual integration.

SO7 002: Using Frequency Tagging To Measure Visual Perception And Selective Attention In Health And Disease

Jason Mattingley, University of Queensland, Australia

Electroencephalography (EEG) studies employing event-related potentials (ERPs) have been particularly successful at characterising instantaneous changes in the amplitude and timing neural signals associated with perceptual and cognitive events. In many situations, however, the neural events of interest unfold over prolonged timescales that can last for several seconds or even minutes. In these circumstances, a more fruitful approach is to employ steady-state evoked potentials (SSEPs), in which several competing stimuli are flickered continuously, and their unique neural signatures recovered from the EEG trace using frequency-based analyses. We have used such "frequency tagging" methods, combined with EEG, to measure various aspects of visual perception and selective attention, in health and disease. Here I provide an overview of these investigations. At the level of early visual perception, we have used frequency tagging to reveal the neural correlates of amodal completion of visual surfaces hidden behind occluding objects. We have used analogous approaches to show that feature-based attention spreads to ignored locations during conjunction search, but not during unique feature search, and that this spread of attention reflects active enhancement of target-coloured items at irrelevant locations. In more recent work we have employed frequency tagging to compare the influence of spatial attention on neural responses to visible and invisible phase-scrambled targets embedded in dynamic noise. Finally, we have adapted several of these paradigms to investigate anomalous visual processing in parietal-lesioned patients with unilateral spatial neglect, and in macular degeneration patients suffering from visual hallucinations.

Biography

Professor Jason Mattingley is Foundation Chair in Cognitive Neuroscience at the Queensland Brain Institute and School of Psychology, University of Queensland. He is an Australian Research Council Laureate Fellow, has been awarded the Australian Psychological Society's Distinguished Contribution to Psychological Science Award, and is an elected Fellow of the Academy of Social Sciences in Australia. Professor Mattingley's research is directed at understanding the neural and cognitive mechanisms that underlie selective attention in health and disease, with a particular focus on how attentional processes influence multisensory integration, motor planning, neural plasticity and consciousness. He has published extensively in high impact journals including Science, Nature, Neuron, Current Biology and Nature Neuroscience.

S07: Understanding High-Level Vision, Attention And Decision Making By Means Of Frequency-Tagging EEG cont'd

SO7 003: Behavioural, Electrophysiological, And Genetic Approaches To Studying Top-Down Visual Attention In Insects

Bruno van Swinderen, Queensland Brain Institute, Australia

Attention allows animals to respond selectively to competing stimuli. In humans and other primates, stimulus-selective responses can occur in the brain before behavioural actions, and this motivational form of attention has been referred to as a "top-down" process, to distinguish it from salience-driven or "bottom-up" attention. Whereas it is now established that even insects display bottom-up attention, at the level of both behavior and brain activity, it is unknown whether attention-like selection in the insect brain might also precede and predict behavioral choices. The case for top-down attention is especially compelling for honeybees, which have demonstrated cognitive capabilities such as the capacity to learn abstract concepts. To effectively relate predictive attention processes to behaviour, however, requires recording brain activity from behaving animals faced with competing choices. I will discuss a novel closed-loop visual attention paradigm for bees and flies that allows these questions to be effectively addressed. In honeybees, stimulus selectivity in the optic lobes was found to precede behavioural choices made by the animal. Replay of the same visual sequences, but without active control by the bee, widened the receptive field of frequency-tagged objects. The same experimental approaches were adapted to the fruit fly Drosophila melanogaster, a much smaller insect with a wide repertoire of genetic tools. These tools, such as the ability to transiently activate key neurotransmitter systems or brain structures, will allow for a better understanding of how bottom-up and top-down attention processes may be coordinated in the simplest animal brains.

Biography

Bruno van Swinderen is Associate Professor and ARC Future Fellow at the Queensland Brain Institute, where he heads a laboratory in cognitive and behavioural neuroscience. His laboratory uses insect model systems, such as flies and bees, to study complex phenomena such as visual selective attention, sleep, and general anaesthesia – with the overall goal to understand stimulus suppression mechanisms in the brain. To achieve this goal, a variety of techniques are used, including behavioural analysis, electrophysiology, and molecular genetic techniques.

SO7 004: A Window Onto The Basic Elements Of Perceptual Decision Making In The Human Brain

Redmond O'Connell, Trinity College Dublin, Ireland

A significant challenge associated with non-invasive recording techniques such as electroencephalography (EEG) is to isolate brain signals that can be directly linked to well-defined neural mechanisms. Here, I will present a series of novel human electrophysiological paradigms that make it possible to simultaneously monitor the key information processing stages intervening between sensation and action during simple perceptual decisions in discrete neural signals. Each of these paradigms involves monitoring continuously presented stimuli for gradual changes in a single sensory feature where the absence of discrete stimulus onsets provides a clear view of the neural computations underpinning decision formation in the trial-averaged EEG. Steady-state stimulation is utilized to generate a precise read-out of early sensory encoding and alpha- and beta-band activity provide independent spectral indices of attentional engagement and motor preparation respectively. This approach has yielded new insights into the neural implementation of perceptual decision making, the speed-accuracy tradeoff and visuo-spatial attention. I will also highlight the potential of this work to improve our understanding of cognitive deficits associated with age-related cognitive decline and attention-deficit/hyperactivity disorder.

Biography

Redmond O'Connell is Assistant Professor at the Trinity College Institute of Neuroscience and School of Psychology, Trinity College Dublin and is an Adjunct Senior Research Fellow at Monash University. Research in the O'Connell laboratory is seeking to understand the neural mechanisms underpinning high-level cognitive functions including decision making, performance monitoring and attention. This work comprises both basic and translational research and employs a range of psychophysiological techniques including EEG, fMRI, autonomic system measurement and transcranial stimulation.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S08: The Dynamic Brain

Claudio R. Mirasso, Institute for Cross-Disciplinary Physics and Complex Systems, Spain
Luis M. Martinez, Institute of Neuroscience, Alicante, Spain
Chair & Speaker: **Leonardo L. Gollo**, Queensland Institute for Medical Research, Australia
Michael Breakspear, Queensland Institute for Medical Research, Australia

Overview

Studying the dynamics of brain activity is fundamental to a deeper understanding of its core computational mechanisms. Modelling and simulating the dynamics of large-scale brain activity is a rapidly emerging neuroscience field that promises a more principled way of interpreting brain imaging data and inferring the relationship between cognition and brain function. More, such "in silico" experiments allow systematic exploration of physiological parameters in a manner that is not otherwise possible: This approach lies at the heart of the enormous European-based Brain project. Our symposium will present four contributions that cover the range of brain network dynamics by emerging and leading international researchers. In particular, we will present cutting edge work that the role of brain network structure plays in shaping cortical dynamics during perceptual and cognitive activities. Together, these talks will cover synchronization in microcircuits, thalamocortical processes that underlie the processing of visual stimuli, stochastic dynamics during decision making, and the origin of slow fluctuations related to mood and affect in deep midline cortical regions. These talks will be of interest to computational neuroscientists, neuroimaging researchers as well as cognitive neuroscientists interested in the modelling activities that are in the process of transforming the field.

SO8 001: Anticipated Synchronization In Neuronal Populations: Reconciling Information Directionality With Negative Time Lag

Claudio R. Mirasso, Institute for Cross-Disciplinary Physics and Complex Systems, Spain

Synchronization has been extensively studied in the brain, where it has been hypothesised to be relevant to issues such as the binding problem, temporal coding, deployment of spatial attention, higher cognitive functions, and many others. Among the tools available to assess the coordinated activity of two or more areas, correlation functions are probably the most widely employed. However, correlations do not detect the directionality of the connection. Granger causality (GC) has shed light on the directional influences and the time arrow of the information flow. A positive GC from an area A to an area B would indicate that the activity of area A causes the activity of area B. Intuitively, one tends to assume that a positive GC is accompanied by a positive time delay (relative phase) between the activities of areas A and B, signaling that activity in A precedes that of B. But would it be possible to compute a positive GC and a negative time delay? This is precisely the scenario we study in this work, motivated by experiments reported in monkeys while performing a visual task.

Biography

Claudio R. Mirasso received the Ph.D. in physics from the Universidad Nacional de La Plata, Argentina, in 1989. He has held post-doctoral positions in Spain and the Netherlands. He is Full Professor at the Physics Department, Universitat de les Illes Balears, Spain and researcher of the Institute for Cross-Disciplinary Physics and Complex Systems (IFSIC, UIB-CSIC).

He has authored or co-authored over 140 journal papers. He was coordinator of the European Projects OCCULT and PHOCUS. His current research interests include modelling and simulation of neuronal dynamics, dynamics and applications of delayed coupled systems, information processing and applications of nonlinear dynamics.

SO8 002: (How The Thalamus Changes) What The Cat's Eye Tells The Cat's Brain

Luis M. Martinez, Institute of Neuroscience, Alicante, Spain

Visual information reaches the brain through the activity of thousands of neurons distributed in non-random arrays across the innermost layer of the retina. Anatomical and physiological studies have shown that both the dendritic arbors and the receptive fields of retinal ganglion cells (RGCs) form mosaics that are coordinated to approach the theoretical resolution limit of a hexagonal lattice. The stereotyped, optimized and hardwired nature of the retinal arrays has led to two main predictions. First, that due to an extensive pooling from neighboring photoreceptors, visual acuity should match the Nyquist limit of the RGCs population. And second, that the spatial arrangement of the mosaics should set a strong constrain on the emergence of different receptive field structures, local circuits and functional properties in downstream visual areas of the brain. In this lecture I will discuss recent results showing how the thalamic array, dynamically transforms the retinal message on its way to the primary visual cortex contributing to high resolution visual processing, the emergence of cortical receptive fields and maps.

Biography

Luis M. Martinez is a Staff Scientist with the Spanish National Research Council at the Institute of Neuroscience in Alicante, where he directs the Laboratory of Visual Neuroscience. PhD in Neurobiology from the University of Santiago de Compostela, Spain, he did his postdoctoral training at The Rockefeller University in New York, under the direction of Torsten N. Wiesel, Nobel prize in 1981, in collaboration with Judith Hirsch, and Jose-Manuel Alonso. Dr. Martinez's long-term scientific goals are to understand how the visual circuits of the brain generate the perception of the world and why different brains do it so differently.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S08: The Dynamic Brain cont'd

SO8 003: Computational Models Of Perceptual Uncertainty And Decision Making

Leonardo L. Gollo, Queensland Institute for Medical Research, Australia

Computing and representing the precision of our beliefs is a key cognitive process which underlies perceptual inference and decision making, particularly in the presence of ambiguous or noisy sensory information. In a recent functional neuroimaging experiment, we showed that detecting change amongst noisy perceptual stimuli engages a constellation of cortical regions in left prefrontal cortex [1]. It is natural to ask how these regions coordinate their activity during the perceptual decision making process during this task. Here we use a Bayesian-based model inversion [2] to disambiguate three candidate classes of network models – parallel, serial and hierarchical. We find strongest evidence for a nonlinear, hierarchical arrangement of causal interactions, in which rostral prefrontal cortex provides context dependent gating of information flowing between different regions of dorsolateral prefrontal cortex.

We provide a computational interpretation of these findings by examining phase and amplitude fluctuation in small network motifs of coupled neural mass oscillators. 1. Karim, M., Harris, J. A., Morley, J. W., Breakspear, M. (2013). The role of prefrontal cortex in representing the precision of our beliefs. Submitted. 2. Friston, K. J., Harrison, L., & Penny, W. (2003). Dynamic causal modelling. Neuroimage, 19(4), 1273-1302.

Biography

Dr Gollo was awarded a PhD in physics at the Universitat de les Illes Balears in 2012 and is currently a postdoctoral fellow of the Systems Neuroscience Group at the Queensland Institute of Medical Research. Dr Gollo's current studies use computational tools and theoretical insights from physics of complex systems and nonlinear dynamics to understand problems of systems neuroscience.

SO8 004: Dwelling Quietly in the Rich Club: Brain Network Determinants of Slow Cortical Fluctuations

Michael Breakspear, Queensland Institute for Medical Research, Australia

The relationship between the fast time scales of neuronal dynamics and the slow fluctuations of mood and affect have not yet found full theoretical explanation. Recent analyses of brain network topology has shown that the regions involved in the regulation of mood and introspection belong to a topological core of the brain known as the rich club – a constellation of densely interconnected regions that form the structural backbone of the brain. Computational models predict that the local network topology of this constellation of brain regions – which include the anterior insula, thalamus, amygdala and precuneus – support slowly fluctuating patterns of sychronization. In contrast, the local network topology of the surrounding "feeder" cortical regions are predicted to show rapidly fluctuating and unstable dynamics. I will hence propose that these network properties of central cortical regions are the structural determinants of the slowly fluctuating changes in neuronal dynamics in these brain regions. These time scales are ideally suited to the regulation of internal visceral states, corresponding to the somatic correlates of mood and anxiety. I will end by reviewing recent analyses of resting state fMRI data from subjects with melancholia that support this proposal.

Biography

Professor Michael Breakspear is the Coordinator of the Mental Health and Complex Disorders Program at the Queensland Institute of Medical Research (QIMR) and a consultant psychiatrist at the Royal Brisbane and Women's Hospital. He trained in medicine and physics at the University of Sydney before completing his specialist training in psychiatry at St Vincent's Hospital. He moved to QIMR in 2009 to become the inaugural program coordinator of mental health and complex disorders. He leads a multidisciplinary research team whom undertake psychiatric and imaging research aimed at improving diagnosis and treatment in clinical psychiatry.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S09: New Approaches To The Neural Basis Of Mathematical Cognition

Chris Clark, University College London, UK
Carlo Semenza, University of Padova, Italy
Teresa Iuculano, Stanford University, USA
Chair & Speaker: Brian Butterworth, University College London, UK

Overview

Numeracy attainment has a substantial economic, cultural, social and personal impact. Educational efforts to address this problem have met with limited success, in part because the core neuro-biology of numeracy remains only partly characterized, mainly on grey matter regions activated in very simple number tasks using PET and fMRI. Here we present methodologies for examining the core neuro-biology that haven't previously been deployed. They reveal new aspects of the functional and anatomical organization of mathematical cognition and their genetic basis.

SO9 001: Microstructural Measures Of The Developing Brain And Its Response To Learning: Evidence From Neuroimaging

Chris Clark, University College London, UK

Diffusion tensor imaging has provided unique information about brain microstructure. The trajectories of these brain microstructural changes have been mapped from birth to adulthood. In particular sexual dimorphisms have been demonstrated which appear to be related to the differential onset of puberty in men and women. In addition to this several studies have used diffusion tensor imaging to detect changes in the structure of the brain following various learning tasks. This raises the question as to whether these types of experiment can be used to measure brain structural changes as a result of the acquisition of mathematical skills.

Biography

Chris Clark is a Reader in Imaging and Biophysics and specialises in diffusion MRI and tractography in studies of the paediatric brain in health and disease. His recent publications include: Gibbard, C.R., et al (in press 2013). White matter microstructure correlates with autism trait severity in a combined clinical-control sample of high-functioning adults. Neuroimage: Clinical Kawadler, J.M., et al (2013, in press). Subcortical and cerebellar volumetric deficits in paediatric sickle cell anaemia. British Journal of Haematology. Assaf, Y., et al and the CONNECT Consortium. (2013, in press). The CONNECT project: Combining Macro- and Micro-structure. Neuroimage

SO9 002: Simple Calculation In The Brain: Evidence From Direct Cortical Electro-Stimulation

Carlo Semenza, University of Padova, Italy

Single digit multiplication and addition were mapped during awake surgery using electro-stimulation in right-handed patients affected by high-grade gliomas located in the left or in the right parietal lobe (3 for each site; more patients will be studied by the time of the conference). In all patients, different sites of the parietal cortex, mainly in the inferior lobule, were detected as being specifically related to calculation (multiplication or addition). These findings add to previous knowledge about the anatomical-functional organization for multiplication and addition within parietal areas, in particular in the right hemisphere.

Biography

Carlo Semenza is professor of Neuropsychology in the Department of Neuroscience at the University of Padova. He works on the neural aspects of the mental lexicon and of mathematical abilities. Recent publications include: Della Puppa, A et al (2013) Right parietal cortex and calculation processing. Intra-operative functional mapping of multiplication and addition. Journal of Neurosurgery. Semenza, C., et al (2012) Genetics and mathematics: FMR1 premutation female carriers. Neuropsychologia, 50(14):3757-63 Salillas, E. et al (2012) Single pulse TMS induced disruption to right and left parietal cortex on addition and multiplication. NeuroImage, 59 (2012) 3159–3165.

SO9 003: Training The "Mathematical Brain": Evidence From Functional Brain Imaging And Neuro-Modulation Techniques

Teresa Iuculano, Stanford University, USA

Here we adopt a multi-componential approach to skill acquisition in typical and atypical learners, particularly those with developmental dyscalculia (DD). It combines training models with functional brain imaging (fMRI) in Study 1 neuro-modulation techniques (Transcranial Electrical stimulation) in Study 2. In Study 1 we show that 2 months of math training in 7-9 year old children with DD significantly improved their performance to the level and normalized brain activity-levels in multiple brain systems known to be important for arithmetic, numerical representation, attention and working memory. Moreover, performance improvement was significantly predicted by functional normalization of these brain regions. In Study 2, we show that the application of a small constant current to the left posterior parietal cortex, a key region for numerical representation, during numerical learning, could normalize behavioral performance in an adult case of severe and persisting DD.

Biography

Teresa Iuculano is a post-doctoral fellow at the Stanford Cognitive and Systems Neuroscience Laboratory, Stanford University School of Medicine, and Honorary fellow at the Institute of Cognitive Neuroscience, University College London. Her research focuses on the behavioural and brain correlates related to the acquisition of mathematical abilities in the typical and atypical brain. Her recent publications include: Iuculano, T, et al. (2013). Brain Organization Underlying Superior Mathematical Abilities in Children with Autism. Biol. Psychiatry, doi: 10.1016/j.biopsych.2013.06.018 Iuculano, T, Cohen-Kadosh, R (2013). The Mental Cost of Cognitive Enhancement. J Neurosci, 33(10), 4482-4486

SO9 004: The Genetics Of The Neural Bases Of Low Numeracy

Brian Butterworth, University College London, UK

The present study of 160 8 to 14 year twins revealed evidence for a core number factor within a wide and varied battery of cognitive tests. There was a significant genetic relationship between numerical attainment and the structure of brain regions known to support the core capacity to represent numerosities. Moreover, the developmental trajectory of grey matter density in the critical brain region differs between high and low attainers.

Biography

Brian Butterworth is Emeritus Professor of Cognitive Neuropsychology at University College and Fellow of the British Academy. He is currently working with colleagues in several countries on the neuropsychology and the genetics of typical and atypical mathematical development. His recent publications include: Butterworth, B., & Kovas, Y. (2013). Understanding Neurocognitive Developmental Disorders Can Improve Education for All. Science, 340(6130), 300-305. Butterworth, B., & Walsh, V. (2011). Neural basis of mathematical cognition. . Current Biology, 21(16), R618-R621 Butterworth, B., Varma, S., & Laurillard, D. (2011). Dyscalculia: From brain to education. Science, 332, 1049-1053.

S10: TMS And TDCS As A Tool In Cognitive Neuroscience: How Does Transcranial Stimulation Influence Behavior?

Michael A. Nitsche, University Medical Center Goettingen, Germany
Carlo Miniussi, University of Brescia & IRCCS Centro San Giovanni di Dio Fatebenefratelli, Italy
Chair & Speaker: **Hartwig R. Siebner**, Copenhagen University Hospital Hvidovre, Denmark

Overview

Non-invasive brain stimulation (NIBS) has become a popular method for inducing reversible brain lesions in normal subjects. If such a "virtual lesion" impairs task performance, it is concluded that the "lesioned" region makes a critical contribution to the cognitive processes that are probed by the task. There is a mismatch between the widespread use of NIBS in cognitive neuroscience and the rudimentary knowledge regarding the mechanisms by which NIBS disrupts brain function. The objective of this symposium is to focus on the neural processes underlying a NIBS-induced "virtual lesion". Vincent Walsh will set the frame by highlighting methodological and theoretical limitations of the virtual lesion approach. Michael Nitsche will discuss the use of low-intensity transcranial electrical stimulation as a tool to manipulate neural excitability and intrinsic neural oscillations and how this relates to stimulation-induced changes in behavior. Carlo Miniussi will provide a "noisy account" on the virtual lesion approach and discuss how NIBS influences brain functions by altering regional noise levels. Hartwig Siebner will adopt a connectionists view on the virtual lesion approach and show that changes in effective connectivity in specific pathways of the stimulated network may account for the absence or presence of NIBS-induced "virtual lesion effects.

S10 001: Transcranial Electrical Stimualtion (Tdcs, Tacs, And Trns) As Tools To Interfere With Cognitive Functions: Shifting Excitability And Shaping Oscillations.

Michael A. Nitsche, University Medical Center Goettingen, Germany

Alterations of cortical excitability, oscillatory as well as non-oscillatory brain activity are physiological derivates of cognitive processes, such as perception, working memory, learning, and long-term memory formation. Since non-invasive brain stimulation is capable to induce respective alterations in the human brain, these stimulation approaches might be attractive tools to modulate cognition. Transcranial direct current stimulation (tDCS) alters spontaneous cortical activity via its impact on cortical excitability, while transcranial alternating current stimulation (tACS), and transcranial random noise stimulation (tRNS) are presumed to induce or interfere with oscillations of cortical networks. Via these mechanisms, the respective stimulation techniques have indeed been shown to modulate cognitive processes in a multitude of studies conducted during the last years. I will summarize the knowledge obtained about the potential of tDCS, tACS, and tRNS to study and modify cognitive processes in healthy humans, and discuss options for directions of future research.

Biography

Michael A. Nitsche is board-certified neurologist, psychologist and associate professor at the Department for Clinical Neurophysiology of the University Medical Center, Goettingen, Germany, where he runs the laboratory for Systemic Neurosciences. His main research interest is plasticity research in humans, including non-invasive brain stimulation, neuropsychopharmacology and its impact on cognition.

S10 002: Non-Invasive Brain Stimulation In Cognitive Neuroscience: A "Noisy" Explanation

Carlo Miniussi, University of Brescia & IRCCS Centro San Giovanni di Dio Fatebenefratelli, Italy

Non-invasive brain stimulation (NIBS) is a unique method to study cognitive functions. NIBS offers the opportunity to study brain mechanisms beyond process localisation, providing information about when activity in a given brain region is involved in a cognitive process, and even how it is involved. We know that NIBS techniques have the potential to transiently influence behaviour by altering neuronal activity, which may have facilitatory or inhibitory behavioural effects, and these alterations can be used to understand how the brain works. NIBS techniques include transcranial magnetic and electric stimulation (TMS and TES). The mechanisms underlying TMS and TES seem to be different, nevertheless, the final behavioural effects induced by TMS and TES are often very similar. In this presentation, I will describe the mutual interactions between NIBS and brain activity and provide an updated perspective on the theoretical frameworks of NIBS and their impact on cognitive neuroscience. Given that NIBS necessarily involves the relatively indiscriminate activation of large numbers of neurons, its impact on a neural system can be easily understood as modulation of neural activity that changes the relation between noise and signal. The framework that I wish to proposed here offers the opportunity to understand how NIBS, by altering levels of noise, could usually impair, but sometimes improve performance on a task. Depending on the amount of noise introduced by NIBS, the existing level of noise in the system or in the task due to the state of the subject, it is possible to evaluate the final result.

Biography

Carlo Miniussi received his M.Sc in Experimental Psychology from Padova University (1994), Ph.D. in Neuroscience from Verona University (1999). He has been a postdoctoral fellow at the Experimental Psychology Dept Oxford University for two years. In 2000 he became chief of the Neurophysiology Laboratory IRCCS Fatebenefratelli Brescia, Italy. In 2005 he was appointed Associate Professor of Human Physiology School of Medicine, University of Brescia. In 2010, he was qualified as full Professor of Human Physiology. In the 2013 he has been elected President elect of Italian Society of Psychophysiology.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S10 003: Non-Invasive Brain Stimulation In Cognitive Neuroscience: A "Connectivity" Account

Hartwig R. Siebner, Copenhagen University Hospital Hvidovre, Denmark

NIBS given before or during an experimental task can produce a change in task performance which is often attributed to a selective disruption of neural processing in the cortical area that has been targeted with NIBS. In the first part of the presentation, I will summarize recent work that modeled the distribution of NIBS-induced electrical currents in the brain and discuss the implication of this work for the virtual lesion approach in cognitive neuroscience. In the second part of the presentation, I will present a set of fMRI studies which assessed the effects of NIBS on functional brain connectivity. These studies provided converging evidence that NIBS dynamically tunes the effective connectivity strength of cortico-cortical and cortico-subcortical connections in functional brain networks and hereby, shapes neural processing well beyond the stimulated region. Based on these results, I will argue that dynamic network models that consider NIBS effects on large-scale effective connectivity may be more appropriate than a local virtual lesion model to account for the behavioral impact of NIBS, including state- and task-specific effects of NIBS on a given brain function.

Biography

Hartwig R. Siebner is board-certified neurologist and professor for functional neuroimaging at the University of Copenhagen. He is heading the Danish Research Centre for Magnetic Resonance (DRCMR) at Copenhagen University Hospital Hvidovre and is Principal Investigator of the "Control of Action" (ContAct) reseach group at DRCMR. His research focuses on the question how the human brain generates and optimizes actions. To this end, he combines advanced magnetic resonance imaging (MRI) of the brain with transcranial stimulation techniques to study causal interactions within motor brain systems and to trace sensorimotor plasticity.

S11: The Menzies Foundation Symposium: A Window Into Normal Cognition: Insights From Synaesthesia

David Brang, University of Chicago, USA
Katie Bankieris, University of Rochester, USA
Derek Arnold, University of Queensland, Australia
Chair & Speaker: Anina N. Rich, Macquarie University, Australia

Overview

The phenomenon of synaesthesia, in which a stimulus elicits an unusual additional experience (e.g., a sound elicits a colour), has generated enormous interest over the past decade. Contemporary cognitive neuroscience methods and novel manipulations of classic measures of behaviour have given insights into the mechanisms that underpin this fascinating phenomenon. In this symposium, the speakers will present recent research on the integration of information across the senses in both synaesthetes and non-synaesthetes, with a focus on the role of higher-level information and the insights we can gain from synaesthesia for understanding cognition more generally. Overall, the goal of the symposium is to promote active debate into the role conceptual information plays in synaesthesia and the inferences we can draw from synaesthetic research to fundamental mechanisms and concepts that underpin the human cognitive system.

S11 001: Implicit Shape-Color Associations In Synesthesia

David Brang, Northwestern University, USA

Grapheme-color synesthesia is a neurological phenomenon in which letters and numbers (graphemes) consistently evoke particular colors (e.g., A may be experienced as red). These sensations are thought to arise through the cross-activation of grapheme processing regions in the fusiform gyrus and color area V4, supported by anatomical and functional imaging. However, the developmental acquisition of grapheme-color associations remains elusive. One account suggests that synesthesia is present at or near birth and initially binds basic shapes and forms to colors, which are later refined to grapheme-color associations through experience. Consistent with this view, we and others have shown that similarly shaped letters and numbers tend to elicit similar colors in synesthesia and that some synesthetes consciously associate basic shapes with colors. This model further predicts that the initial shape-color correspondences in synesthesia may persist as implicit associations, driving the assignment of colors for novel characters. Examining the presence of latent color associations for novel characters, we trained synesthetes and controls on pre-defined associations between colors and complex shapes, on the assumption that the prescribed shape-color correspondences would on average differ from implicit synesthetic associations. Consistent with our suggestion that implicit form-color associations conflict with these learned pairings, synesthetes were significantly less accurate than controls to learn novel shape-color associations. In sum, this series of results suggests that grapheme-color associations may originate as shape-color associations early in development, before synesthetes acquire the necessary experience with numbers and letters to associate them with colors.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S11: The Menzies Foundation Symposium: A Window Into Normal Cognition: Insights From Synaesthesia cont'd

Biography

Dr David Brang is a cognitive neuroscientist at Northwestern University and the University of Chicago, where he studies the anatomical and functional networks underlying multisensory processes present in both the general population and in special populations including synesthetes. He is one of the most prolific synesthesia researchers in the United States, publishing 16 articles on the topic since 2008. His research highlights both conceptual and perceptual components to synesthesia and emphasizes the numerous cognitive benefits bestowed upon synesthetes. This research has been highlighted in media outlets worldwide, including CNN, MSNBC, Scientific American, and National Geographic.

S11 002: What Can Synaesthesia Teach Us About Sound Symbolism

Katie Bankieris, University of Rocherster, USA

Sound symbolism is a linguistic device that directly links phonological form to semantic meaning. Sound symbolism can allow speakers to understand the meanings of etymologically unfamiliar foreign words, although the mechanisms are not well understood. We examined whether sound symbolism is mediated by the same types of cross-modal processes that typify synaesthetic experiences. Synaesthesia is an inherited condition in which stimuli (e.g., words) cause additional, unusual cross-modal percepts (e.g., colours). Synaesthesia may be an exaggerated form of normal cross-sensory processing; if so, we may find synaesthesia-like correlates in normal cross-modal processing, such as in sound symbolism. To test this we predicted that synaesthetes may have superior sound symbolic understanding. In our study, 19 grapheme-colour synaesthetes (who experience colours from letters/digits) and 57 non-synaesthete controls were presented with adjectives from 10 unfamiliar languages (e.g., 'avraam' [Tamil]) and were asked to guess each meaning from two choices (loud or quiet?). Both groups showed superior understanding compared to chance in some semantic domains, and synaesthetes significantly outperformed controls in these semantic domains. This heightened ability suggests that sound symbolism may rely on the type of cross-sensory integration that drives synaesthetes' unusual experiences. It also suggests synaesthesia co-occurs with heightened multisensory skills in domains unrelated to the specific form of synaesthesia.

Biography

Katie Bankieris is a graduate student advised by Richard Aslin in the University of Rochester's Brain and Cognitive Sciences. She is broadly interested in cue integration within and across sensory modalities. Her work as a US-UK Fulbright Scholar focused on the relationship between synesthesia and crossmodal correspondences in the general population. Her doctoral work addresses synesthesia as a phenomenon leading to widespread cognitive changes as well as the development of cue integration.

S11 003: Grapheme-Colour Synaesthesia: More Than A Vivid Memory?

Derek Arnold, The niversity of Queensland, Australia

Grapheme-colour synaesthetes have sensations of colour when reading printed achromatic graphemes, such as black letters and digits. For some grapheme-colour synaesthetes seeing a printed grapheme automatically triggers a sensation of colour, whereas hearing the name of a grapheme does not. This dissociation allowed us to compare the precision with which synaesthetes are able to match their colour experiences automatically triggered by visible graphemes, with the precision of their matches for recalled colours based on the same graphemes spoken aloud. In six syntesthetes colour matching for printed graphemes was equally variable relative to recalled experiences. In a control experiment synaesthetes and age-matched controls either matched the colour of a circular patch while it was visible on a screen, or they judged its colour from memory after it had disappeared. Both synaesthetes and controls were more variable when matching from memory, and the variance of synaesthetes' recalled colour judgements matched that associated with their synaesthetic judgements for visible graphemes in the first experiment. Results suggest that synaesthetic experiences of colour triggered by achromatic graphemes are analogous to recollections of colour.

Biography

A/Prof Derek Arnold publishes widely on topics in perception, elucidating computations underlying conscious sensory experience. His work has featured in many of the world's leading outlets for neuroscience research, including "Nature, Current Biology, Journal of Neuroscience and Proceedings of the Royal Society B". He received the 2008 Early Career Research award from the Australian Psychological Society, and has won a string of prestigious research fellowships, most recently a Future Fellowship from the Australian Research Council. His work on synaesthesia has focussed on identifying the stage of colour analysis at which synaesthetic experiences are generated.

SYMPOSIA OVERVIEW
& SPEAKER ABSTRACTS

S11 004: A Conceptual Mediation Hypothesis Of Synaesthesia: What Can Yellow Tuesdays Tell Us About How We Represent Objects?

Anina N. Rich, Macquarie University, Australia

Synaesthesia is a phenomenon in which stimulation in one sensory modality triggers involuntary experiences typically not associated with that stimulation. A synaesthete may experience colours when seeing words, letters, and digits, or while listening to music or smelling an odour. There has been considerable progress over the last decade in understanding the cognitive and neural mechanisms of synaesthesia. Current neurocognitive models of synaesthesia construe it as a perceptual phenomenon and hence focus primarily on the modality-specific brain regions for perception. Many behavioural studies, however, suggest an important role for conceptual level information in synaesthesia. We will give an overview of this evidence, and results of neural stimulation studies, as the basis for proposing that synaesthesia resembles more general conceptual knowledge for object attributes, at both psychophysical and neural level.

Biography

A/Prof Anina Rich is co-director of the Macquarie University Perception in Action Research Centre and heads up the "Synaesthesia@ Macquarie" research group. She is Australia's leading expert on synaesthesia, with publications on the topic in high profile journals including "Nature" and "Nature Reviews Neuroscience". Her work has made a clear argument for selective attention playing a critical role in synaesthetic binding, analogous to normal binding of object features for conscious perception. Her work has received considerable media attention, and she has won a number of awards, including most recently, the Academy for the Social Sciences in Australia 2013 Paul Bourke Award.

S12: Working Memory 2014: 40 Years On Since Baddeley & Hitch

Nahid Zokaei, University of Oxford, UK
Chair & Speaker: Eva Feredoes, University of Reading, UK
Mathilde Bonnefond, Radboud University, Netherlands
Yoni Pertzov, Hebrew University, Jerusalem

Overview

Since its theoretical formalisation in 1974, working memory (WM) has been a consistently intensive area of research, generating much debate at psychological and neuroscientific levels. Recently this has centred on the precise placement of WM in relation to other cognitive constructs; it appears to share many operations with attention and long-term memory and is not necessarily an independent short-term retention system. Here we outline the new wave of WM research focussed on understanding the 'place' of WM. Using a variety of research techniques including patient lesion studies, fMRI, TMS (including concurrent TMS-fMRI) and MEG, we have evidence towards an updated theoretical and neural conceptualisation of WM. First, we describe the attention-dependent dynamic nature of information retention in sensory cortex (Zokaei). Next, the necessity of hippocampus for binding WM items will be shown (Pertzov). A mechanistic model of alpha-gamma oscillations for controlling information flow in WM, and accompanying empirical evidence, will then be provided (Bonnefond). Finally, these findings will be brought together in an up-to-date account of WM with focus on effective combinations of cutting-edge neuroscience techniques, and theoretical and computational models, that can make valuable contributions for the formulation of sophisticated accounts of how the brain solves WM (Feredoes).

S12 001: The Role Of Attention In Working Memory Maintenance

Nahid Zokaei, University of Oxford, UK

What do attention and working memory (WM) systems share? While many have pointed out the intimate connection between the two processes, the exact role of attention in WM maintenance remains unclear. We investigated the relationship between these two processes using a more sensitive, recently developed measure of WM precision that relies on participants to reproduce the exact qualities of a feature in memory. Behaviourally, I will first show the important role of attention in maintenance of bound representations. When asked to do an attentionally demanding task during WM maintenance, participants more frequently reported non-probed features with no change in memory precision for the features themselves. Secondly, I will show changes in the representational state of items in WM maintenance through both top-down and bottom-up influences of attention. By having attention focused on retained items, some were represented in a more prioritises state, with their recall later improved over non-privileged items. Privileged state was achieved through incidental cueing in WM maintenance (a task regarding an irrelevant feature of items in WM) or automatically, by virtue of recency. We also investigated causal evidence for different representational state in WM maintenance in early visual cortex using the causal approach of transcranial magnetic stimulation (TMS). Strikingly, TMS to MT+ during memory retention of motion directions disrupted only the memory of items prioritised within WM. Hence the maintenance of items in the privileged state appears to rely on sensory cortex.

S12: Working Memory 2014: 40 Years On Since Baddeley & Hitch cont'd

Biography

I started my academic education in the department of Psychology in University College London (UCL).

Throughout my undergraduate studies, I worked part-time as a research assistant in the Department of Psychology and became interested in visual attention and working memory. I pursued this interest through a Ph.D., funded by the Brain Research Trust and supervised by Profs. Masud Husain and Geraint Rees, both leaders in the field. I am currently a post-doctoral researcher in the Cognitive Neurology group at Oxford University, where I investigate the cognitive neuroscience of WM using diverse approaches including special patient groups, TMS and MEG.

S12 002: The Neural Mechanisms Of Top-Down Control During Visual Working Memory

Eva Feredoes, University of Reading, UK

Top-down control is an important aspect of WM, determining, for example what information will be retained across the short term and how it will be protected from intervening interference. But the precise conditions under which top-down control occurs during WM, the brain regions involved and the nature of their signals remains to be described more completely. One important brain region for exerting top-down control is lateral prefrontal cortex (LPFC). I will present evidence on how LPFC communicates with category-specific areas retaining WM information. Using the causal connectivity approach of concurrent TMS-fMRI, I will show how LPFC-based top-down control occurs in the presence of external distractors, protecting the contents of WM by enhancing the representations of memorised information. This fits with previous findings in which LPFC is concerned with task-relevant over irrelevant information, by neurally biasing the former over the latter. I will then conclude by bringing together the diverse findings presented in the symposium, demonstrating their contribution to a view of WM that more seamlessly incorporates attention and long-term memory, and which adopts more general neural mechanisms in an emergent manner. I will also highlight how the cutting-edge experimental methodologies described in the talks are able to propel theoretical, neuroscientific and computational accounts of WM.

Biography

I became a cognitive neuroscientist after some charismatic undergraduate lectures given by Emeritus UQ Prof. Jack Pettigrew. (His exam question, asking for our own 'interhemispheric switch rates' by measuring our breathing through each nostril was a particular highlight!) Since my PhD (UNSW), I have developed a research programme investigating the neural underpinnings of working memory using causal approaches such as concurrent TMS-fMRI. I am currently establishing my own research group as a University of Reading lecturer and will continue to pursue my goal of understanding how the brain 'solves' the simple problem of remembering across the short term…stay tuned!

S12 003: Alpha Activity As A Mechanism To Preserve Working Memory Integrity

Mathilde Bonnefond, Radboud University, Netherlands

The ability to suppress the processing of interfering stimuli is a core process of working memory. This ability is correlated with working memory capacity and its change with age has been shown to be associated with the decline of working memory. Alpha oscillatory activity (8-13 Hz) is thought to underlie this process through pulses of inhibition silencing a network node every ~100 ms. I will present evidence showing that, on a Sternberg-like working memory task, both visual alpha power and phase are top-down adjusted so that the processing of a predictable distractor is optimally suppressed. Moreover, I will show that alpha activity is coupled with low gamma (~40Hz) and high gamma (> 60Hz) power and that the stronger the alpha power, the weaker the high gamma power specifically at the alpha trough.

This confirms that stronger alpha power is associated with stronger pulses of inhibition and that the adjustment of both the power and the phase of alpha activity allow the inhibition level to be maximal at the onset of the distractor. I will introduce a general theory about how alpha activity might act as a mechanism for limiting and prioritising the input flow in order to prevent information overload.

Biography

During my Ph.D. at the University of Lyon I used M/EEG to test different theories of reasoning. My skills in electrophysiology to investigate cognition led me to a post-doctoral fellowship at the prestigious Donders Institute for Brain, Cognition and Behaviour, mentored by Prof. Ole Jensen. I investigated the nonlinear dynamical properties of brain alpha oscillations in attentional and working memory tasks, using MEG and fMRI. I am now a senior researcher at the Donders Institute, working on brain network plasticity, and also continue to investigate the complex electrophysiological mechanisms that underlie attention and working memory.

PANEL DISCUSSION OVERVIEW
AND SPEAKER BIOGRAPHIES

S12 004: The Hippocampus Is Necessary For Binding Object Identity To Location In Visual Working Memory

Yoni Pertzov, Hebrew University, Jerusalem

It has been suggested that objects are maintained as integrated units in working memory and when forgotten they are lost as a whole, without leaving behind any trace. To study the relevance of this claim to real-life situations, we investigated how object-location information is remembered â€“ and forgotten. We used a localization task with a continuous, analogue scale of reporting rather than binary (correct/incorrect) responses, with difficult-to-verbalize stimuli and variable delays. Analysis of the distribution of localization errors for healthy participants showed that items were sometimes mislocalized near the original position of other items in memory (â€˜swap errorsâ€™). Moreover, when objects were forgotten they did not disappear completely from memory, but rather the links that bound identity and location became vulnerable over time, so swap errors increased with longer retention intervals. Maintaining object-location links was found to be especially fragile in patients with bilateral damage of the medial temporal lobes (MTL), specifically hippocampus. Increased binding errors also occurred in pre-symptomatic carriers of an autosomal dominant gene (PSEN1 or APP) which gives 100% risk of developing Alzheimerâ€™s disease. Hippocampal volume in these individuals, who scored within normal range in standard neuropsychological tests, correlated inversely with the number of binding errors. These findings provide insight into the early cognitive deficits associated with Alzheimerâ€™s disease and strengthen claims that hippocampus is necessary for maintaining associative information across short retention intervals, challenging traditional accounts of MTL function as exclusively for long term memory.

Biography

My academic education started in Communication System Engineering. However, my fascination with Neuroscience led me to the graduate program of the Interdisciplinary Center for Neural Computation at the Hebrew University, Jerusalem where I obtained my PhD. I then moved to London where I was a post-doc at the UCL Institute of Cognitive Neuroscience. Currently I am a Senior Lecturer in the Psychology Department at the Hebrew University. The questions that motivate my research all revolve around visual working memory. I am using various research methods including neuroimaging in healthy individuals and patients with neurological disorders.

D02: How Do We Improve Medical Translation? Developing Translational Approaches Towards Exploring Cognitive And Behavioural Endophenotypes In Animal Models Of Disease

Chair & Speaker: Jess Nithianantharajah, University of Edinburgh, UK
Anthony J Hannan, Florey Institute of Neuroscience and Mental Health, Australia
Caitlin E McOmish, Columbia University Medical Center, USA

Overview

Impairments in cognition are common to many brain diseases and represent a major unmet medical need. As a result of human genetic studies there is an increasing recognition that many human disorders of cognition are caused by underlying mutations. The identification of these mutations and the availability of animal models carrying mutations in orthologous genes place mutant mice at the forefront of translational approaches. For over 20 years mice carrying gene mutations have been studied in learning paradigms such as the water maze and fear conditioning and these rodent behaviours said to be similar to human behaviour and mutant mice showing phenotypes in these behaviours have been promoted as models of human disease. Moreover, drugs have been tested on mutant mice in rodent behavioural tests and led to human clinical trials. While this approach may seem logical, if the behaviours measured in mice are not homologous to those in humans, then drug trials may potentially be misleading. A way forward is to critically assess the behaviours measured in rodents that model those symptoms observed in patients. Recent advancements in technologies such as touchscreen cognitive tests that measure similar components of cognition in mice and humans can be combined with genetics and provide a powerful tool for translation, identification of new targets for drug development and improve drug trial design (Nithianantharajah et al., 2013: Nithianantharajah & Grant, 2013).

In a complementary way, this panel discussion will bring together research experts (Dr Jess Nithianantharajah, A/Prof. Anthony Hannan & Dr Caitlin McOmish) in cognitive and behavioural analysis of animal models of cognitive diseases to discuss the current stance, future directions for effective translation from animal models of disease to the clinic and the potential pitfalls and solutions in existing translational approaches that rely on rodent behavioural testing. It will also discuss genetic, environmental and pharmacological factors in disease modelling and how technologies including the touchscreen cognitive testing can pave for future medical translation. Elucidating common disease symptoms/mechanisms that underlie cognitive disorders and developing methods to improve how these can be modelled in animals will be essential for increasing our understanding of cognitive dysfunction in brain disorders and future development of novel therapeutic approaches.

PANEL DISCUSSION OVERVIEW
AND SPEAKER BIOGRAPHIES

D02: How Do We Improve Medical Translation? Developing Translational Approaches Towards Exploring Cognitive And Behavioural Endophenotypes In Animal Models Of Disease cont'd

D02 001

Jess Nithianantharajah, University of Edinburgh, UK

Biography

Jess Nithianantharajah did her doctoral thesis in behavioural neuroscience at the University of Melbourne. She commenced her postdoctoral training at the Howard Florey Institute before undertaking training with Prof. Seth Grant in the Genes to Cognition team at the Wellcome Trust Sanger Institute, Cambridge, UK where she collaborated with Drs. Tim Bussey and Lisa Saksida at the University of Cambridge where the rodent touchscreen technology was developed. She is currently based at the University of Edinburgh and her recent research employing the touchscreens has been the first demonstration of assessing cognitive components in humans and mice carrying the same mutation. These data also show that it is possible to genetically dissect different behaviours and identify their underlying molecular mechanisms using these methods as standardized approaches, with the prospect of understanding the genetic architecture of the cognitive repertoire towards the identification of new drug targets.

D02 002

Anthony J Hannan, Florey Institute of Neuroscience and Mental Health, Australia

Biography

Anthony Hannan received his undergraduate training and PhD from the University of Sydney. He was then awarded a Nuffield Medical Fellowship at the University of Oxford, where he subsequently held other research positions before returning to Australia on to establish a laboratory at the Florey Institute. He is currently a Professorial Fellow and head of the Neural Plasticity Laboratory, Florey Institute of Neuroscience and Mental Health. He also holds an ARC Future Fellowship (FT3), Honorary NHMRC Senior Research Fellowship, and is a Principal Fellow at the University of Melbourne. He has published over 100 peer-reviewed papers, in leading journals such as Nature, Nature Neurosci., Mol. Psychiatry, J. Neurosci., Brain, Annals Neurol., Cerebral Cortex, Nature Rev. Neurosci., and Trends Neurosci. His laboratory investigates gene-environment interactions and experience-dependent plasticity in the healthy and diseased brain, focusing on cognitive disorders. This includes research on models of Huntington's disease, where he and his colleagues first discovered the beneficial effects of environmental enrichment and exercise, as well as depression-like and dementia-like symptoms and associated abnormalities of neural plasticity. This research team at the Florey is also investigating how genetic and environmental factors combine to cause specific disorders of cognition, including schizophrenia and autism spectrum disorders.

D02 003

Caitlin E McOmish, Columbia University Medical Center, USA

Biography

Caitlin McOmish received her PhD from the University of Melbourne. She was then awarded an NH&MRC overseas biomedical fellowship (previous CJ Martin fellowship) to undergo postdoctoral training at Columbia University Medical Center, NY, USA. She has received several awards and honours including awards from the American College of Neuropsychopharmacology, the Society for Neuroscience, and the Australasian Neuroscience Society, as well as holding a current NARSAD Young Investigator award. Dr. McOmish's research aims to identify the mechanisms that underlie precise symptom clusters in psychiatric disease, most notably schizophrenia. Schizophrenia symptoms are classified as positive, negative or cognitive. These classes of symptoms appear to derive from distinct neuropathology, and cognitive symptoms in particular, have been demonstrated to significantly impact the outcome of the patients. Despite this, the overwhelming focus of both animal models, and clinical trials remains the positive symptoms. Identifying effective intervention strategies to treat all subsets of the disease is thus an important avenue forward. Her research to date has been published in several international journals including the top ranked journal in psychiatry – Molecular Psychiatry – as well as Biological Psychiatry, and Neuropsychopharmacology.

ORAL PRESENTATION
ABSTRACTS

OP2: Cognition, Memory & Learning

Matar Haller, University of California, Berkeley, USA
Britta Worringer, RWTH Aachen University, Germany
Corinna Haenschel, City University London, UK
Catherine Wacongne, INSERM, France

OP2 001: Temporally Sustained Activity in Lateral Prefrontal Cortex Supports Decision Making

Matar Haller, University of California, Berkeley, USA

Decision-making relies on temporally coordinated activity across a network of cortical and subcortical brain regions, reflecting stimulus perception and evaluation as well as response selection, preparation and execution. The lateral PFC is a crucial node in decision-making networks, yet the temporal dynamics and spatial distribution of activation within lateral PFC is not defined in humans. Capitalizing on the superb temporal and spatial resolution of direct cortical recordings from subdural electrodes (electrocorticography;; ECoG), we identified specific temporal patterns of cortical activation and examined their spatial distribution. Subjects (n=18) performed a number of tasks graded in difficulty (7 total). Local field potential power in the broadband high gamma range (HG;; 70-150Hz) indexed local cortical activity. Electrodes with significant HG increases over baseline (FDR adjusted $p<0.05$) were classified as task-active. Principal component analysis (PCA) with hierarchical clustering was used to identify consistent temporal patterns of HG activation. These patterns included transient stimulus- or response- locked activity as well as sustained activation from stimulus presentation through response execution. All cortical areas featured multiple patterns of HG activity, suggesting that temporally and spatially distributed network activity is required for successful goal-directed behavior. The majority of electrodes with sustained HG activity were in lateral PFC (72%), reflecting the central role of this region in information integration. Within lateral PFC, the majority of active sites (60%) exhibited sustained activity. The proportion of lateral PFC sites with sustained activity significantly increased with task difficulty ($p<0.01$), and the peak of HG activation at these sites predicted reaction times. We propose that temporally sustained activity in the lateral PFC reflects the critical role of this region in decision-making networks.

OP2 002: Investigating Neural Correlates of Dual-Tasking and Task-Switching: A Meta-Analytic Approach

Britta Worringer, RWTH Aachen University, Germany

Many dual-tasking and task-switching studies have demonstrated limitations of the human cognitive system in performing several tasks at once. A number of functional magnetic resonance imaging experiments revealed a fronto-parietal network associated with performance decrements in both experimental settings. However, despite numerous commonalities across dual-tasking and task-switching, both paradigms have been investigated largely independently from each other. The current study provides new insights into the neural commonalities and differences of dual-tasking and task-switching by performing an Activation Likelihood Estimation meta-analysis of 17 dual-tasking and 22 task-switching neuroimaging experiments. Moreover, by contrasting 8 crossmodal and 9 unimodal dual-tasking experiments we investigated modality-specific effects. The results indicated activity associated with both paradigms in the left parietal lobule. Contrasted to dual-tasking, which yielded more consistent activation in left middle and superior frontal areas, task-switching evoked more consistent activation in the supplementary motor area (SMA). In contrast to unimodal dual-tasking, which did not evoke more consistent activation in any brain area, crossmodal dual-tasking yielded more consistent activation in a widespread bilateral frontal network. Results indicate a common neural base of limited information processing in task-switching and dual-tasking associated with increased activation in left parietal lobule. More consistent activation in SMA during task-switching suggests a more demanding process of task-set updating, while stronger activation during dual-tasking in left middle and superior frontal areas points to more demands on action planning, organization and regulation. Furthermore, we hypothesise that increased activation in frontal areas during crossmodal dual-tasking reflects a modality translation process due to modality-incompatibility of stimulus-response mappings.

ORAL PRESENTATION
ABSTRACTS

OP2 003: Effects Of Acute Ketamine Infusion On Visual Working Memory Encoding: A Study Using ERPs

Corinna Haenschel, City University London, UK

The impairment of working memory (WM) is regarded as a central deficit in schizophrenia spectrum disorders. We have previously demonstrated a relationship between EEG measures of visual stimulus encoding and WM performance in schizophrenia. Specifically, we examined the early visual P1 and the later occurring P3 ERP component. Both ERPs were attenuated in participants with schizophrenia. However, the P1 was predictive of WM performance in healthy controls. The findings emphasise the importance of visual encoding anomalies in explaining WM deficits in schizophrenia. These information processing abnormalities have been suggested to be the result of a NMDA glutamate receptor abnormality. Ketamine, a non-competitive NMDA antagonist, can be used to explore the neurophysiological characteristics of acutely induced glutamate receptor dysfunction in healthy volunteers. In this study, we aimed to test whether the administration of IV ketamine can replicate the cognitive and electrophysiological patterns that our group previously observed in schizophrenia patients and schizotypal individuals. 44 healthy volunteers were randomised to receive IV infusion of ketamine or placebo. A 64 channel EEG was used to obtain event-related potentials in response to a delayed discrimination working memory (WM) task. The two groups were compared in respect to their performance task as well as the amplitude of the P1 and P300 ERPs. The psychiatric scales scores (BPRS, CADSS) were significantly increased in the ketamine group when compared to saline. While there was no difference in terms of reaction times to the task, accuracy in the ketamine group worsened significantly with increase in working memory load than in controls. Ketamine significantly increased the P1 but lead to a decrease in P300. In this study acute NMDA antagonism induced a WM deficit that was associated with visual processing and memory abnormalities. Specifically, ketamine increased the amplitude of the P1 potential and reduced the P300 amplitude. In addition P1 but not P300 predicted performance on the WM task. These effects could be mediated ketamine-induced acute glutamate release in the visual cortex, enhancing neuronal responses to visual stimuli and increasing the signal-to-noise ratio which in turn disrupted higher order cognitive function.

OP2 004: Modeling Managment Of Access To Working Memory As A Self-Evalution Process For Intrinsically Motiveted Prediction

Catherine Wacongne , INSERM, France

Working memory offers the unique possibility to maintain information during an arbitrary long time. However, this possibility comes with the constraint that the number of items that can be maintained this way is very limited. This situation creates a computational problem of optimizing working memory content by choosing appropriately which items should be maintained and which items should be discarded. Previous work by O'Reilly (O'Reilly & Frank, 2006) showed that a reinforcement learning scheme could allow training of a basal ganglia dependent gating mechanism to successfully manage working memory content in order to complete diverse tasks. The predictive coding framework, proposes that one of the intrinsic purpose of the brain is the prediction of future events. Data (Bekinschtein et al., 2009) suggests that the involvment of working memory can be crucial, even in the absence of an explicit task to discover long distance temporal dependencies. We studied a simplified version of the working memory management problem by reducing working memory capacity to one slot. We show that using a value system that is sensitive to prediction accuracy, and a reinforcement learning algorithm, the brain can use self-evaluation to learn a successful gating policy to control the access to its working memory slot and optimize predictions. Specifically, we studied the performance of this value based working memory access (vbWMA) model on simple sequences of stimuli whose probability of occurrence was chosen independently of the past, except for one long distance predictive relation. The vbWMA model was able to learn to store the predictive stimulus for the appropriate duration. The dynamics of policy discovery was non-linear. Comparison with other models shows that this strategy offers an excellent trade-off between final performance and learning time. We also show that the vbWMA develops appropriate strategies in more complex situations with multiple long distance dépendencies.

POSTER SESSION 2

TOPICS IN THIS POSTER SESSION ARE:

TOPIC	CODE
Attention	TAT
Cognition and Executive Processes	TCE
Emotion and Social Processes	TES
Language	TLA
Methods Development	TME
Sensation & Perception	TPE

Attention

TAT001: Prediction and Attention: an ERP Study on the Effects of Stimulus Probability and Task Relevance

Presented by: Anna Marzecová, University of Leipzig, Germany

Authors: Anna Marzecová, Iria SanMiguel, Andreas Widmann, Sonja A. Kotz, Erich Schröger

TAT002: fMRI Reveals Abnormal Attentional Networks in People with Migraine Headache in Between Headache Attacks

Presented by: Marla Mickleborough, University of Saskatchewan, Canada

Authors: Marla Mickleborough, Layla Gould, Chelsea Ekstrand, Eric Lorentz, Paul Babyn, Ron Borowsky

TAT003: A Systematic Review Of Comorbidity In PTSD Using Eye Tracking And MEG

Presented by: Selma Music, Swinburne University of Technology, Australia

Authors: Selma Music, Susan Rossell, Joseph Ciorciari

TAT004: Genetically Mediated Resistance To Distraction: Influence Of Dopamine Transporter Genotype On Attentional Selection

Presented by: Mark Bellgrove, Monash University, Australia

Authors: Mark Bellgrove, Daniel Newman, Tarrant Cummins, Janette Tong, Beth Johnson, Joseph Wagner, Jack Goodrich, Ziarih Hawi, Chris Chambers

TAT005: Inter-Hemispheric Activation Asymmetry And Trial-To-Trial Fluctuations In Alertness: An Electrophysiological And Pupillometric Investigation

Presented by: Daniel Newman, Monash University, Australia

Authors: Daniel Newman, Gerard Loughnane, Rafael Abe, Marco Zoratti, Simon Kelly, Redmond O'Connell, Mark Bellgrove

TAT006: The Suppression of N1 To Predicted Sounds Depends On Attention

Presented by: Tim Paris, University of Western Sydney, Australia

Authors: Tim Paris, Jeesun Kim, Chris Davis

TAT007: The Upper Visual Field Advantage For Face-Processing: A Product Of Endogenous Attentional Bias?

Presented by: Genevieve Quek, Macquarie University, Australia

Authors: Genevieve Quek, Matthew Finkbeiner

TAT008: Efficiency Of Attentional Selection Is Continuous Rather Than Categorical

Presented by: Dragan Rangelov, Ludwig-Maximilians University, Germany

Authors: Dragan Rangelov, Hermann Müller, Thomas Töllner

TAT010: Emotion And Attention Interactively Regulate The Flow Of Information In V1 As Early As 75 ms After Stimulus Onset

Presented by: Valentina Rossi, Ghent University, Belgium

Authors: Valentina Rossi, Gilles Pourtois

TAT011: Dissociating The Neural Mechanisms Underlying Spatiotopic And Retinotopic Inhibition Of Return: An Investigation Using Eye Tracking And Electroencephalography

Presented by: Jason Satel, University of Nottingham, Malaysia

Authors: Jason Satel, Matthew D. Hilchey, Zhiguo Wang, Raymond M. Klein

TAT012: Allocation of Attention During Tasks Involving Discriminations of Rotated Stimuli

Presented by: Jordan Searle, University of Auckland, New Zealand

Authors: Jordan Searle, Jeff Hamm

TAT013: Temporal Orienting Of Attention And Predictive Timing In Anticipatory Auditory Processing

Presented by: Chase S. Sherwell, Queensland Brain Institute, The University of Queensland, Australia

Authors: Chase S. Sherwell, Marta I. Garrido, Ross Cunnington

TAT014: Attending to the Unseen: The Effects of Spatial Attention on Neural Responses to Visible and Invisible Stimuli

Presented by: Cooper Smout, Queensland Brain Institute, The University of Queensland, Australia

Authors: Cooper Smout, Jason Mattingley

TAT015: Visuospatial Attention Bias is Related to ADHD Symptomology: A Behavioural and Electrophysiological Analysis

Presented by: Joseph Wagner, The University of Queensland, Australia

Authors: Joseph Wagner, Daniel Newman, Gerard Loughnane, Simon Kelly, Redmond O'Connell, Mark Bellgrove

POSTER SESSION 2

Attention cont'd

TAT017: Distinct Neuronal Effects Of Perspective And Hand Grip On Paired-Object Affordance: An fMRI Study

Presented by: Melanie Wulff, University of Birmingham, UK

Authors: Melanie Wulff, Glyn W Humphreys, Pia Rotshtein

TAT018: Early Intraparietal Involvement In Motion-Driven Attention Identified With fMRI-Neuronavigated TMS

Presented by: Bonnie Alexander, La Trobe University, Australia

Authors: Bonnie Alexander, Robin Laycock, Sheila Crewther, David Crewther

TAT019: Differences in Attentional Biases to Food Cues between Obese and Healthy Weight Individuals as Measured by a Stroop Task and Electroencephalographic Indices

Presented by: Joshua Hendrikse, Deakin University, Australia

Authors: Joshua Hendrikse, Melissa Hayden, Emily Kothe

TAT020: The Neural Correlates Evidence For The Time Course Of Distractor Dilution Under Attentional Load

Presented by: Tzu-Yu Hsu, National Taiwan University, Taiwan

Authors: Tzu-Yu Hsu, Shao-Ming Lee, Yei-Yu Yeh

TAT023: Measuring Attention In Rodents: Comparison Of The 5-choice Serial Reaction Time Task (5C-SRT) and Continuous Detection Task (CDT)

Presented by: Karly Turner, Queensland Brain Institute, The University of Queensland, Australia

Authors: Karly Turner, James Peak, Thomas Burne

TAT024: Coding Dichotomy In Lateral Intraparietal Cortex (LIP) Of The Macaque Monkey And Its Role In Spatial Attention

Presented by: Trichur Vidyasagar, University of Melbourne, Australia

Authors: Trichur Vidyasagar, Ekaterina Levichkina, Yuri Saalmann

Cognition & Executive Processes

TCE002: Diagnostic Markers Of Young Children's Numerical Cognition: The Significance Of Precise Small Number, Approximate Number, Executive Function And Vocabulary Abilities

Presented by: Sarah Gray, University of Melbourne, Australia

Authors: Sarah Gray, Robert Reeve

TCE003: Cortico-Striatal-Pallidal-Thalamic Circuitry Changes Associated With Reduced Causal Awareness In Early Onset Depression

Presented by: Kristi Griffiths, Brain and Mind Research Institute, University of Sydney, Australia

Authors: Kristi Griffiths, Jim Lagopoulos, Daniel Hermens, Ian Hickie, Bernard Balleine

TCE005: Cortical Representations of Cognitive Control and Working Memory are Dependent Yet Non-Interacting

Presented by: Ian Harding, University of Melbourne, Australia

Authors: Ian Harding, Ben Harrison, Michael Breakspear, Christos Pantelis, Murat Yucel

TCE006: Cognitive Development And Volumes Of The Corpus Callosum And Lateral Ventricles In Normal And Premature infants

Presented by: Thalia Harmony, National Autonomous University of Mexico, Mexico

Authors: Thalia Harmony, Yuria Cruz, Jorge Bosch-Bayard, Erika Cruz, Manuel Hinojosa, Thalia Fernandez, Josefina Ricardo-Garcell, Berta González-Frankenberger, Antonio Fernández-Bouzas

TCE007: Deep Brain Stimulation of Anterior Thalamic Nuclei Modulates Emotion - Executive Function Interaction in Humans

Presented by: Kaisa Hartikainen, Tampere University Hospital, Finland

Authors: Kaisa Hartikainen, Lihua Sun, Markus Polvivaara, Maarja Brause, Juha Öhman, Jukka Peltola, Kai Lehtimäki

TCE008: Impulsivity in Obesity: An Event-Related Potential Investigation

Presented by: Melissa Hayden, Deakin University. Australia

Authors: Melissa Hayden, Emelia Olsson, Emily Kothe

TCE009: Beyond P300: An Auditory ERP Paradigm With Sequential Stimulation

Presented by: Johannes Hoehne, Technical University of Berlin, Germany

Authors: Johannes Hoehne, Michael Tangermann

TCE010: MEG Responses Over Right Inferior Frontal Gyrus During Stop-Signal Task Performance

Presented by: Matthew Hughes, Swinburne University of Technology, Australia

Authors: Matthew Hughes, William Woods, Neil Thomas, Patricia Michie, Susan Rossell

TCE011: Age Differences In The Reliance On Executive Resources During Updating Working Memory Depend On Memory Load

Presented by: Michel Isingrini, University of Tours, France

Authors: Michel Isingrini, Lucie Angel, Severine Fay, Laurence Taconnat, Patrick Lemaire, Badiaa Bouazzaoui

TCE012: Multivoxel Coding of Visual Stimuli is Flexible: Frontoparietal and Visual Cortices Adapt to Code the Currently Relevant Distinction

Presented by: Jade Jackson, Macquarie University, Australia

Authors: Jade Jackson, Anina N. Rich, Mark A. Williams, Alexandra Woolgar

TCE013: A P300 Brain-Computer Interface for Controlling a Robot by Issuing a Color Flashes Located in His "Eyes" as Target and Non-target Stimuli

Presented by: Alexander Kaplan, Moscow State University, Russia

Authors: Alexander Kaplan, Arina Kochetova

TCE014: Cerebral Language Lateralisation Attenuates In Old Age: Evidence From Functional Transcranial Doppler Methods

Presented by: Hannah Keage, University of South Australia, Australia

Authors: Hannah Keage, Owen Churches, Lisa Kurylowicz, Atlanta Flitton, Louise Lavrencic Lavrencic, Jessica Hofmann, Mark Kohler, Nicholas Badcock

TCE015: Cortical Excitability Modulates The Sensory Strength Of Visual Mental Imagery

Presented by: Rebecca Keogh, University of New South Wales, Australia

Authors: Rebecca Keogh, Joel Pearson

POSTER SESSION 2

TCE016: Functional Neuroimaging Of Prefrontal Cortex In Parkinson's Disease Using Near Infra-Red Spectroscopy: Effects Of Cognitive Task During Seated And Standing Postures

Presented by: Graham Kerr, Queensland University of Technology, Australia

Authors: Graham Kerr, Mark Muthalib, Roger Pegoraro, Luisa Roeder, Tim Piatkowsk, Ian Stewart, Simon Smith

TCE018: Transcranial Direct Current Stimulation Of Prefrontal Cortex: An Event-Related Potential And Proton Magnetic Resonance Spectroscopy Study

Presented by: Lilly Knechtel, University of Newcastle, Australia

Authors: Lilly Knechtel, Ulrich Schall, Gavin Cooper, Todd Jolly, Peter Stanwell, Saalladah Ramadan, Renate Thienel

TCE019: Inter-Individual Differences In Intrinsic Connectivity Of The Ocular Motor Network Predict Anti-Saccade Spatial Accuracy

Presented by: Scott Kolbe, University of Melbourne, Australia

Authors: Scott Kolbe, Sanuji Gajamange, Sharna Jamadar, Beth Johnson, Gary Egan, Joanne Fielding

TCE020: Anterior Cingulate Cortex Activity During a Counting Stroop Task Predicts Successful Smoking Cessation

Presented by: Klaus-Martin Krönke, Technical University of Dresden, Germany

Authors: Klaus-Martin Krönke, Max Wolff, Annika Benz, Thomas Goschke

TCE023: Sleep Deprivation And Inference Under Uncertainty

Presented by: Irma Triasih Kurniawan, Duke-NUS Graduate Medical School, Singapore

Authors: Irma Triasih Kurniawan, Konstantinos Tsetsos, Michael W.L. Chee

TCE024: The Care And Testing Of Video-Game Players: Using Patterns Of Performance To Provide Insight Into The Effects Of Video-Game Experience And Expertise

Presented by: Andrew James Latham, The University of Sydney, Australia

Authors: Andrew James Latham, Christine Westermann, Lucy L. M. Patston, Lynette J. Tippett

TCE025: Using Multiscale Entropy to Quantify the Complexity of Neural Systems during the Process of Cognitive Control

Presented by: Wei-Kuang Liang, National Central University, Taiwan

Authors: Wei-Kuang Liang, Chi-Hung Juan

TCE027: Impaired Cognitive Functioning In Cervical Dystonia

Presented by: Tobias Loetscher, Flinders University, Australia

Authors: Tobias Loetscher, Michelle McDonnell, Lynley Bradnam

TCE028: Inter-Individual Variability In MRI-Related Anxiety Predicts Task Based Brain Activity

Presented by: Valentina Lorenzetti, Monash Clinical and Imaging Neuroscience, Australia

Authors: Valentina Lorenzetti, Rebecca Kerestes, Ian Harding, George Youssef, Christopher Davey, Murat Yucel, Ben Harrison

TCE030: Characterizing Rare Copy Number Variants In Schizophrenia: A Clinical, Cognitive, And Neuroimaging Study.

Presented by: Andrew Martin, Queensland Brain Institute, The University of Queensland, Australia

Authors: Andrew Martin, Gail Robinson, David Reutens, Bryan Mowry

TCE031: Optimal Group Decision: A Matter of Confidence Calibration

Presented by: Sebastien Massoni, Queensland University of Technology, Australia

Authors: Sebastien Massoni, Nicolas Roux

TCE032: Structural And Functional Correlates Of Cognitive Ability Differ Across The Adult Lifespan

Presented by: Ian McDonough, University of Texas at Dallas, USA

Authors: Ian McDonough, Jenny Rieck, Gérard Bischof, Patricia Reuter-Lorenz, Denise Park

TCE033: Hippocampal Asymmetry Is Associated With Cognitive Decline In Type 2 Diabetes

Presented by: Nicole Milne, The University of Western Australia, Australia

Authors: Nicole Milne, David Bruce, Sergio Starkstein, Melinda Nelson, Wendy Davis, Ronald Pierson, Romola Bucks

TCE035: Contingency Degradation In Humans: The Effect Of Outcome Identity

Presented by: Richard Morris, Sydney University, Australia

Authors: Richard Morris, Amir Dezfouli, Kristi Griffiths, Bernard Balleine

TCE037: Distributed And Overlapping Neural Bases For Object Individuation And Identification

Presented by: Claire Naughtin, The University of Queensland, Australia

Authors: Claire Naughtin, Paul Dux, Jason Mattingley

TCE038: Small Numerosities Are Associated With The Left, Large Numerosities Are Associated With The right: Evidence From A SNARC Task

Presented by: Fiona Nemeh, University of Melbourne, Australia

Authors: Fiona Nemeh, Mark Yates, Tobias Loetscher, Anna Ma-Wyatt, Michael E. R. Nicholls

TCE039: How Task-Set-Size Influences Cognitive Control: Alpha Power And Medial-Frontal Negativities Reflect Cognitive effort

Presented by: Roland Nigbur, Otto von Guericke University Magdeburg, Germany

Authors: Roland Nigbur, Markus Ullsperger

TCE040: Dissociating The Component Processes Of Impulsivity In Parkinson's Disease

Presented by: Claire O'Callaghan, Neuroscience Research Australia, Australia

Authors: Claire O'Callaghan, James Shine, Alana Muller, Courtney Walton, Simon Lewis, Michael Hornberger

TCE043: Eye Movements In Enumerating Visual Dot Arrays: The Significance For Math Cognition

Presented by: Jacob Paul, University of Melbourne, Australia

Authors: Jacob Paul, Jason Forte, Robert Reeve

TCE044: What's In A Punchline? Using jokes & fMRI To Determine The Processes Underlying Humour Expectation And Appreciation

Presented by: Moos Peeters, University of Cambridge, UK

Authors: Moos Peeters, Tristan Bekinschtein, Deab Mobbs

POSTER SESSION 2

Cognition & Executive cont'd

TCE045: Centromedian Nuclei of Thalamus Contributes To Working Memory Performance: Evidence From Electric Stimulation of CMN In A Human Subject Treated With DBS For Refractory Epilepsy

Presented by: Jari Peräkylä, Tampere University Hospital, Finland

Authors: Jari Peräkylä, Lihua Sun, Markus Polvivaara, Juha Öhman, Jukka Peltola, Kai Lehtimäki, Kaisa Hartikainen

TCE046: Intracultural Effects On Adult Theory-Of-Mind Reasoning

Presented by: Daniel Perez-Zapata, The University of Queensland, Australia

Authors: Daniel Perez-Zapata, Virginia Slaughter, Julie Henry

TCE047: Impact Of Genome-Wide Discovered Psychosis-Risk Gene ZNF804A On White Matter Integrity In Health And Psychosis

Presented by: Diana Prata, Kings College London, London, UK

Authors: E-J Mallas, C Chaddock, J Sato, S Shergill, J Woolley, MM Picchioni, E Kravariti, M Walshe, M Allin, T Toulopoulou, E Bramon, C McDonald, GJ Barker, DP Prata

Emotional & Social Processes

TES001: The Error-Related Negativity (ERN) as a Marker of Individual Differences in Cognitive Empathy

Presented by: Azhani Amiruddin, The University of Western Australia, Australia

Authors: Azhani Amiruddin, Allison Fox, Karen L. Clunies-Ross, Veronica Connaughton, Vicole Bothma

TES002: Negative Biases And The Slow Negative Wave In Parkinson's Disease

Presented by: Tiffany Au, The University of Queensland, Australia

Authors: Tiffany Au, Anthony Angwin, David Copland, John O'Sullivan, Gerard Byrne, Peter Silburn, Rodney Marsh, George Mellick, Nadeeka Dissanayaka

TES003: Empathy Correlates With Insula And Cingulate Cortex Activity During Encoding But Not Enactment Of Manual Imitation

Presented by: Lieke Braadbaart, University of Aberdeen, UK

Authors: Lieke Braadbaart, Justin Williams, Gordon Waiter

TES004: Isoluminant Figure-Ground Emotional Stimuli Reveal The Crucial Role Of The Magnocellular Visual System In Exogenous (Automatic) Attention

Presented by: Luis Carretié, Autonomous University of Madrid, Spain

Authors: Luis Carretié, Sandra Hoyos, María J. García-Rubio, Dominique Kessel, Manuel Tapia, Almudena Capilla, Jacobo Albert, Sara López-Martín

TES005: A MEG Investigation into Rapid Amygdala Responses

Presented by: Sean Carruthers, Swinburne University of Technology, Australia

Author: Sean Carruthers

TES006: Simulating Cooperative Interactions to Investigate the Neural Correlates of Joint Attention

Presented by: Nathan Caruana, Macquarie University, Australia

Authors: Nathan Caruana, Alexandra Woolgar, Jon Brock

TES007: GABAergic Control Of Anxiety-Potentiated Responding To Stimulus Deviance

Presented by: Brian Cornwell, Swinburne University of Technology, Australia

Authors: Brian Cornwell, Christian Grillon

TES009: Emotional And Cognitive Processing In Parkinson's Disease

Presented by: Nadeeka Dissanayaka, The University of Queensland. Australia

Authors: Nadeeka Dissanayaka, Tiffany Au, Anthony Angwin, John O'Sullivan, Gerard Byrne, Peter Silburn, Rodney Marsh, George Mellick, David Copland

TES010: Are Gaze Patterns And Autism-Relevant Traits Related To Inferred Mirror Neuron Activity?

Presented by: Peter Donaldson, Deakin University, Australia

Authors: Peter Donaldson, Caroline Gurvich, Joanne Fielding, Peter Enticott

TES012: Deep Repetitive Transcranial Magnetic Stimulation (rTMS) Of Dorsomedial Prefrontal Cortex Improves Social Relating In Autism Spectrum Disorder

Presented by: Peter Enticott, Deakin University, Australia

Authors: Peter Enticott, Bernadette Fitzgibbon, Hayley Kennedy, Sara Arnold, David Elliot, Amy Peachey, Abraham Zangen, Paul Fitzgerald

TES013: Anatomical Differences In Empathy Related Brain Areas: A Voxel-Based Morphometry Study

Presented by: Robert Eres, The University of Queensland, Australia

Authors: Robert Eres, Jean Decety, Winnifred Louis, Pascal Molenberghs

TES014: Mismatch Field Provides a Biological Link Between High Autistic and Schizotypal Tendencies.

Presented by: Talitha Ford, Swinburne University of Technology, Australia

Authors: Talitha Ford, David Crewther

TES015: An fMRI Investigation into Facial Affect Perception in Body Dysmorphic Disorder

Presented by: Sally Grace, Swinburne University of Technology, Australia

Authors: Sally Grace, Ben Buchanan, Matthew Hughes, Jerome Maller, Richard Nibbs, David Castle, Susan Rossell

TES016: Altered Neural Synchronisation In Major Depressive Disorders During Emotional Video Viewing

Presented by: Christine Guo, QIMR Berghofer, Australia

Authors: Christine Guo, Vinh Nguyen, Matthew Hyett, Gordon Parker, Michael Breakspear

TES017: Adult Attachment Style: Biases in Threat-Related and Social Information Processing

Presented by: Graham Jamieson, University of New England, Australia

Authors: Raewyn Stinson, Ian Evans, Graham Jamieson

TES019: Social Cognition Is Not Associated With Cognitive Reserve In Older Adults

Presented by: Louise Lavrencic, University of South Australia, Australia

Authors: Louise Lavrencic, Lisa Kurylowicz, Mark Kohler, Owen Churches, Hannah Keage

TES020: Response Inhibition During Emotional Contexts In Children With ADHD: Neural And Behavioral Data

Presented by: Sara López-Martín, Autonomous University of Madrid, Spain

Authors: Sara López-Martín, Jacobo Albert, Alberto Fernández-Jaén, Luis Carretié

POSTER SESSION 2

Language

TLA002: The Use Of High-Density Electrophysiology In The Early Detection Of Cognitive And Language Impairments In Preterm Infants.

Presented by: Natacha Paquette, University of Montreal, Canada

Authors: Natacha Paquette, Phetsamone Vannasing, Michelle McKerral, Franco Lepore, Maryse Lassonde, Anne Gallagher

TLA003: Behavioural And fMRI Evidence Of Semantic Categorisation Deficits In Schizophrenia

Presented by: Susan Rossell, Swinburne University of Technology, Australia

Authors: Susan Rossell, Matthew Hughes

TLA004: Different Language Trainings Modulate Word Learning in Young Infants: a Combined EEG and fNIRS Study

Presented by: Sonja Rossi, Medical University Innsbruck, Austria

Authors: Sonja Rossi, Maria Richter, Micol Vignotto, Julia Mock, Franziska Stephan, Hellmuth Obrig

TLA005: Two Sides Of The Predictive Coin: Age-Related P300 vs. N400 Dissociations In Language Processing Differentiate Prediction Fulfilment From Internal Model Updating

Presented by: Matthias Schlesewsky, Johannes Gutenberg-University, Germany

Authors: Matthias Schlesewsky, Markus Philipp, Franziska Kretzschmar, Tanja Grewe, Petra Schumacher, Maike Gumpert, Ina Bornkessel-Schlesewsky

TLA006: Genome-Wide Supported Dyslexia Risk Variant rs11100040 Alters Neural Connectivity Profiles Affecting Phonological Awareness In Children

Presented by: Michael Skeide, Max Planck Institute for Human Cognitive and Brain Sciences, Germany

Authors: Michael Skeide, Holger Kirsten, Indra Kraft, Gesa Schaadt, Bent Müller, Arndt Wilcke, Jens Brauer, Johannes Boltze, Angela Friederici

TLA007: L2 minus L1 Difference In N400 Amplitude Reveals The L2 Vocabulary Size

Presented by: Jakub Szewczyk, Jagiellonian University, Poland

Authors: Jakub Szewczyk, Zofia Wodniecka

TLA008: A Study Of The Relationship Between Receptive And Expressive Language Processing In Schizophrenia

Presented by: Eric Tan, Monash University, Australia

Authors: Eric Tan, Gregory Yelland, Susan Rossell

TLA009: Auditory Envelope Following Responses In The Mature And Developing Human Brain

Presented by: Huizhen Tang, CCD, Macquarie University, Australia

Authors: Huizhen Tang, Jon Brock, Stephen Crain, Blake Johnson

TLA010: Are Babies Born With Left-Hemisphere Language Dominance? An fNIRS Study

Presented by: Phetsamone Vannasing, Sainte-Justine Hospital, Canada

Authors: Phetsamone Vannasing, Anne Gallagher, Natacha Paquette, Julie Tremblay, Olivia Florea, Dima Safi, Renée Béland, Franco Lepore, Maryse Lassonde

TLA011: Motor Speech Deficits In Behavioural Variant Frontotemporal Dementia

Presented by: Matthew Poole, University of Melbourne, Australia

Authors: Matthew Poole, Amy Brodtmann, Hugh Pemberton, Essie Low, David Darby, Adam Vogel

TLA014: Understanding of Interface or Neurotransmitter between Cerebral Lobes and Parts of Speech in Inter-language Interpreting answers Super-language Interpreting Theory and Psychotherapy

Presented by: Yoshinori Inoue, The Federation of Academic Interpreters / Translators, Japan

Author: Yoshinori Inoue

TLA016: Neural Mechanisms Of Verb Processing: An ERP study With Locative Alternations

Presented by: Abhilasha Srivastava, Centre of Behavioural and Cognitive Sciences, University of Allahabad, India

Authors: Abhilasha Srivastava, Narayanan Srinivasan

Methods Development

TME003: A Test Of Conventions: An Empirical Study To Determine Whether ERP Researchers Should Start Plotting All Waveforms With Negative Downward

Presented by: Owen Churches, Flinders University, Australia

Authors: Owen Churches, Mike Nichols, Daniel Feuerriegel, Mark Kohler, Hannah Keage

TME004: Introducing SPoC: A Multivariate Analysis Framework For The Analysis Of Cross-Frequency Power Coupling As Well As For Multimodal Integration Of EEG/MEG Power With Hemodynamics

Presented by: Sven Dähne, Berlin Institute of Technology, Germany

Authors: Sven Dähne, Stefan Haufe, Vadim Nikulin, Klaus-Robert Müller

TME005: Distance Concentration in High-Dimensional fMRI Datasets: Possible Analysis Implications

Presented by: Jo Etzel, Washington University, USA

Authors: Jo Etzel, Todd Braver

TME006: Optimization of the Neurofeedback protocol in children with Learning Disabilities and a lag in their EEG maturation

Presented by: Thalia Fernandez, National Autonomous University of Mexico, Mexico

Authors: Thalia Fernandez, Thalia Harmony, Jorge Bosch-Bayard, Roberto A. Prado-Alcala, Gloria A. Otero-Ojeda, Fabiola Garcia, Maria del Carmen Rodriguez, Maria Isabel Caballero, Judith Becerra

TME007: Sensorimotor Plasticity In Pain: Effects, Mechanisms And Consequences

Presented by: Paul Hodges, The University of Queensland, Australia

Author: Paul Hodges

POSTER SESSION 2

Methods Development cont'd

TME009: Visualization and Quantification of Differences in Interaction Strength of Sensory and Motor Networks in the Human Brain using Differential Correlation Analysis and Graph Theory

Presented by: Christof Karmonik, Houston Methodist Research Institute, USA

Authors: Christof Karmonik, Jeff Anderson, Steve Fung, Amit Verma, Robert Grossman

TME011: Measuring Neurovascular Coupling by Combining Electroencephalogram and Functional Transcranial Doppler: A Detailed Method

Presented by: Lisa Kurylowicz, University of South Australia, Australia

Authors: Lisa Kurylowicz, Nicholas Badcock, Mark Kohler, Owen Churches, Hannah Keage

TME012: Dual Logic and Dual Neural Basis for Reciprocal Social Interaction

Presented by: Ray Lee, Princeton University, USA

Author: Ray Lee

TME013: The Rich Club Of The Brain In Bipolar Disorder

Presented by: Anton Lord, The University of Queensland, Australia

Authors: Anton Lord, Gloria Roberts, Michael Breakspear, Phillip Mitchell

Sensation & Perception

TPE001: Neural Adaptation Of Visual ERP Components: Effects Of Adaptor Stimulus Duration And Interstimulus Interval

Presented by: Daniel Feuerriegel, University of South Australia, Australia

Authors: Daniel Feuerriegel, Owen Churches, Mark Kohler, Hannah Keage

TPE002: Disentangling the Study of Person Cue Processing from Face and Body Processing

Presented by: Justin Gaetano, Southern Cross University, Australia

Authors: Justin Gaetano, Anna Brooks, Rick Zwan

TPE003: Vestibular-Auditory Interactions: Assessing the Influence of Passive Self-Motion on Auditory Localisation

Presented by: Luzia Grabherr, University of South Australia, Australia

Authors: Luzia Grabherr, Vanda Lory, Fred Mast

TPE005: Impaired Generation Of High-Frequency Oscillations In A Rat Model Of Schizophrenia

Presented by: Lauren Harms, University of Newcastle, Australia

Authors: Lauren Harms, Deborah Hodgson, William Fulham, Markku Penttonen, Ulrich Schall, Juanita Todd, Patricia Michie

TPE006: Pleasant to Touch: How Touch Avoidance Influences Pleasant Perceptions of CT-targeted Touch

Presented by: Emily Hielscher, Queensland Centre for Mental Health Research (QCMHR), Australia

Authors: Emily Hielscher, Doug Mahar

TPE007: Neural Correlates of Motion Velocity in Human Auditory Cortex

Presented by: I-Hui Hsieh, National Central University, Taiwan

Authors: I-Hui Hsieh, Chao-An Meng, Kourosh Saberi

TPE008: Optokinetic Nystagmus Confirms Multistable Rivalry Between Four Discrete Overlapping Motion stimuli

Presented by: Laila Hugrass, Swinburne University of Technology, Australia

Authors: Laila Hugrass, David Crewther, Imogen Bell, Linden Parkes, Philip Sumner, Alistair Walsh, Michael Reynolds

TPE009: The Brain Establishes, Tests, And Updates Predictive Models For Visual Inputs That Are Never Perceived

Presented by: Bradley N Jack, Southern Cross University, Australia

Authors: Bradley N Jack, Urte Roeber, Robert P. O'Shea

TPE010: Developmental Dyscalculia Like Symptoms Induced Psychophysically Via High Contrast Surround Masking In Neurotypical Observers

Presented by: Nicola Jastrzebski, Swinburne University of Technology, Australia

Authors: Nicola Jastrzebski, Laila Hugrass, David Crewther

TPE011: Magnetoencephalographic (MEG) Response Properties Associated With Capacity-Limited Sensory Gating Resources During More/Less Estimation Judgements: Case Of The Disappearing Magnetic Dipole In Right Posterior Parietal Cortex (rPPC) Under The Cloak Of Surro

Presented by: Nicola Jastrzebski, Swinburne University of Technology, Australia

Authors: Nicola Jastrzebski, David Crewther, William Woods

TPE012: Can SSRIs Enhance Human Visual Cortex Plasticity?

Presented by: Alice K. Lagas, University of Auckland, New Zealand

Authors: Alice K. Lagas, Joanna Black, Cathy M. Stinear, Winston D. Byblow, Geraint Phillips, Bruce R. Russel, Robert R. Kydd, Benjamin Thompson

TPE013: Decoding of Single Auditory Features Investigated by Mismatch Negativity

Presented by: Melissa Larsen, Danish Research Center for Magnetic Resonance, Denmark

Authors: Melissa Larsen, Morten Mørup, Michelle Rosgaard Birknow, Elvira Fischer, William Baaré, Thomas Werge, Hartwig Siebner

TPE014: Investigating The Effect Of Stimulus Variables And Eye Movement Profiles On Binocular Rivalry Rate: Implications For Large-Scale Endophenotype Studies

Presented by: Phillip Cheuk Fung Law, Monash University, Australia

Authors: Phillip Cheuk Fung Law, Jacqueline Riddiford, Caroline Gurvich, Trung Ngo, Steven Miller

TPE015: To Hear Or Not To Hear: Stimulus-Specific Adaptation In The Auditory System

Presented by: Manuel Malmierca, University of Salamanca, Spain

Authors: Manuel Malmierca, Yaneri A. Ayala, Flora M. Antunes, Daniel Duque, Javier Nieto, Blanca N. Aguillon, David Pérez-González, Xin Wang,

TPE016: Motion Discrimination is Impaired in Cannabis Users

Presented by: Elena Mikulskaya, University of Newcastle, Australia

Authors: Elena Mikulskaya, Frances Martin

POSTER SESSION 2

TPE017: Individual Differences In Visuotactile Processing Predict Susceptibility To The Rubber Hand Illusion

Presented by: Hannah Morgan, Macquarie University, Australia

Authors: Hannah Morgan, Regine Zopf

TPE018: Ketamine As A Model For Schizophrenia Deficits

Presented by: Susan Rossell, Swinburne University of Technology, Australia

Authors: Susan Rossell, Celia Morgan, Nicole Joshua, Olivia Carter, Erica Neill

TPE019: Neural Entrainment To Musical Rhythms In Human Auditory Cortex, As Revealed By Intracerebral recordings

Presented by: Sylvie Nozaradan, Catholic University of Louvain, Belguim

Authors: Sylvie Nozaradan, Jacques Jonas, Jean-Pierre Vignal, Louis Maillard, Andre Mouraux

TPE020: Large Auditory Evoked Potentials To Rare Emotional Stimuli In Preterm Infants At Term Age

Presented by: Satu Pakarinen, Cognitive Brain Research Unit, University of Helsinki, Finland

Authors: Satu Pakarinen, Anna Grekula, Iina Ala-Kurikka, Kaija Mikkola, Vineta Fellman, Minna Huotilainen

TPE022: Investigating the Ecological Validity of Predictive Auditory Processing

Presented by: Martin Reiche, Carl von Ossietzky University of Oldenburg, Germany

Authors: Martin Reiche, Andreas Widmann, Alexandra Bendixen

TPE023: Odours Influence Distributed Patterns Of Brain Activity For Matching Visual Objects

Presented by: Amanda Robinson, The University of Queensland,Australia, Australia

Authors: Amanda Robinson, Zhengyi YANG, Jeiran Choupan, Judith Reinhard, Jason Mattingley