

ABSTRACTS

DAY 1: Wednesday, October 20th

In search of an ecologically valid measure of the Dysexecutive Syndrome: Can virtual reality help in rehabilitation?

A. Jansari

University of East London, UK

The accurate assessment of individuals with dysexecutive syndrome (DS) is vital for effective rehabilitation. Although neuropsychological tests of executive function exist, they are not necessarily ecologically-valid or predictive of real-world adjustment (Shallice & Burgess, 1991). The JAAM© paradigm (Jansari, Agnew, Akesson & Murphy, 2004) is an office-based role-playing task constructed to tap the major deficits seen in DS; it employs a virtual reality environment presented on a standard laptop computer making it highly portable. JAAM© has been shown to be able to successfully differentiate patients with DS from normal controls; importantly, a Swedish translation of the paradigm has been successfully replicated on a brain-injured population in Stockholm demonstrating cross-cultural validity. As well as showing overall task performance, the assessment provides a profile of performance across eight cognitive constructs central to executive functions; this means that the fine-grained analysis of an individual's performance to guide future rehabilitation is possible. Further studies have shown that JAAM© is also sensitive to changes in executive functions as a result of ecstasy use, healthy ageing, androgen-deprivation therapy for prostate cancer, the long-term effects of chronic alcohol use and the intake of nicotine. Initial results also show its ability to detect executive problems in individuals with schizophrenia. JAAM© can therefore be used as a tool in a number of areas of research as well as for guiding rehabilitation.

The evolution of meaningful object representations through recurrent processing

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Objectives: Meaningful object recognition is accomplished through recurrent, interactive processing whereby an initial feedforward sweep through the ventral stream is followed by recurrent interactions. However, critical questions remain regarding the factors that mediate the degree of recurrent interactions during object recognition and what kind of information these processes reflect. fMRI studies have shown activity in the ventral stream is modulated by the degree of semantic integration required for recognition, with anteromedial temporal cortex engaged when semantic integration demands are high. The novel prediction we tested is that increasing semantic integration demands result in increasing recurrent interactions within the ventral stream, and because semantic integration demands can be described by feature-based statistical measures, these effects should be concurrently expressed in the data.

Methods: MEG signals were recorded while participants named visual objects in low and high integration conditions defined by the stimuli (nonliving vs. living objects) and task (category-level vs. unique naming).

Results: We find that source reconstructed time-courses and phase synchronisation measures show increased recurrent interactions between left anterior temporal and left posterior fusiform regions for unique over category naming, and for living over nonliving things. These effects occurred after approximately 200 ms. In addition, we demonstrate that MEG signals during this time significantly correlate with feature-based semantic measures that are predicted to underlie conceptual representations.

Conclusions: These findings demonstrate that the cortical dynamics during object processing are modulated by the complexity of conceptual information required, and that feature-based statistics capture these effects.

Neural correlates of the urge for action

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Objectives: Our objective was to investigate the neural correlates of the urges that may precede some forms of action. A number of psychiatric and neurological disorders, particularly those with a neurodevelopmental origin (e.g., ADHD, OCD, Tourette syndrome), are characterised by the presence of unwanted and involuntary thoughts and actions that are difficult to suppress. Individuals with Tourette syndrome perceive a relatively constant demand to suppress their tics in social situations and while voluntary suppression of tics is possible, many individuals report that it can be uncomfortable and stressful to suppress tics and that the urge to tic becomes uncontrollable after a period of suppression. This suggests that tics may be executed to remove the unpleasant sensations associated with the urge to tic.

Methods: We used quantitative meta-analytical techniques, along with new investigations using ultra high field functional MRI, to examine the neural correlates of urges that precede action in both healthy individuals and those with Tourette syndrome. We also carried out functional connectivity analyses on our new data to investigate the patterns of inter-connectivity between brain areas identified in the meta-analyses.

Results: Our data indicate that a network of brain areas including: cingulate cortex, insular cortex, and several thalamic nuclei are particularly involved in the urges associated with involuntary action.

Conclusions: These results are discussed with reference to the suggestion that the insular cortex plays a key role in body representation, and that the anterior insular cortex (AIC) in particular is important for the conscious representation of subjective feelings through the integration of the body's visceral states with emotional signals.

SYMPOSIUM: WHEN TOP-DOWN RULES BRAIN FUNCTION (Organiser: David Soto)

Introduction to symposium

David Soto

Centre for Neuroscience, Imperial College, London

The symposium will illustrate the remarkable role of top-down factors associated with individual's strategies, rules, expectations and other forms of memory representations, at influencing different brain processes related to attention and the control of action.

Investigating the neural basis of inhibitory control using brain stimulation

Neil Muggleton

Institute of Cognitive Neuroscience, UCL

Inhibitory control mechanisms are important in a range of behaviors to prevent execution of motor acts which, having been planned, are no longer necessary or appropriate. Examples of this can be seen in a range of sports, such as cricket and baseball, where the choice between execution and inhibition of a bat swing must be made in a very brief time window. Deficits in inhibitory control have been associated with problems in behavioural regulation in impulsive violence as well as a range of clinical disorders and are typically related to dysfunction of the prefrontal cortex. The roles of the frontal eye fields (FEF), an area most frequently described in relation to eye movement functions, but also involved in visual processes, and the pre-supplementary motor area (pre-SMA) were investigated using an inhibitory control task and transcranial magnetic stimulation (TMS). A stop signal task with manual responses was employed, providing measures of impulsivity and inhibitory control. TMS over FEF had no effect on response generation (impulsivity, indexed by go signal RT), but disrupted inhibitory control (indexed by stop signal RT). Similarly, pre-SMA also only disrupted the ability to respond to the stop signal. The contributions of the two areas to performance seems to differ with pre-SMA being involved when the task is relatively novel whereas this was not the case with FEF stimulation. These findings extend our knowledge of the brain areas contributing to inhibitory control and supplement previous TMS findings of the role for inferior frontal gyrus (IFG) in inhibitory control, with the clarification of the specific relative contributions of each area a focus of future work.

Attentional guidance by knowledge of others' memory: Contributions from culture

Xun He

Behavioural Brain Sciences Centre, University of Birmingham

People are very often involved in interactions with others in everyday life. Evidence has suggested that people will represent and be affected by others' actions when they carry out tasks jointly. It remains unclear, however, what core functions have been influenced by this co-representation. Furthermore, we asked the question that what role the culture background plays, considering that people interact in greatly different ways across cultures. We tested three groups of people, including a) native Caucasians, b) South Asians born and raised in Britain (therefore much influenced by the British society and culture), and c) native Chinese people who were raised in China but lived in UK by the time of the experiment. Each participant did a visual search task and a memory test, with a testing partner performing similar tasks at the same time in front of a single screen. We replicated the results that attention can be guided towards the image in the working memory in all three groups. More interestingly, for the first time we showed that visual attention can also be directed by the knowledge that some images were in the testing partner's working memory. However, this effect only occurred between Caucasians and between South Asians (British citizens), and not between Chinese. These data suggest that jointly engaged participants could generate a representation of others' memory, which is used to guide subsequent attentional deployment, dependent on the culture background of involved people.

Top-down modulations in visual cortex: patterns of baseline activity underlying attention and visual imagery

Mark Stokes

Department of Experimental Psychology, University of Oxford

Activity in visual cortex is determined by recurrent input as well as direct sensory stimulation. In particular, feedback from top-down control systems continuously shapes activation patterns in visual cortex according to current goals and expectations. For example, during a difficult perceptual task, predictive information can be used to pre-activate specific perceptual templates, and consequently, bias visual processing in favour of task-relevant information. During visual imagery, on the other hand, top-down feedback can be used to co-opt perceptual machinery for internally generated representations. This talk will focus on how these top-down mechanisms selectively activate highly specific neural populations in visual cortex in the absence of the corresponding driving stimulus. We have used multivoxel pattern analysis across a range of experiments to explore selective modulations of specific neural sub-populations measured in human visual cortex during attention, visual imagery and short-term memory. We explore whether a common set of neural principles underlies top-down activation of visual cortex according to diverse task contexts, and we also consider how these top-down signals are coded in prefrontal cortex.

Top-down hippocampal modulation: a mechanism underlying the suppression of unwanted memories

Michael Anderson

MRC Cognition and Brain Sciences Unit, Cambridge

We have all had moments when an object or event reminds us of an experience we would prefer not to think about. When such reminders occur, we often exclude the unwanted memory from awareness. In past work, we have sought to understand how attentional control mechanisms interact with brain structures involved in episodic memory to allow people to control unwanted memories. Our approach focuses on a model situation that captures essential features of what people confront in naturally occurring circumstances: exposure to reminders of some target event, together with a goal to prevent the associated event from coming into awareness. Using tasks that model this situation (Anderson & Green, 2001), we have discovered that people engage control mechanisms mediated by the lateral prefrontal cortex to suppress retrieval of unwanted memories. This process induces forgetting of the excluded trace, with the amount of forgetting predicted by engagement of lateral prefrontal cortex (Anderson et al. 2004). Importantly, episodic forgetting induced by retrieval suppression is produced by modulation of hippocampal activation that is triggered by memory intrusions. Strikingly, this hippocampal modulation induces a temporally extended window of memory impairment around the epoch of suppression, the amnesic penumbra, within which recently experienced events are disrupted, irrespective of their relevance to the target memory. These findings suggest that top-down hippocampal modulation may serve as an important mechanism underlying selective forgetting (Anderson & Levy, 2009).

FREDA NEWCOMBE LECTURE - SPONSORED BY WILEY-BLACKWELL

Direct routes in object processing

Glyn Humphreys

School of Psychology, University of Birmingham

Ratcliff and Newcombe (1982) proposed the idea various forms of stored knowledge (in their case, names) could be accessed directly by objects, without mediation from associative and context-related semantic knowledge. In this talk I will elaborate on the theme of direct routes in object processing, highlighting neuropsychological and cognitive neuroscientific evidence for a direct visual mapping from image information to stored knowledge of objects, and for a direct mapping of object representations to action. I will also evaluate whether the non-systematic relations between objects and names means that, unlike other forms of object-driven processing, name retrieval is largely semantically mediated.

DAY 2: Thursday, October 21st

Voice processing in dementia

Julia C. Hailstone, Sebastian J. Crutch, Jason D. Warren

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Objectives: Impairments of voice recognition (phonagnosia) are less well characterised than prosopagnosia. Cognitive models propose that voices like faces are processed hierarchically: perceptual analysis precedes and interacts with semantic mechanisms. Here we investigated perceptual and semantic voice processing in patients with behavioural variant frontotemporal lobar degeneration (bvFTLD), semantic dementia (SD) and Alzheimer's disease (AD). A further objective was to characterise in detail a patient (QR) with progressive phonagnosia at presentation.

Methods: We designed a novel neuropsychological battery to assess processing of voices in relation to faces and proper names, including tests of perceptual processing (vocal gender discrimination, vocal size encoding, discrimination of unfamiliar speakers, Benton facial recognition), and semantic processing (familiarity and recognition of famous voices, faces and names). Patients' performance was compared with healthy older control subjects. QR's performance was compared with a case control (KL) with progressive prosopagnosia.

Results: Relative to healthy controls, SD and AD patients demonstrated similar impairments of voice and face recognition with relative sparing of perceptual encoding; SD patients were significantly more impaired on proper name recognition. QR had impaired voice recognition with intact perceptual analysis of voices and relatively spared face recognition: associative phonagnosia. In contrast, KL exhibited multimodal impairments of person recognition.

Conclusion: Both SD and AD may be associated with impaired voice (and face) recognition; proper name recognition performance may differentiate SD from AD, in keeping with a multimodal deficit of person knowledge in SD. Progressive associative phonagnosia as a relatively selective deficit may be a presenting feature of FTLD.

Emergent length effects in a parallel reading model

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²School of Computer Science, University of Manchester

Objectives: Word-length effects have been taken as a serious challenge to models of single word reading which postulate a parallel processing mechanism: length effects are usually interpreted as evidence of serial processing. However, an alternative account is that visual processes outside the scope of existing models are responsible for generating the length related phenomena. We developed a parallel reading model, including a visual processing stage, to investigate whether the additional visual processing might contribute to length effects in normal reading.

Methods: We used an architecture based on the Plaut et al.'s (1996) version of the triangle model, with two additional visual layers prior to the orthographic layer. The simulation was trained on 8,160 monosyllabic words taken from the English Lexicon Project (Balota et al., 2007) and tested for length effects using Weekes' (1997) stimuli.

Results: The model exhibited significant word length by lexicality interactions which were similar to those found in comparable experiments using human participants.

Conclusions: This study demonstrates that a parallel reading model can account for the length effects in normal reading, provided that it has a visual processing component and that the orthographic representational structure is allowed to emerge through exposure to the learning environment. This work suggests that the visual processing is the key to understanding word-length effects in normal reading.

TMS evidence for an extended executive-semantic system: The contribution of left prefrontal, temporal and parietal cortex to controlled retrieval and selection

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Objectives: To understand the meanings of the words and objects we encounter, we need to store semantic knowledge and employ executive mechanisms that retrieve and manipulate this information in a task-appropriate way. The brain network that supports semantic control remains controversial. Neuroimaging studies have focussed on the role of left inferior frontal gyrus (IFG), while neuropsychological research suggests that damage to a widely-distributed set of brain regions – left temporoparietal cortex as well as IFG – elicits impairments of semantic control. There is also debate about the relationship between semantic control and wider executive control.

Methods: We used transcranial magnetic stimulation (TMS) in healthy volunteers to create 'virtual lesions' in three target regions: left IFG, posterior middle temporal gyrus (pMTG) and intraparietal sulcus (IPS). The influence of TMS on tasks varying in semantic and non-semantic control demands was examined to gain insights into the (i) functional specialisation and (ii) domain-dependence of the hypothesised semantic network.

Results: The results revealed that TMS over left IFG and pMTG disrupted similar aspects of semantic control, including controlled retrieval of semantic material and semantic selection. Stimulation of left IPS specifically interfered with semantic selection but not controlled retrieval. The

roles of IFG and pMTG were restricted to the semantic domain, while IPS participated in non-semantic control.

Conclusion: These observations are consistent with a large-scale semantic control network, as predicted by lesion data, that draws on semantic-specific (i.e., IFG and pMTG) and domain-independent executive components (i.e., IPS).

Is anybody in there? A novel method for detecting conscious awareness independently of language comprehension or behavioural responses

Ryan Scott

School of Psychology, University of Sussex

Objectives: To evaluate a novel learning-based procedure designed to permit the detection of conscious awareness in patients without language comprehension or behavioural responses.

Methods: The method exploits a situation whereby only consciously detected violations of an expectation lead to changes in skin conductance response (SCR). 30 healthy volunteers listened to sequences of 3 piano notes that, without their being told, predicted a pleasant fanfare or an aversive white noise according to a simple rule. Stimuli were presented either without distraction (attended condition) or while distracted by a visual task to simulate the absence of conscious awareness (unattended condition). The test-phase included occasional violations of the rule where white noise followed a note pattern normally predicting the fanfare.

Results: All participants in the attended condition and none in the unattended condition reported awareness of the rule and its subsequent violation. Thus, learning occurred without instruction and was attention-dependent. Six participants did not show a robust SCR to the white noise and were hence excluded from assessment. In the remaining participants (12 per condition), we examined if SCR was greater for white noise occurring in violation, versus accordance, with the rule. In the attended condition this difference was significant for 11 participants ($p < 0.05$) and marginal for 1 ($p = .071$). In the unattended condition the difference was not significant for any participant (all $p > .13$). Thus, learning was detectable from SCR differences.

Conclusions: The proposed procedure may provide a viable assessment method for detecting conscious awareness in patients lacking language comprehension and behavioural responses.

Neural mechanisms of immediate and delayed recall: a voxel based morphometry study

Charumati Raghavan, Wai-Ling Bickerton, Joff Lee, Glyn W Humphreys & Pia Rotshtein
School of Psychology, University of Birmingham

Objectives: There is current debate between two contrasting memory models: Multiple Storage vs. Unitary models. The current study aims to test these models by identifying whether immediate (IR) and delayed recall (DR) are based on common or dissociated neural mechanisms. We used a lesion-deficit approach to assess correlation between verbal memory and neural integrity using voxel based morphometry.

Methods: 230 patients (Mean age=70.73 years, SD=13.47), who suffered from sub-acute stroke (<3months) were recruited as part of Birmingham University Cognitive Screen (bucs.bham.ac.uk). Performance on various cognitive domains including episodic memory was assessed and CT scans obtained for each patient. The data were analyzed using SPM8. A general linear model was used for statistical analysis of variables of interest (IR & DR), while controlling for potential

cognitive confounds: e.g. orientation, language, executive function, sustained attention. Separate models were generated for grey and white matter tissue. Exclusive masking was used to identify isolated neural structures for IR and DR respectively and inclusive masking to investigate any overlapping mechanisms. Reliability threshold: FWE-cluster-level-corrected $p < 0.05$, cluster extent=100 voxels.

Results: IR and DR scores correlated ($r=0.79$, $p < 0.05$), suggesting a degree of processing overlap between the memory types. However, lesions to left frontal and superior-temporal gyri impaired immediate-recall, while lesions to left anterior-hippocampus affected delayed-recall. Lesions to posterior-hippocampus and fornix affected both types of memory.

Conclusion: Our data support the multi-storage model showing a double dissociation for different retention durations, though common structures were also observed implying possible overlap for aspects of information encoding and retrieval.

SYMPOSIUM: IMPULSIVITY FROM A TRANSDIAGNOSTIC PERSPECTIVE (Organisers: Georgina Jackson and Rhiannon Corcoran)

Introduction to symposium

Rhiannon Corcoran

Division of Psychiatry, University of Nottingham

Impulsivity is a psychological feature of several neuropsychiatric, neurodevelopmental and neurological disorders which can be defined, explored and understood in a number of different ways. This symposium will examine this complex transdiagnostic construct using experiential, experimental and imaging data.

Impulsivity in Parkinson's disease

Masud Husain

UCL Institute of Cognitive Neuroscience & UCL Institute of Neurology

Introduction: Recent reports have highlighted the risk of some patients with Parkinson's disease (PD) developing impulsive control disorders (ICDs) such as gambling, compulsive shopping or hypersexuality. These problems appear to arise in the context of treatment, particularly with dopamine agonists which act directly at dopamine receptors in the brain. However, it remains unclear why only some PD patients develop ICDs on such drugs.

Method: We assessed responses to novelty and willingness to take risks in PD patients with ICDs comparing them to PD patients without ICD and elderly controls. Participants were also assessed on a novel oculomotor decision-making task that we have devised.

Results: PD patients with a history of ICD demonstrated poor decision making on our eye movement task. A sub-group of PD patients – those with an akinetic-rigid phenotype – as well as those with ICD were significantly quicker to respond to novel compared to non-novel perceptually salient stimuli. By contrast tremor dominant PD patients and controls responded equally quickly to both types of stimuli.

Faster reaction times to novel stimuli correlated with greater risk-taking on the Iowa Gambling Task for akinetic-rigid PD patients only. Importantly, there was no association between these measures and dopaminergic medication dose. Instead, preserved structural integrity of mesolimbic regions

(assessed with magnetisation transfer imaging) correlated with novelty-seeking in PD patients without ICD and increased risk-taking in the ICD patients.

Conclusion: These results suggest that preservation of the mesolimbic dopaminergic system may play an important role in the development of ICD. Furthermore, akinetic-rigid PD patients may be more susceptible to developing ICDs.

Impulsive people show impaired goal-directed control over action selection

Lee Hogarth

School of Psychology, University of Nottingham

Introduction: Basic research in behavioural neuroscience has identified two dissociable learning systems underpinning motivated behaviour. Whereas goal-directed actions are intentional in being mediated by an expectation of the current value of the consequences, habitual behaviours are reflexive in being elicited by Pavlovian cues directly without retrieving knowledge of the consequences. Moreover, impulsivity in animals has been associated with a predominance of the habitual over the goal-directed controller, as manifested by an inability to modify reward-seeking on the grounds of knowledge that the reward has been devalued.

Method and Results: This talk will report two experiments which have shown a comparable association between human impulsivity and the predominance of habitual versus goal-directed control over motivated behaviour.

Conclusions: The implication of these findings is that impulsive humans, by virtue of their predilection for habit learning, are tied to repeating behaviours in contexts in which these behaviours have previously been rewarded, rather than make adaptive decisions based upon up-to-date knowledge about the consequences of these behaviours.

Good things come to those who wait? Differential roles of PFC in impulse control

Renate Reniers

Institute of Mental Health, Nottingham

Introduction: The process of intertemporal choice depends on circuits including limbic-striatal regions and lateral prefrontal cortex. Choosing to wait longer for a larger reward has been shown to preferentially engage lateral prefrontal cortex. In this study we assessed the impact of strategic factors on neuronal correlates of intertemporal choice.

Methods: Subjects were scanned with fMRI while choosing between a small reward after a short delay and a larger reward after a longer delay. Magnitudes of rewards and the short delay were fixed, but the longer delay varied contingent on previous choices, critically introducing a strategic component.

Results: Long delay choices were associated with right inferior frontal responses. Short delay choices were associated with right dorsolateral prefrontal cortex (DLPFC) responses that were significantly greater than responses to long delay choice in direct comparison. The DLPFC response to short delay choices increased as delay of the long delay choice decreased. By contrast, ventrolateral prefrontal response to long delay choice was observed independent of delay

and ventral striatal response to long delay choice increased as the delay associated with that choice decreased.

Conclusion: We argue that increased DLPFC response to short delay choice as delay of the long delay option decreases reflects a strategic decision to maintain less profitable, short delay responding in the short term to maximise longer term gains. This finding suggests that strategic factors over a series of trials may critically modulate the neuronal basis of intertemporal choice and significantly develops our understanding of this complex process. This may have important implications for understanding disorders of impulse control.

Hypomania and the occurrence and experience of impulsivity in a non-clinical sample

Jodie Finalyson-Burden

Division of Psychiatry, University of Nottingham

Introduction: Recent research has indicated strong links between bipolar disorder and impulsivity, with the suggestion that impulsivity may be a key causal factor for many behaviours commonly found in bipolar disorder. This research intended to (1) test whether relationships between impulsivity, bipolar disorder and behaviour could be replicated throughout the bipolar spectrum and (2) investigate qualitatively how impulsivity and impulsive behaviour is experienced in a non-clinical continuum sample.

Methods: A battery of questionnaires including the UPPS and BIS was completed by 650 students. Using purposive sampling, a selection of participants were then invited to take part in a semi-structured interview which explored single and specific incidents of impulsivity from the participants' lives.

Results: Questionnaire data indicated that students who had experienced hypomania (Hyp+) had significantly higher levels of self reported impulsivity when compared to individuals who had no experience of hypomania (Hyp-) ($p < 0.001$). Hyp+ individuals were also more likely than Hyp- individuals to endorse engaging in a wide range of impulsive and risky-type behaviours; including excessive drinking, spending or computer use, attempting suicide, going AWOL, fire setting, self harming and engaging in risky sex. Data from the qualitative stage of the research indicates that impulsive behaviour in Hyp+ individuals is frequently triggered by intense emotional states, with behaviour functioning as a means of managing these emotions. Over time, many originally impulsive behaviours become habitual. At this stage the impulsive aspects of the behaviour in fact bear more relation to compulsivity, with participants describing the need to 'deal with' unpleasant 'urges'.

Conclusions: Impulsivity is an important factor in predicting behaviour throughout the bipolar spectrum. The relationship between impulsivity and compulsivity needs further investigation.

Impulsive decision-making in problem gambling

Luke Clark

Dept of Experimental Psychology, University of Cambridge

Introduction: Gambling is a widespread form of entertainment that may afford unique insights into the weaknesses of human decision-making. It is also a behaviour that can become harmful, and potentially addictive, in some individuals. There is a longstanding association between problem gambling and elevated trait impulsivity, as well as other aetiological links to the substance use

disorders. Recent studies have begun to characterise more precisely the neurocognitive sequelae of problem gambling.

Method: Problem gamblers and individuals with alcohol dependence performed various measures that explore impulsive responding (Cambridge Gamble Task; Information Sampling Task; Stop Signal Task).

Results: Shared impairments in risky and impulsive decision-making in problem gamblers and individuals with alcohol dependence were found. The alcohol dependent group were further impaired in response inhibition and working memory, as a possible consequence of long-term alcohol consumption. In addition to these neuropsychological findings, cognitive approaches to gambling have identified a number of erroneous beliefs held by gamblers, which cause them to over-estimate their chances of winning. One such bias, the near-miss effect, may operate through the anomalous recruitment of brain reward circuitry (insula, vmPFC, and ventral striatum) that is a likely focus of dysregulation in problem gambling.

Conclusions: These findings may implicate pathophysiology in the ventromedial prefrontal cortex in the underlying vulnerability to a range of addictive disorders.

BNS Spring Meeting 2011

Wednesday and Thursday 30th and 31st March

Clinical Neurosciences Centre, 33 Queen Square, London, WC1N 3BG

9th Elizabeth Warrington Prize lecture by Aikaterini (Katerina) Fotopoulou
“The affective neuropsychology of confabulation and anosognosia”

President’s invited lecture by Jeffrey Binder
“Some language networks in the brain, what they do, and why?”
Sponsored by Cambridge University Press

Symposium on
“Re-considering language as the function of a large-scale neural network:
Towards a new understanding of normal language and aphasia”
Organised by Matt Lambon Ralph

Speakers include:
Hugues Duffau, Peter Nestor, Cathy Price and Richard Wise

THE CALL FOR ABSTRACTS IS NOW OPEN (until 10th December 2010)

Please submit a 250 word abstract structured with the following subheadings:
objectives, methods, results and conclusions
to Jamie Ward, Meetings Secretary: jamiew@sussex.ac.uk