WALES INSTITUTE OF COGNITIVE NEUROSCIENCE (WICN)

Annual Conference 2009

Deganwy, 8-10 July

The Quay Hotel & Spa

PROGRAMME & ABSTRACTS

WEDNESDAY JULY 8TH 2009

Crafnant Room	Title/Presenter
12.00-13.00	REGISTRATION (Reception Area) & BUFFET LUNCH (Vue Restaurant, First floor)
13.15-13.30	Ed Wilding, Chair WICN Science Group: Welcome
	Themed Symposium 1: Clinical Neuroscience
13.30-14.00	David Linden (Bangor): *Functional imaging and the treatment of mental disorders*
14.00-14.30	Paul Keedwell (Cardiff): *Neuroimaging risk markers of depression in young adults: A preliminary study*
	COFFEE (Crafnant Foyer Area)
15.00-15.30	Stefanie Linden (Bangor): *Emotion processing in schizophrenia*
15.30-16.00	Rodger Wood & Claire Williams (Swansea): *Emotional deficit disorder following traumatic brain injury*
16.00-16.30	Natalia Lawrence, Ella Hinton (Cardiff), John Parkinson (Bangor) & Andrew Lawrence (Cardiff): *Conscious desire and cue-triggered 'wanting' for food have dissociable neural substrates*
16.30-17.30	INVITED ADDRESS Luke Clark, University of Cambridge: *Problem Gambling, Near-Misses and the Brain Reward System* Chair: John Parkinson
18.00	Conference Dinner (Vue Restaurant, First floor)

THURSDAY JULY 9TH 2009

Crafnant Room	*Themed Symposium 2: TMS*
09.00-09.10	Chris Chambers (Cardiff): *TMS group overview*
09.10-9.40	Chris Allen (Cardiff): *Theta burst stimulation of visual cortex increases awareness of visual stimuli independently of*

	discrimination ability
9.40-10.10	Martynas Dervinis (Cardiff): *Orienting attention on the edge of awareness: Missing trigger or bad aim?*
10.10-10.40	Veldri Kurniawan (Cardiff): *Multisensory spatial and feature-based attention in vision and touch: An fMRI and TMS study*
	COFFEE (Crafnant Foyer Area)
11.00-11.30	Wen Zhang (Cardiff): *The effect of crossmodal attentional load on sensory processing and the control of attentional resources*
11.30-12.00	Jane Klemen (Cardiff): *Functional and anatomical correlates of top-down control of cross-modal attention and its effects on sensory processing*
12.00-12.30	Marcel Meyer (Cardiff): *Affective control: Evidence from the Eriksen flanker task*
12.30-13.00	Frederick Verbruggen (Ghent). *Functional relation between cognitive and neural mechanisms of response inhibition and performance monitoring after theta-burst stimulation*
	LUNCH (Vue Restaurant, First floor)
14.00-15.30	POSTER SESSION & TEA/COFFEE (Crafnant Foyer Area)

Crafnant Room	*Themed Symposium 3: Perception & Action*
15.30-16.00	Paul Downing, Alison Wigget & John Taylor (Bangor): *Visual cortex: a view on body representations*
16.00-16.30	Kim Shapiro & Zhao Fan (Bangor), Krish Singh & Suresh Muthukumaraswamy (Cardiff): *Serial chaining of cognitive operations in humans: RT costs and a sustained posterior MEG component*
16.30-17.00	Jane Raymond, Jen O'Brien, Yoshi Yagi, Niklas Ihssen & Mark Fenske (Bangor & Guelph University): *The effect of value learning on visual attention and perception*

17.00-18.00

INVITED ADDRESS

Anne Sereno, The University of Texas Medical School at Houston
& WICN Visiting Scholar

Neural Substrates of Spatial and Shape Visual Processing

Chair: Bob Rafal

FREE EVENING
(see enclosed list for suggestions)

FRIDAY JULY 10TH 2009**

**Tegid Suite (Please note room change for today)	*Themed Symposium 3: Perception & Action (contd.)*
09.30-10.00	Charles Leek (Bangor), Irene Reppa (Swansea) & Simon Watt (Bangor): *Inhibitory mechanisms of object-based visual selection in human vision*
10.00-10.30	Martijn van Koningsbruggen (Bangor): *Parietal TMS disrupts the remapping saliency maps*
	COFFEE (Crafnant Foyer Area)
	Themed Symposium 4: Learning & Memory
11.00-11.30	Helen Morgan (Bangor): *Oscillatory brain activity during visuo-spatial working memory*
11.30-12.00	Andrea Greve, E.L. Wilding, K.S. Graham (Cardiff): *How learning semantically related and unrelated word pairs is supported by the medial temporal lobe*
12.00-12.30	Paul Mullins (Bangor): *Alternate MR methods for investigating brain function*
	LUNCH (Vue Restaurant, First floor)
13.30-14.00	Matt Mundy (Cardiff): *Is perceptual learning stimulus specific?*
14.00-14.30	Simon Dymond (Swansea), Ella Hinton, Ulrich Von Hecker, & John Evans (Cardiff): *Neural correlates of relational reasoning: Involvement of parietal cortex activation*
14.30-15.00	Mark Blagrove, Nathalie Fouquet, Johannes Thome (Swansea), Oliver Turnbull (Bangor), Ed Pace-Schott, (Harvard), & Patrick McNamara, (Boston): *The relationships between behaviour-related neurohormones (oxytocin and cortisol) and sleep stage and dream content*
15.00	
	CONFERENCE END

POSTERS: Thursday July 9th, 14.00-15.30 (Crafnant Foyer Area)

Titles/Presenters

Alice Varnava (Swansea), Ann Taylor, Rhiannon Buck, Owen Hughes & Richard Wise*: Imaging neural responses to affective and pain-related stimuli in chronic pain patients vs. healthy controls*

Charles Leek (Bangor), Mark Roberts (Bangor), Irene Reppa (Swansea) & Alan Pegna (Geneva): *What's so special about the N170? Modulation of N170 by geometric shape attributes of 3D objects*

Corinna Haenschel (Bangor): *Cortical oscillatory activity is critical for working memory as revealed by deficits in early onset schizophrenia*

Corinna Haenschel (Bangor): *Effects of working memory training on ERPs and oscillatory activity in patients with mild cognitive impairment*

James Grange, George Houghton & Paloma Mari-Beffa: (Bangor): *The role of cue-target relationships in task switching*

Alex Kirkham & Paloma Mari-Beffa (Bangor): *Creating the Cognitive Connection in Parkinson's Disease: Executive Functioning & Articulation*

Titles/Presenters

Dave Playfoot, Jeremy Tree & Cris Izura (Swansea): *Acronym reading in semantic dementia*

Victoria Wright, Cris Izura, Nathalie Fouquet & Debbie Mills (Swansea): *Hemispheric processing of words by bilingual speakers: Differences and similarities across hemispheres and languages*

Bethany Chia-Yun Wu (Bangor): *Working memory and long-term memory: Event-related potential evidence for dissociations of encoding and retrieval*

Giovanni d'Avossa (Bangor): *Resting state type effects on the amplitude of deterministic and stochastic BOLD*

Niklas Ihssen, Linden, D., Shapiro, K (Bangor): *Increased visual short-term memory for sequential displays: Behavioural and neuronal dynamics*

Javad Salehi Fadardi (Ferdowsi University of Mashhad, Iran & Bangor University) Masoud Moghadaszadeh (Ferdowsi University of Mashhad, Iran) & Omid Rezazadeh (Rezazadeh's Nutrition and Diet Clinic, Mashhad, Iran): *What Feeds Obesity? The Role of Eating Type and Attentional Bias*

Javad Salehi Fadardi (Ferdowsi University of Mashhad, Iran & Bangor University), Masoud Moghadaszadeh (Ferdowsi University of Mashhad, Iran & W. Miles Cox (Bangor): *A Combi Stroop Test to Measure Food Attentional Bias*

Kenneth S.L. Yuen, Jorien van Paasschen, Linda Clare, & David E.J. Linden (Bangor): *Goal-oriented cognitive rehabilitation for people with early-stage Alzheimer's disease: An fMRI investigation*

Zohreh Sepehri Shamloo (Ferdowsi University of Mashhad, Iran) & W. Miles Cox (Bangor): *Motivation-Enhancement Techniques Improve Adaptive Motivation Independent of Changes in Mood*

ABSTRACTS
Keynote Speakers

Luke Clark, University of Cambridge

PROBLEM GAMBLING, NEAR-MISSES AND THE BRAIN REWARD SYSTEM

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. Recent studies have begun to characterise more precisely the neurocognitive sequelae of problem gambling. We have found a shared impairment in impulsive decision-making in problem gamblers and individuals with alcohol dependence, which implicate pathophysiology in the ventromedial prefrontal cortex in the underlying vulnerability to a range of addictive disorders. The alcohol dependent group displayed further impairments in working memory function, 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. I will present recent fMRI findings that show how one such bias - the near-miss effect - may operate through the inappropriate recruitment of brain reward systems

Anne Sereno, The University of Texas Medical School at Houston & WICN Visiting Scholar

NEURAL SUBSTRATES OF SPATIAL AND SHAPE VISUAL PROCESSING

Visual processing is commonly divided into dorsal and ventral streams- the dorsal stream associated with the representation of spatial relations and visuomotor control; the ventral stream involved in object identification and discrimination. Research has shown that dorsal stream areas are important for processing of spatial attributes, and ventral stream areas for processing object properties such as color and shape. Recent work has shown shape processing in dorsal stream areas (LIP and FEF) and spatial selectivities (both retinal and eye position) in a ventral stream area (AIT). First direct comparisons of these shape and spatial attributes across dorsal and ventral streams at both a single cell and population level reveal important differences in encoding. It is clear that both streams process shape and spatial information, but not as a result of direct interactions. Instead, we find independent representations, presumably a result of different input and output requirements.

Presentations & Posters

Abstracts are listed in alphabetical order (first author)

Chris Allen

THETA BURST STIMULATION OF VISUAL CORTEX INCREASES AWARENESS OF VISUAL STIMULI INDEPENDENTLY OF DISCRIMINATION ABILITY

Damage to the primary visual cortex can result in *blindsight*, where discrimination of stimuli is preserved despite a lack of awareness. Blindsight highlights the dissociation between conscious awareness (i.e. reported detection of a stimuli) and the ability to respond veridically to the environment (i.e. discrimination between stimuli). Using a procedure that can address this distinction we show that theta burst stimulation (TBS) of visual cortex selectively *enhances* conscious detection without effecting discrimination of the same stimuli. Since TBS is generally thought to reduce cortical excitability, our findings run contrary to initial predictions and may, in part, reflect disinhibition of frontal-occipital recurrent interactions. Further research is planed to investigate the timing of such interactions and the pathways that are crucial for conscious vision.

Mark Blagrove

THE RELATIONSHIPS BETWEEN BEHAVIOUR-RELATED NEUROHORMONES (OXYTOCIN AND CORTISOL) AND SLEEP STAGE AND DREAM CONTENT

This study investigates differences in levels of oxytocin (a hormone associated with emotional attachment) and cortisol (a hormone associated with stress) between Rapid Eye Movement (REM) sleep and non-REM sleep (specifically, stages 3 and 4 Slow Wave Sleep), and whether oxytocin and cortisol are associated with REM dream content (friendly social dreams and unpleasant dreams respectively). Data collection is planned to commence in October 2009. The study follows hypothesises that a) there are higher levels of oxytocin in REM sleep than in non-REM sleep when controlling for time of night, and b) higher levels of oxytocin following REM dreams that have multiple characters and social / friendly content, than in REM dreams that have content that is non-social or even threatening.

Bethany Chia-Yun Wu, David E. J. Linden, Christoph Klein, Stephan G. Boehm

WORKING MEMORY AND LONG-TERM MEMORY: EVENT-RELATED POTENTIAL EVIDENCE FOR DISSOCIATIONS OF ENCODING AND RETRIEVAL

Working and long-term memory have long been considered distinct memory types. Based on recent neuroimaging studies and a critical re-evaluation of earlier lesion studies, a high degree of overlap between the areas subserving both types of memory has been highlighted, raising doubts on a double dissociation of working and long-term memory. Furthermore, it is widely accepted that working memory is the pathway to long-term memory. Here, we investigated whether working memory encoding is indeed a pre-requisite for successful formation of long-term memory. Additionally, we used event-related potentials to investigate whether similar neural processes support both types of memory. Participants were engaged in a working memory task for famous faces, which was followed by a long-term memory test for faces presented during the working memory task. Behavioural results showed a considerable degree of independence between performance in working memory and long-term memory. Clear neural signatures of successful encoding into working and long-term memory were present between 550-1100 ms; the spatial distributions of these potentials indicate different encoding between working and long-term memory. Positive old/new effects were present for both working (300-500 ms, 500-700 ms) and long-term memory

(500-800 ms). The topographies of all these old/new effects were significantly different from each other. Both our behavioural and event-related potential results support at least partially distinct memory systems for working and long-term memory. Our results raise questions on the idea of working memory as the pathway into long-term memory and support a high degree of dissociation between working and long-term memory.

Giovanni d'Avossa

RESTING STATE TYPE EFFECTS ON THE AMPLITUDE OF DETERMINISTIC AND STOCHASTIC BOLD

Results from two experiments in which participants either kept their eyes closed or fixated in separate scans or alternated between eyes closed and fixation within the same scans are presented. The amplitude of spontaneous BOLD signals are larger during eyes closed than fixation periods in a number of visual regions of striate and extra-striate cortex and primary auditory and somato-sensory areas. The anatomical congruency between deterministic BOLD responses, time locked to the instruction to open or close one's eyes, and spontaneous BOLD signal whose amplitude is modulated by resting state type is poor. Moreover, while all regions showed decreases in spontaneous BOLD signal following eyes opening and fixation, only some showed decreases in evoked BOLD signal. Finally the pattern of spontaneous BOLD synchronization between a mediodorsal thalamic seed region and the rest of the brain showed differences during eyes closed and fixation. During the former, this region showed out of phase BOLD synchronization with extrastriate regions, while during fixation, dorsal fronto-parietal regions and primary visual cortex showed in phase synchronization. We conclude that deterministic and stochastic components of the BOLD signal may be both controlled endogenously and that intrinsic organization of the visual system indicates two parallel systems, one centered on primary visual cortex under the control of dorsal network, the second on extrastriate regions.

Martynas Dervinis

ORIENTING ATTENTION ON THE EDGE OF AWARENESS: MISSING TRIGGER OR BAD AIM?

The purpose of this series of experiments is to examine the more specific psychological processes underlying spatial orienting of attention and neural mechanisms that support them. Posner identified three such sequential psychological processes: disengagement, shift, and re-engagement of attention on behaviourally relevant stimuli. We are interested in detailed examination of processes that are concerned with the initiation of the shift of attention as compared to processes that complete it. By comparing distributions of target identification errors on valid and invalid trials of Posner cueing paradigm, we would be able to determine whether errors of detecting a target stimulus are due to failures in any of these processes. If they are more likely to occur within cued locations, this would suggest the failure in triggering the shift of attention to the target. If they are more likely to occur at locations close to the target, that would mean the failure of re-engagement. Furthermore, we are using the same experimental paradigm to see whether error distributions vary as a function of subjectively reported awareness of the target or as a function of target's visibility to retinotectal and magnocellular visual pathways using stimuli that bypass them. The results of the latter experiments are still being awaited.

Paul Downing, Alison Wigget & John Taylor

VISUAL CORTEX: A VIEW ON BODY REPRESENTATIONS

As a social species, we must accurately perceive and interpret the behaviour of other individuals. A number of brain areas appear to be specialised to support this ability, e.g. by representing faces, actions, or others' mental and emotional states. In our research we have focused on two areas of extrastriate cortex that are selective for static and dynamic visual images of the human body and its parts. Here we will discuss recent studies of the properties of these regions, with an aim to better understanding what they contribute to social perception. We focus on WICN-funded fMRI and ERP studies of their sensitivity to viewpoint, and of their possible involvement in motor behaviour. We conclude from these and previous studies that jointly they provide a mid-level visual representation of bodies that is decoupled from the motor system.

Simon Dymond, Ella Hinton, Ulrich von Hecker & John Evans

NEURAL CORRELATES OF RELATIONAL REASONING: INVOLVEMENT OF PARIETAL CORTEX ACTIVATION

Contextually controlled derived comparative relations (more than/less than) may provide a model of the behavioral processes involved in “transitive inference”, long considered a hallmark of human reasoning. The present study describes the findings of two experiments designed to test this relational reasoning model by synthesising procedures from research on relational frame theory with behavioral neuroscience research on “transitive inference”. First, a behavioral study compared the effects of two training schedules (A<B<C<D<E and E>D>C>B>A) on subsequent novel performance. Next, the neural correlates of this behavior were examined with fMRI. Results demonstrated no differences between training schedules on subsequent novel probe performance, but an overall improvement in accuracy and decrease in response latencies from trained to tested relations in both groups. Imaging findings broadly supported those of previous studies. Hippocampal activation was correlated with accuracy on some test trial-types, and activity in PFC and parietal cortex showed the same trend as the behavioral data (i.e., ‘distance effect’).

Javad Salehi Fadardi, Masoud Moghadaszadeh, & Omid Rezazadeh

WHAT FEEDS OBESITY? THE ROLE OF EATING TYPE AND ATTENTIONAL BIAS

Food Attentional Bias (FAB) matters in overeating. Dieters and non-dieters show different eating types (ET). Objectives. We tested the effects of ETs, and dieting on FAB in Iran. Participants were dieters (N=34) and non-dieters (N=35). Methods. Dutch Eating Behaviour Questionnaire (DEBQ), and a Stroop test, including congruent and incongruent colour words, food- and concern-related and control words were administered. Results. Dieters scored higher on FAB, BMI, Emotional Eating, and Restrained Eating than non-dieters. Compared to underweight and normal BMI, obese participants scored higher on FAB, Emotional Eating, and Restrained Eating. External Eaters showed the lowest BMI than the other two types of eaters. Conclusion. When treating dieters, we recommend to take into account their eating type—e.g., dieting could make restraint eaters eat even more—and their FAB—e.g., the higher their BMI, the lower could be their ability to ignore food.

Javad Salehi Fadardi, Masoud Moghadaszadeh, & W. Miles Cox

A COMBI STROOP TEST TO MEASURE FOOD ATTENTIONAL BIAS

There are methodological complexities with the supraliminal-lexical versions of the modified versions of the Stroop tests that could be responsible for inconsistencies across the literature (Field & Cox, 2007). We tested whether a combination of

subliminal-pictorial and classic Stroop test can differentiate between dieters' and non-dieters' Food Attentional Bias (FAB). Participants were dieters (N = 30) and non-dieters (N = 32) who were tested three hours after having a meal. There were 24 pairs of high- and low-calorie food pictures presented for 32_{ms} before the appearance of a congruent or an incongruent colour word, in response to which the participants pressed a colour-key as quickly-and-accurately as possible. Colour-naming latencies and interference scores were calculated. Dieters showed slower RTs to incongruent colour words following high-calorie foods and larger FABs than non-dieters. The combi Stroop test has differential validity. Also, findings suggest that FAB can result from early allocation of dieters' attention to food-related stimuli.

James Grange, George Houghton & Paloma Mari-Beffa

THE ROLE OF CUE-TARGET RELATIONSHIPS IN TASK SWITCHING

Recent investigations of task-switching have used two cues per task to dissociate cue-switch costs from task-switch costs. In this paper, the role of cue processing in generating costs was investigated employing a cued target-location paradigm in which the basic task was kept constant (only targets changed), while the transparency of the cue-target relationship was manipulated. Results show that despite there being no switch in task-set, the typical pattern of task-switch costs was still found, and that these could be divided into cue-switch costs, and set-switch costs, associated with switching attention to a new target. When the cue-target relationship was maximally transparent, cue-switch costs were eliminated. Despite this, set-switch costs were still evident, demonstrating that attention switching induced a cost not attributable to switching cues. The results are discussed in terms of recent theories regarding the role of cue encoding in generating costs and benefits in task-switching designs.

Andrea Greeve, E.L. Wilding, K.S. Graham

HOW LEARNING SEMANTICALLY RELATED AND UNRELATED WORD PAIRS IS SUPPORTED BY THE MEDIAL TEMPORAL LOBE

Word pairs containing two semantically related words are more memorable than pairs containing two unrelated words. We investigated the brain regions that support this advantage by acquiring fMRI data during memory encoding. Participants studied word pairs that were semantically related (same category) and unrelated (different category). Recognition memory was subsequently tested by presenting intact (studied pairs), novel (unstudied pairs) and recombined pairs (a combination of two previously studied pairs). We found no encoding differences within the medial temporal lobe for subsequently recollected vs. familiar events as tested by intact and recombined pairs. Semantically related pairs (intact and recombined), however, elicited more encoding activity in left perirhinal cortex (Prh) and anterior hippocampus (aHC) relative to posterior hippocampus (pHC). Bilateral posterior parahippocampus (PHC) also showed greater activity for semantically related compared to unrelated pairs. These results reveal a number of medial temporal lobe regions that are modulated by semantic relations, but the findings are difficult to reconcile with the view that the HC supports recollection and the Prh supports familiarity.

Corinna Haenschel

CORTICAL OSCILLATORY ACTIVITY IS CRITICAL FOR WORKING MEMORY AS REVEALED BY DEFICITS IN EARLY ONSET SCHIZOPHRENIA

Impairments in working memory (WM) are a core cognitive deficit in schizophrenia (SZ). Neurophysiological models suggest that deficits during WM maintenance in

schizophrenia may be explained by abnormalities in the GABA-ergic system, which will lead to deficits in high-frequency oscillations. However, it is not yet clear which of the three WM phases (encoding, maintenance, retrieval) are affected by dysfunctional oscillatory activity. We investigated the relationship between impairments in event-related potentials (ERPs) and oscillatory activity in a broad frequency-range (3-100 Hz) and WM load in the different phases in 14 early onset patients with schizophrenia and 14 matched control participants using a delayed matching to sample paradigm. Our findings suggest that the WM deficit in schizophrenia is associated with impaired oscillatory activity during all phases of the task and that the cortical storage system reaches its capacity limit at lower loads. The inability to maintain oscillatory activity in specific frequency bands could thus result in the information overload that may underlie both cognitive deficits and symptoms of schizophrenia.

Corinna Haenschel

EFFECTS OF WORKING MEMORY TRAINING ON ERPS AND OSCILLATORY ACTIVITY IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT

The stages of cognitive impairment that may lie between normal ageing and early dementia are of great interest if we want to develop strategies for preventing dementia. Recently, the construct of mild cognitive impairment (MCI) has been proposed to designate an early state of cognitive impairment that deviates from the age norm. We conducted a cognitive training study with an MCI group and healthy elderly controls in order to investigate how far mechanisms of neural plasticity are preserved in these groups. Our particular interest was whether and to what degree cognitive training might lead to a change in ERPs and oscillatory activity. Our findings suggest that working memory training has beneficial effects in both groups and is associated with an increase in the ERP component P1 and both low and high-frequency oscillatory activity during encoding and retrieval. Furthermore, group differences were observed mainly in high-frequency gamma band activity. Gamma band activity may thus be specifically sensitive to changes with MCI and may prove to be useful in the diagnosis of this condition.

Niklas Ihssen, Linden, D., Shapiro, K

INCREASED VISUAL SHORT-TERM MEMORY FOR SEQUENTIAL DISPLAYS - BEHAVIOURAL AND NEURONAL DYNAMICS

It has been argued that the number of items that can be maintained in visual short-term memory (vSTM) is limited to 3 - 4 objects (Luck and Vogel, 1997). This view has been recently challenged by work of Fecteau and Shapiro (VSS 2008). They showed that splitting the to-be-remembered items into two sequential arrays increases vSTM capacity by a factor of nearly two. A possible confound in these studies was the time each individual object was available for encoding. Both conditions used the same presentation duration for a given display resulting in a halving of single objects' encoding time in the standard condition, relative to the new, sequential condition. Here, we report behavioural data that replicate the basic behavioural finding with controlled encoding time. Further, we extend the previous results by showing that both i) splitting the objects and ii) sequencing/repeating the (full) display produces a benefit. These effects also occurred when perceptual load was equated across conditions. Finally, pilot data from functional magnetic resonance imaging (fMRI) point to possible neuronal mechanisms contributing to the behavioural effects.

Paul Keedwell

NEUROIMAGING RISK MARKERS OF DEPRESSION IN YOUNG ADULTS: A PRELIMINARY STUDY

Diminished capacity for pleasure (anhedonia) is a core feature of depression, with an increasingly well-described neural correlate of disordered responses to positive stimuli in the ventral cingulate and ventral striatal regions (e.g. Keedwell et al, 2005). Disordered reward processing and disordered processing of positive stimuli in general might indicate a prodrome of depressive illness in young, at-risk populations: I will present preliminary data on reward processing and its neural correlates in healthy female volunteers, aged 18 to 30, with or without a 1st degree family history of depression (n=15 each group, age and sex matched). I will also present data on the effect of trait personality measures such as hedonic tone, anxiety, positive and negative affect and neuroticism.

Alex Kirkham & Paloma Mari-Beffa

CREATING THE COGNITIVE CONNECTION IN PARKINSON'S DISEASE: EXECUTIVE FUNCTIONING & ARTICULATION

Sometimes the most debilitating effects of Parkinson's disease (PD) are not the stereotypical motor problems; they are the lesser-known cognitive deficits that appear as a result of the reduction in dopamine levels. Past task-switching research has shown that such changes, as a consequence of PD, result in a significant increase in reaction time (RT). In addition, problems have been highlighted whereby patients struggle to switch from one task-set to new task-sets, and instead revert to the previous. This could be as a result of problems associated with working memory, potential overload factors, or alternatively as a result of cortical connections. This study will use a task-switching design with additional elements of articulation. PD patients, alongside age-matched and student controls will participate. All will perform three trial blocks (two pure blocks and one block of an alternating runs design) for each of two articulatory strategies of 'articulation of the task cue' or 'articulatory suppression'. It has previously been suggested that Broca's area and the basal ganglia are interconnected through a loop system. Therefore drawing upon this theory, it is expected that the PD patients will improve their RT performance to a greater level than the controls in the cue articulation trials. However, it is anticipated that the PD patients will perform very poorly in the articulatory suppression trials, unlike the controls, due to this cortical connection. It is hoped that this research may lead to further examination of the causes of cognitive decline in PD.

Jane Klemen

FUNCTIONAL AND ANATOMICAL CORRELATES OF TOP-DOWN CONTROL OF CROSS-MODAL ATTENTION AND ITS EFFECTS ON SENSORY PROCESSING

Task-irrelevant information can interfere with the processing of task-relevant information. It remains to be established in what cortical areas interference takes place and how it is expressed neuronally. In the present study, functional magnetic resonance imaging (fMRI) data will be collected during a visual detection task. We will use multi-voxel-pattern-analysis (MVPA) to classify cortical areas in which stimulus features can be discriminated by their blood oxygen level dependent (BOLD) activation. In these areas we aim to identify the effect of concurrent task-irrelevant distraction on the information content of sensory representations, and the extent to which these effects depend on task performance (correct or incorrect). Insights into the structural connectivity of the activation patterns will be gained from diffusion tensor imaging (DTI). Areas whose activation is modulated by task performance are likely targets of

interference from task-irrelevant stimuli or related to performance monitoring. In follow-up experiments we intend to contrast these possibilities using transcranial magnetic stimulation (TMS). The structural connectivity of the areas will give insights into the networks within which these operate.

Veldri Kurniawan

MULTISENSORY SPATIAL AND FEATURE-BASED ATTENTION IN VISION AND TOUCH: AN FMRI AND TMS STUDY

In everyday life, we continuously perceive different types of signals coming from inside and outside of our body into our sensory systems. These multimodal signals are initially perceived by different sensory system in their respective modalities before they are integrated in higher brain areas. Coordination of these multiple sensory processes and selection of the most relevant stimuli at a given moment are crucial for proper behavior in this world. This study aimed to investigate the neural mechanisms that underlie the balance between specialized and generalized attentional control in frontal and parietal areas of the brain, focusing on selection of visual and tactile information according to spatial location and non-spatial features. A cued discrimination task (Posner, 1980) is used to probe attentional effects within and between modalities. Neural activations during execution of this task are measured using fMRI and then analyzed using both standard mass-univariate statistics and multi-voxel pattern analysis (MVPA). Guided by the result of fMRI analysis, subsequent TMS or TBS study will be conducted to gain more insight into the underlying mechanism of multisensory attention.

Natalia S. Lawrence

CONSCIOUS DESIRE AND AND CUE-TRIGGERED 'WANTING' FOR FOOD HAVE DISSOCIABLE NEURAL SUBSTRATES

Based on animal lesion studies, Berridge and colleagues have suggested that reward processing can be separated into two distinct but overlapping neural systems related to implicit 'wanting' (incentive motivation) and 'liking' (pleasure). Furthermore, there are both explicit and implicit forms of 'wanting' with potentially distinct neural substrates (e.g. the orbitofrontal cortex and ventral striatum, respectively). There has been limited research in humans demonstrating that these different components of reward can be dissociated, and most of this research has been behavioural. This talk will present data showing that explicit and implicit 'wanting' can be dissociated at the neural level, using a food cue-reactivity paradigm during fMRI. Findings revealed that activation in the nucleus accumbens to food cues predicted non-conscious 'wanting' (indexed by subsequent snack consumption and willingness to pay for food), but was unrelated to conscious wanting (explicit ratings of desire for food). Conversely, activation in the ventromedial prefrontal cortex was associated with conscious wanting but not food intake. These findings suggest that dissociable cortical and subcortical neural circuits mediate the conscious and unconscious desire for food in humans, which has important implications for appetite control and environmental contributions to the 'obesity epidemic'.

Charles Leek, Irene Reppa & Simon Watt

INHIBITORY MECHANISMS OF OBJECT-BASED VISUAL SELECTION IN HUMAN VISION

Previous work has shown that mechanisms of visual selection in human vision involve both facilitatory and inhibitory processes that can operate on spatial locations and on objects independently of their locations in space. In this project, we investigated the

nature of object-based inhibitory visual selection using stereographic 3D object displays in a target detection spatial cueing paradigm. The results show that the distributions of inhibition are modulated by object-internal structure. These findings place new constraints on theoretical models of visual selection

Charles Leek, Mark Roberts, Irene Reppa, Alan Pegna

WHAT'S SO SPECIAL ABOUT THE N170? MODULATION OF N170 BY GEOMETRIC SHAPE ATTRIBUTES OF 3D OBJECTS

Previous studies have shown that the N170 component of the event-related potential, although widely associated with face processing, is sensitive to a range of stimulus variables including proficiency of subordinate-level perceptual categorisation (expertise), and, more recently, some measures of variance in low-level image similarity (e.g., ISVP). Here we report results from an ERP study designed to examine the time-course of encoding different geometric shape attributes (edges, surfaces and 3D volumes) during object recognition. A whole-part matching task was used in which Ss were shown a whole novel 3D object followed by a part comparison stimulus containing a sub-set of geometric shape information from the whole object (edges, surfaces or 3D volumes). Ss were instructed to decide whether the part stimuli matched or did not match information in the preceding stimulus. Consistent with earlier published evidence (Leek et al., 2005: JEP: HPP, 31, 668-684) Ss were faster at matching surface and volumetric parts than edges to whole objects indicating a role for surface-based primitives in 3D shape representation. Analyses of the ERP data showed distinct patterns of modulation of the N170 (but not P1) component according to object part-type. Temporal segmentation analyses revealed two distinct scalp topographies within the N170 time period, one for the volumetric part condition and another for the surfaces and edges. The LAURA source localisation algorithm placed the generators of the N170 maps in the ventral occipito-temporal cortex, regions known to support object recognition processes. The N170 modulation cannot be accounted for by either face-selective or expertise-related processes, or in terms of low-level perceptual variance measures such as ISVP. Rather, the data suggest that (1) the N170 responds to relatively high-level and complex geometric attributes of 3D object structure and, (2) different geometric primitives are associated with unique topographical ERP distributions in ventral occipito-temporal cortex.

David Linden

FUNCTIONAL IMAGING AND THE TREATMENT OF MENTAL DISORDERS

Functional brain imaging allows investigators to measure the activity of the human brain noninvasively. It has been used to identify the brain correlates of psychiatric symptoms, such as hallucinations, and to explore brain activation patterns that may be typical of specific mental disorders. The ultimate aim of this would be to use functional imaging to aid the diagnosis of mental disorders. However, we may be able to go even one step further and utilise functional imaging to aid therapy. Some studies have already used functional imaging to monitor the brain effects of psychiatric drugs, and of psychotherapy. A better understanding of the brain effects of treatment may enable clinicians to predict which patients will benefit from what kind of treatment and form a basis for rational treatment choices. Functional imaging may also aid in the development of new treatments. Based on the activation of auditory cortex during hallucinations, several groups have explored the use of transcranial magnetic stimulation to disrupt this activity temporarily. If functional imaging reliably identifies dysfunctional regions of the brain in a mental disorder, this may guide other physical

treatment approaches, such as deep-brain stimulation, although ethical and safety issues may limit this application. Finally, training patients to self-regulate specific areas of their brain through neurofeedback may have effects on their mental states that can be explored in the service of psychotherapy. With this application, functional imaging would become a therapeutic tool in its own right.

Stefanie Linden

EMOTION PROCESSING IN SCHIZOPHRENIA

Although schizophrenia is defined by characteristic psychopathological features such as thought disorder, hallucinations or delusional beliefs, cognitive deficits are also observed in the vast majority of patients. These affect a range of domains including memory, perception and attention. Deficits in the recognition of emotional expressions of faces are of particular clinical interest because they may be the basis for patient's difficulties in social interaction. We studied emotion recognition and working memory in conjunction with the recently described memory-enhancing effect of angry facial expression. Although patients performed generally worse on the working memory task, they showed the same benefit for angry faces as control participants. These results indicate preserved implicit emotion processing in schizophrenia patients, which contrasts with their impairment in emotion recognition. With regard to clinical practice, our findings underline the importance of assessing responsiveness to emotions in patients with schizophrenia, with a view possibly to utilize preserved implicit emotion processing in cognitive remediation programs.

Marcel Meyer

AFFECTIVE CONTROL: EVIDENCE FROM THE ERIKSEN FLANKER TASK

McClure et al. (2007) proposed that the detection and control of competition between cognitive and emotional processes engages similar brain regions (i.e. dorsolateral prefrontal cortex and anterior cingulate cortex) as when such conflict arises between cognitive ones. A paradigm that can be usefully employed to test competition is the Eriksen flanker task (Eriksen and Eriksen, 1974), of which emotional and cognitive versions exist (see e.g. Ochsner et al., in press). Aiming to use such a task to test and extend the model by McClure et al. (2007) with MRI, we initially conducted two behavioural studies utilizing the flanker paradigm. In experiment 1 we presented photographs of happy, angry and neutral facial expressions as target and flanker stimuli. Results showed virtually no flanker effects. For experiment 2 we created cognitive and affective versions of the flanker task using word stimuli. The results from experiment 2 are discussed in relation to the findings from the face flanker task and the future direction of our work.

Helen Morgan

OSCILLATORY BRAIN ACTIVITY DURING VISUO-SPATIAL WORKING MEMORY

Working memory (WM), the ability to temporarily maintain and manipulate information, involves co-ordinated activity of multiple neural regions. The ventral/dorsal "what/where" segregation of perceptual processing has been shown to continue into higher visual and prefrontal areas involved in WM. However, the way in which these functionally and anatomically distinct subprocesses are coordinated in the brain to represent a gestalt is poorly understood. Oscillatory activity in the gamma frequency range (40-100Hz) has been proposed as a neural mechanism for the solution of this "binding problem". The current study used MEG to examine the role of oscillatory activity in WM for visual and spatial information and visual-spatial

conjunctions. Participants had to mentally manipulate the colours and/or rotation angles of two briefly presented sample stimuli to find the average, then indicate whether a subsequent test stimulus matched or mismatched the average of the two samples. Task-related desynchronisation was observed in the lower frequency bands, and this desynchronisation distinguished between visual and spatial processing. Of most interest, gamma synchronisation over parietal cortex was found during the coordination of visual and spatial information in working memory, and this gamma activity correlated with successful performance during the coordination task, but not during the separate visual and spatial tasks. These results confirm a major role for gamma activity in the coordination of spatially distinct neural processing streams.

Paul Mullins

ALTERNATE MR METHODS FOR INVESTIGATING BRAIN FUNCTION

The invention of Magnetic Resonance Imaging (MRI) can be safely said to have revolutionised medical imaging. The development of BOLD based functional MRI (fMRI) likewise was a boon for researchers interested in cognitive neuroscience, and quickly became the leading neuroimaging methodology for the study of brain function. However, measuring changes in oxygen levels in response to brain function is only one of the ways in which MR techniques can be used to investigate the inner workings of the brain. This talk will look at some of those alternatives, and will present some data from recent studies at Bangor University, and abroad.

Matt Mundy

IS PERCEPTUAL LEARNING STIMULUS SPECIFIC? WBC024

Unsupervised exposure to a pair of highly similar stimuli can improve subsequent discrimination between them. This is true with many types of stimuli e.g., pictures of faces, random chequerboards, dots and visual scenes (e.g. Mundy et al., 2007). Our previous work suggests that different neural regions may be recruited in tasks using different types of complex stimuli (Mundy et al., 2008; see also Graham et al., 2006). In the current event-related fMRI study participants were given pre-exposure to confusable face-pair, scene-pair and dot-pair stimuli. Subsequently they were asked to perform same/different judgements with pre-exposed compared with novel-at-test stimuli as an index of perceptual learning. Stimulus-independent activation was seen in early visual cortex; the exact visual regions involved were pinpointed using a retinotopic mapping technique. Activity in early visual cortical regions was shown to correlate with the behavioural degree in perceptual learning. As the benefit of pre-exposure increased, activity in visual cortex decreased. Stimulus-selective activation was seen in the parahippocampal place area and posterior hippocampus for scenes; fusiform face area, and perirhinal cortex for faces. This stimulus-selective activity sits well with a model of medial temporal lobe function that emphasises its role in stimulus discrimination.

Dave Playfoot, Jeremy Tree, Cris Izura

ACRONYM READING IN SEMANTIC DEMENTIA

Semantic dementia patients often present with reading deficits, commonly surface dyslexia. In this disorder, irregular words such as *broad* or *steak* are less likely to be read aloud correctly than regularly-spelled words like *breed* or *steam* (Coltheart, Masterson, Byng, Prior & Riddoch, 1983). In a series of recent studies, Laszlo and Federmeier (2007a; 2007b; 2008) used acronyms as an ideal set of familiar yet irregular stimuli to explore the reading routes of skilled readers. Here, we report the

performance of 'JD', a patient in the early stages of semantic dementia, in reading aloud and recognising acronyms and words. Results are discussed in terms of the patient's deficit and the dual route model for reading.

Jane Raymond, Jen O'Brien, Yoshi Yagi, Nicklas Ihseen & Mark Fense

THE EFFECT OF VALUE LEARNING ON VISUAL ATTENTION AND PERCEPTION

When interactions with objects reliably produce perceived outcomes (positive, negative, or neutral), then perceptual representations of those objects become predictive of future events. We report a series of recent projects that ask how neural codes for outcome prediction influences attention and perception, especially when outcome prediction is irrelevant (due to changed context). Using a simple choice game, we first gave participants an opportunity to associate different face stimuli with different monetary outcomes (wins, losses, or no outcomes). After value learning, these stimuli were presented as targets or distractors in different types of attentional tasks. We report generally that items associated with wins versus losses are better perceived when attention is limited but that when attentional resources are readily available, previously learned outcome predictability determines performance. These studies link processes underlying motivation and affect with those used to prioritize perceptual processing, such as attention.

Zohreh Sepehri Shamloo & W. Miles Cox

MOTIVATION-ENHANCEMENT TECHNIQUES IMPROVE ADAPTIVE MOTIVATION INDEPENDENT OF CHANGES IN MOOD

Shamloo and Cox (2007) introduced Motivational Enhancement Techniques (choice, information-enhancement, feedback, and goal-setting) to improve adaptive motivation. Objectives. The present study experimentally tested whether the improvement in task-specific adaptive motivation were merely due to changes in participants' mood. Methods. Participants (N=75) were randomly assigned to a control or one of the two experimental (happy vs. sad mood) groups. Measures. The Task-Specific PCI and the PANAS were administered. First, happy and sad moods were induced using music and Bos's technique. Next, participants completed anagrams and tasks with the Concept-Training Cards. Results. PANAS scores confirmed post-experimental mood induction. On the post-test, none of the groups had changed from the pre-test on task-specific adaptive motivation. Conclusion. Although an induced positive mood might improve performance and increase perceived success on simple tasks, it probably does not alter more complex goal-pursuit patterns, which may require multi-dimensional interventions that address various aspects of the complex construct.

Kimron Shapiro, Zhao Fan Krish Singh & Suresh Muthukumaraswamy

SERIAL CHAINING OF COGNITIVE OPERATIONS IN HUMANS: RT COSTS AND A SUSTAINED POSTERIOR MEG COMPONENT

A fundamental process in human cognition is to accomplish chained sequential operations in which the second task requires an input for the preceding one. We present two behavioural and one Magnetoencephalographic (MEG) experiments that attempt to isolate the chronometric cost due to chaining, over and above classical dual-task serial costs. Participants were required to respond as quickly as possible to two sequential visual tasks that were either chained or independent. All three experiments

consistently demonstrated that the chaining operation significantly altered the distribution of RT, particularly to the second Task in terms of increased mean and variance relative to the independent condition. Also, all three experiments identified a reduced correlation between RT1 and RT2 when two high contrast Tasks were chained together at short SOA levels, suggesting an extra central processing stage involved in serially chaining. The first behavioural experiment also manipulated a perceptual aspect (contrast) of each of the two targets with the results revealing an interaction between contrast of Tasks 1 and Task 2 on RT2 and correlation of RT1 and RT2. In the second behavioural and the MEG experiment, half trials only contained the first task (single-task trial) while the other half contained both tasks (dual-task trial). The independent condition also included two sub-conditions: Incongruent cue and Congruent cue. The former involved attention switch while the latter did not and made it more comparable to the Chained condition. The Event-Related Field data in MEG experiment suggested that a SPC (Sustained Posterior Component) beginning from 0.3s after Task 2 onset was linked with chained processing of two cognitive operations. This component lasted for about 700ms. Multiple-Channel Contrast demonstrated that this component comes from Occipital-Parietal areas and mainly spread over the left hemisphere. It is more positive for Chained condition. At the same time, this SPC did not appear in other two contrasts (Chained single vs. Independent single; Independent-Incongruent cue vs. Independent-Congruent cue), suggesting it is linked with Chained processing rather than task difficulty or attention switch. We suggested that this left SPC may be linked with the consolidation, retrieval and updating of T1 results before and during T2 processing.

Martijn van Koningsbruggen

PARIETAL TMS DISRUPTS THE REMAPPING SALIENCY MAPS

The parietal cortex has been implicated in the updating, after saccades, of a salience map that is required for coherent visual experience. The current experiment investigated whether TMS over the anterior-parietal cortex (APCx), just after a saccade, would affect the ability to update and maintain a salience map. In order to generate a salience map, an uninformative cue was presented at one object in a display to generate IOR- an inhibitory tag that renders the cued object less salient than others in the display, and that slows subsequent responses to visual transients at its location. Following the cue, participants made a saccade to either left or right, and we then probed for updating of the location of IOR by measuring manual reaction time to targets appearing at cued relative to the uncued location. Between the time of saccade initiation and target appearance, dual-pulse TMS was targeted over the right (Experiment 1) or left AIPCx (Experiment 2), and a vertex control side. Updating of the location of IOR was eliminated by TMS over the right, but not the left, AIPCx, suggesting that the right parietal cortex is involved in the remapping of IOR. Remapping was eliminated by right AIPCx regardless of whether the saccade was made to the towards the contralateral ipsilateral visual field, and regardless of which field the target appeard in. We conclude that the right AIPCx is the neural substrate for maintaining a salience map across saccades, and not simply for propagating an efference copy of saccade commands.

Alice Varnava, Ann Taylor, Rhiannon Buck, Owen Hughes & Richard Wise

IMAGING NEURAL REPSONSES TO AFFECTIVE AND PAIN-RELATED STIMULI IN CHRONIC PAIN PATIENTS VS HEALTHY CONTROLS – WORK IN PROGRESS

Neuroimaging has allowed for an improved understanding of how variables such as cognition, emotion and context can influence the perception of chronic non-malignant pain (CNMP). However, the majority of neuroimaging work has focused on acute experimentally-induced pain. This can be very different from CNMP in its characteristics and threat value. According to the fear-avoidance model of CNMP (Vlayen & Linton, 2000), if pain is interpreted catastrophically, this can result in a vicious cycle of fear, hyper-vigilance and avoidance of activities. This in turn can result in disuse, disability, depression and lower pain threshold, thereby perpetuating the problem. Therefore, obtaining reliable objective information related to the individual's subjective pain experience provides a powerful means of understanding CNMP. The intention is to investigate neural activity in affective and attentional regions in CNMP patients vs. healthy controls, as assessed by fMRI. The project will play a vital role in developing the methodology for further planned research investigating individual differences and treatment effects. Fifteen chronic low back pain patients and 15 healthy controls will complete two tasks whilst being scanned. Participants will also complete questionnaires to assess pain, fear/anxiety, and depressed mood. The two tasks are: (1) a counting version of the Stroop which requires the participant to indicate the number of times a (neutral, pain-related or negative affective) word appears while ignoring its meaning; (2) passive viewing of images that CNMP patients perceive as neutral, or associated with pain-related fear or negative affect, but which are all innocuous to healthy controls. The design will follow a three factor structure: *condition* (CNMP vs. healthy) x *fear of pain* (high vs. low) x *stimulus type* (pain-related vs. negative affective vs. neutral). The first two factors are between person while the third is within person, therefore a mixed ANOVA model will be required. We predict (1) there will be a main effect of stimulus type for both healthy controls and CNMP patients in the Stroop task, with 'threatening' words (i.e. pain-related or negative affective) being more attentionally demanding, both in terms of behavioural performance and neural activity within the 'pain matrix' (including increased activation in the amygdala and anterior cingulate cortex); (2) CNMP patients will show greater neural activation than controls in regions associated with fear in response to images they associate with pain.

Frederick Verbruggen

FUNCTIONAL RELATION BETWEEN COGNITIVE AND NURAL MECHANISMS OF RESPONSE INHIBITION AND PERFORMANCE MONITORING AFTER THETA-BIRST STIMULATION

Response inhibition supports flexible behavior in a constantly changing environment: when actions are no longer relevant, they can be stopped completely. Recent work shows that successful stopping depends on both inhibitory and non-inhibitory attentional processes, including monitoring process that optimize behavior. In this study, we used the context-cuing paradigm (Verbruggen & Logan, 2009) to further examine the neuro-cognitive mechanisms of successful inhibition. We show that go latencies decrease but stopping latencies increase after delivery of theta-burst stimulation (TBS) of right inferior frontal gyrus (rIFG). Moreover, TBS of rIFG tended to influence dual-task performance in general, which suggests that rIFG may play a more general role in stopping then initially assumed. In contrast to TBS of rIFG, TBS of right pre-supplementary motor area impaired aspects of go and dual-task performance, but there was no effect on stopping. Implications for current theories on neuro-cognitive mechanisms of response inhibition will be discussed.

Rodger Wood & Claire Williams

EMOTIONAL DEFICIT DISORDER FOLLOWING TRAUMATIC BRAIN INJURY

This talk will examine the role of alexithymia as a major contributor to what is becoming known as "emotional deficit disorder" after head trauma. Alexithymia has been associated with dysfunction in a number of cerebral structures, including the right hemisphere (Mandal et al., 1999), the corpus callosum (Houtveen et al., 1997), and the frontal lobes (Berthoz et al., 2002; Hornak et al., 1996). Consequently, alexithymia should be prevalent following head trauma because of the predominant involvement of frontal structures in such injuries (Adams et al., 1982). Our research has shown that the frequency of alexithymia is far higher in a head trauma group than in the general population and that it results in both a lack of empathy and a tendency to somatise psychological distress, both of which have serious consequences for the brain injured person's ability to function in the community.

Victoria Wright, Cris Izura, Nathalie Fouquet & Debbie Mills

HEMISPHERIC PROCESSING OF WORDS BY BILINGUAL SPEAKERS: DIFFERENCES AND SIMILARITIES ACROSS HEMISPHERES AND LANGUAGES

The ability of skilled readers to recognise printed words varies as a function of the position of the word within the visual field. Short and long words are identified at equal speed when presented to the right visual field (RVF) but a length effect is observed when words appear to the left visual field (LVF), with short words being recognised faster than long words. This effect, generally called 'right visual field advantage' (RVFA), has been reported and replicated a significant number of times. The RVFA is often attributed to the language dominance that is credited to the left hemisphere. In this study, 20 Welsh-English bilingual speakers recognized short and long words presented laterally in their two languages. Results showed a RVFA when bilingual speakers were recognising words in the dominant and irregular language (English) but not when they were recognising words in the non-dominant and regular language (Welsh). This outcome can be interpreted in relation to the participant's reading expertise but also in terms of the regularity of the languages. A further experiment has been programmed to look at the RVFA in bilingual speakers whose dominant language is this time regular and non-dominant language, irregular. Their EEG and behavioral responses will be recorded. It is predicted that if the RVFA is related to the regularity of the language, differences will be detected, as before, in English but no Spanish. However, if the effect is due to language dominance, differences will be observed in Spanish but not in English. Based on the consensus that the RVFA emerges from the early stages of word processing, we anticipate to see a main ERP difference in the early peak (N170), and will extend our analysis to the P300.

Kenneth S.L. Yuen, Jorien van Paasschen, Linda Clare, & David E.J. Linden

GOAL-ORIENTED COGNITIVE REHABILITATION FOR PEOPLE WITH EARLY-STAGE ALZHEIMER'S DISEASE: AN FMRI INVESTIGATION

The current study investigated the neurobiological changes in brain activity during memory processing associated with an 8-week individualised goal-oriented cognitive rehabilitation (CR) program focused on improving performance in targeted areas of everyday activity. A supporting element of the program involved the application of memory strategies for learning or relearning information, using face-name association learning as a practice paradigm. Early-stage Alzheimer's patients were randomly assigned to CR or control conditions. Nineteen of these participants underwent fMRI scanning before and after the intervention period, 7 in the CR group and 12 in the

Control group. Following intervention, the CR group had significantly higher ratings of performance in targeted areas than the Controls. A face-name association task was used to assess participants' brain activity during memory processing pre- and post-treatment using functional Magnetic Resonance Imaging (fMRI). Both groups exhibited a trend of behavioural improvement on the task over time, although no significant group x time interaction was observed. Despite the lack of significant behavioural differences, fMRI data showed differential patterns of brain activity in the two groups in a network comprising the right fusiform face area, right temporal parietal junction, right anterior cingulate cortex, right parahippocampal region, left basal ganglia, bilateral insula and bilateral prefrontal cortices. Activity in these regions declined with time in the control group but was maintained in the CR group. This may indicate increased cognitive reserve capacity in the CR group, which would be commensurate with the improvement in their subjective reports of performance of targeted activities following intervention. We suggest that functional imaging is a helpful tool for the non-invasive investigation of neural plasticity in people with dementia.

Wen Zhang

THE EFFECT OF CROSS MODAL ATTENTIONAL LOAD ON SENSORY PROCESSING AND THE CONTROL OF ATTENTIONAL RESOURCES

The control of selective attention partially depends on the level of attentional load of a relevant task. However, the mechanism of attentional load within and between vision and somatosensation is not well known. The aim of this study is to assess the neural consequences of attentional load manipulations within and between sensory modalities at various levels of cortical representation. We seek to discover whether the mechanism by which the attentional load modulates sensory representations differs from one modality to another. We also attempt to identify and differentiate multisensory areas from modality-specific areas in the fronto-parietal attention regions. A dual-task paradigm was used to investigate the effect of attentional load. Both visual and tactile stimuli were presented for the primary tasks while only visual stimuli were presented for the secondary tasks. We examined the effect of attentional load of a primary detection task on the brain activation that was related to a secondary detection task. Brain activations were evaluated using fMRI. Load-dependent activity were analysed using Multivariate Analysis. The consequences of attentional load within and between modalities offer evidence about whether attentional load modulated sensory representations in a unimodal or cross-modal manner. The result of the MVA shows whether the fronto-parietal attention regions were multisensory or modality-specific.