CPCN

UQ Centre for Perception and Cognitive Neuroscience

CPCN Workshop
2nd – 3rd December 2010

School of Psychology
The University of Queensland

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16:00–17:00	**Keynote Address** **Dr. Mark Williams** ***Neural Underpinnings of Face Perception***

Friday

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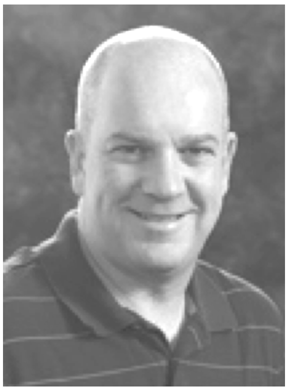
Keynote Speakers

Thursday 2nd December
16:00 – 17:00



Mark Williams
Macquarie Centre for Cognitive Sciences
Macquarie University, Sydney, Australia.

Dr. Williams completed his PhD, at Monash University Melbourne Australia, in 2003 before completing post-doctoral research fellowships at the University of Melbourne and the Massachusetts Institute of Technology (MIT). He took up a position at Macquarie University in 2007.

Dr. Mark Williams' research focuses primarily on the cognitive and neural mechanisms involved in face and facial expression perception. He is also interested in other aspects of perception, such as the processing of objects and complex scenes. He uses neuroimaging techniques such as fMRI and simultaneous MEG/EEG to explore questions concerning the location and timing of neural events.

Dr. William's research is frequently published in some of the world's leading general interest and specialist Neuroscience journals, such as Nature Neuroscience, PNAS, Current Biology and the Journal of Neuroscience.

Abstract:
Neural Underpinnings of Face Perception
Face perception is a vital aspect of normal social functioning that is underpinned by specialised cognitive and neural mechanisms. I will present a series of functional neuroimaging studies examining the neural locus of face perception. I will highlight studies in normals and individuals with developmental prosopagnosia using both functional MRI and Magnetoencepholgraphy. These neuroimaging studies have resulted in a comprehensive anatomical understanding of the face perception process.

Keynote Speakers

Friday 3rd December
16:00 – 17:00

René Marois
Department of Psychology, Vanderbilt University, USA

Dr. René Marois completed his PhD at Yale University in 1996, before completing a post-doctoral fellowship at Yale University (1997 – 1999). He took up a faculty position at Vanderbilt University in 1999.

Dr. Marois' research focuses on the neural bases of attention and information processing in the human brain, using a combination of fMRI and psychophysical tools. He is particularly interested in understanding the neural basis of attentional capacity limits (e.g. Why can we only attend to very few objects at a time? Why can't we select or execute more than one task at a time?), and in understanding the relationships between attention, working memory and awareness.

Dr. Marois' research is frequently published in some of the world's leading general interest and specialist Neuroscience journals, such as Nature, Nature Neuroscience, PNAS, Neuron and Cerebral Cortex.

Abstract:
The Neural Basis of Attentional Control and its Limitations

We are constantly bombarded with more information than we can process. To solve this computational problem, we use attention, the process that selects which information is preferentially processed at the expense of other information. Attention, however, is itself limited, a characteristic that has important consequences for what we can consciously perceive, think about, or act upon. Research in my laboratory has highlighted a region of the posterior lateral prefrontal cortex that is consistently engaged in tasks that stress our attentional capacity limits at multiple stages of information processing. Correspondingly, this brain region appears to play a central role in the control of attention, and is strategically positioned to coordinate activity in posterior frontal and parietal attention networks. Our recent efforts have focused on functionally distinguishing the role of this brain region from those of the posterior attention areas. The results of these studies lead us to the conclusion that the prefrontal cortex is involved in the dynamic routing of attentional weights to guide information processing. The central role of this area in attention not only accounts for its involvement in diverse paradigms such as the attentional blink and the psychological refractory period, it also has implications for the very nature of human performance limitations in both perception and action.

Talk Sessions

Session 1, Thursday 2nd December
09:30 – 10:30
Chair: Derek Arnold, CI: Perception Lab

09:30 – 10:00
Warrick Roseboom – Perception Lab
Learning to reach for 'invisible' objects: evidence of 'blindsight' in normal observers.
Blindsight refers to the ability of patients with visual cortex damage to detect, localise or discriminate visual stimuli that they deny 'seeing'. In this study we sought to create an analog of blindsight in normal observers using binocular masking via continuous flash suppression. Participants reached toward and pretended to grasp a pair of parallel lines oriented horizontally or vertically, made 'invisible' via masking. The dependent variable was the orientation of the hand at grasp. Over a period of training (six 100 trial sessions) during which trial-by-trial feedback was provided as to accuracy, participants showed a significant improvement in their ability to orient their hand to grasp the 'invisible' target. No improvement was evident when other participants simply provided verbal responses, even with matched training. Trial-by-trial reports of subjective visibility and confidence in performance revealed that, while participants never reported 'seeing' the target, performance was highly correlated with confidence. These data have important implications for the treatment of cortically blind patients, and highlight the indistinct boundaries between visible and invisible inputs.

10:30 – 11:00
David Painter - Cognitive and Behavioural Neuroscience Lab
Neural and behavioural mechanisms underlying feature-based attention
The attentional system selects visual inputs for extended processing on the basis of their features or location. Considerable research has investigated the mechanisms underlying both featural and spatial selection, yet the extent to which these processes overlap is unclear. Here, we tested whether or not feature-based attention acts independently of spatial information, by examining whether a featural set applies at locations that are completely task-irrelevant: where the target object never appears. In two experiments, human observers searched a central location for colored letters, while we recorded steady-state electroencephalogram responses to peripherally presented objects that either matched, mismatched or were neutral to the target color. Cortical responses were enhanced at the irrelevant location for objects that shared features with the target. This finding provides strong evidence that feature-based attention applies globally across the visual field, regardless of spatial priority.

Session 2, Thursday 2nd December
11:00 – 13:00
Chair: Ada Kritkos, CI: Perception and Action Lab

11:00 – 11:15
Dana Schneider – Attention & Control Lab
The Eyes Have It! Sustained Spontaneous Belief Processing
Crucially important to human social competency is the possession of a theory of mind (ToM), which refers to an ability to understand the mental states - beliefs, intensions and knowledge - of others. Belief-processing abilities are commonly measured using false belief reasoning tasks (e.g. Sally-Anne tasks). Here, in crucial false belief trials an actor – Anne – hides a ball in one box after Sally, another actor, has seen it being placed into a different box and left the room. The task is for participants to identify the box that is consistent with Sally's belief about the ball's location as opposed to the ball's actual location. The ability to pass this test is a developmental milestone and typically achieved by 4 years of age. However, recent eye-movement research has provided evidence that children as early as 13 months process beliefs of others. To accommodate these conflicting findings Apperly and Butterfill (2009) have proposed a two-path cognitive system of belief processing consisting of a late developing, cognitively more demanding, and flexible component and an early developing, cognitively less demanding, and efficient component. To date eye-movement findings have only been observed in experiments containing single belief trials. Thus, it is unknown to what extent automatic belief processing operations are sustained over time. Here we adapted a belief-processing eye-movement paradigm to a repeated trial design in order to replicate evidence supporting the existence of an efficient belief-processing system and explore the temporal nature of it. Strikingly, we found that implicit belief attributions sustained across multiple trials over a prolonged time period. This provides further evidence for a low-level/efficient belief-processing system and importantly, that its action is not transient in nature.

11:15 – 11:30
Stephanie Goodhew – Attention & Control Lab
Implicit semantic perception in object substitution masking
Decades of research on visual perception has uncovered many phenomena, such as binocular rivalry, backward masking, and the attentional blink, that reflect 'failures of consciousness'. Although stimuli do not reach awareness in these paradigms, there is evidence that they nevertheless undergo semantic processing. Object substitution masking (OSM), however, appears to be the exception to this rule. In OSM, a temporally-trailing four-dot mask interferes with target perception, even though it has different contours from and does not spatially overlap with the target. Previous research suggests that OSM has an early locus, blocking the extraction of semantic information. Here, we refute this claim, showing implicit semantic perception in OSM using a target-mask priming paradigm. We conclude that semantic information suppressed via OSM can nevertheless guide behaviour.

11:30 – 11:45
Andrew Bayliss – Perception & Action Lab
The influence of reciprocated joint attention bids on person perception
By attending the same object at which another person is currently looking, we may become aware of an important yet undetected stimulus. Moreover, we also gain crucial insight into others' mental states. In previous work on 'Joint Attention', the focus has always been on the 'follower'. For example, in adults, the 'gaze cueing' paradigm has shown that automatic attention shifts follow the observation of averted gaze. Gaze-following also boosts the affective evaluation of the faces and objects of a joint attention episode. This project takes the converse perspective – what influence does *initiating* joint attention have on the 'leader'? In this study, different faces either reciprocated or rejected the participants' joint attention bids. Measuring fixation duration on faces and objects as well as explicit ratings of face pleasantness reveal intriguing patterns of data about social referencing and the reward associated with making others follow our eyes.

11:45 – 12:00
Anjali Diamond – Perception Lab
Evidence opposing opponent facial coding
Exposure to a face can alter the appearance of faces viewed subsequently. For instance, a male face can make subsequent androgynous faces look female. It has been proposed that these aftereffects are driven by an opponent neural code 'face space' (Leopold et al., Nature Neuroscience, 2001). The centre of this 'face space' is thought to reflect a time average of encountered faces. Exposure to a distinctive face is thought to shift the average toward that face, making previously average looking faces take on the

appearance of a face that differs from average in the opposite manner to the initial face – hence an androgynous face looking more female after exposure to a male face. Here we present data that, we believe, pose a fundamental challenge to this account. We simultaneously adapt people to male and female faces in different spatial positions, causing androgynous faces to look more female and male respectively. These effects persist when initial and subsequent faces differ in size, which is usually taken as evidence ruling out the contribution of low-level retinotopically organized coding mechanisms. The existence of simultaneous, opposite facial aftereffects is inconsistent with mediation via a single opponent facial code, dictating that researchers must consider alternate explanations of facial aftereffects.

12:00 – 12:15
Anina Rich – Macquarie Centre for Cognitive Science
Irrelevant pitch cues visual attention in space
Integration of information across the senses occurs in a seemingly effortless fashion. Previous studies have demonstrated a cross-modal 'mapping' of pitch with spatial location (high pitch = upper, low pitch = lower) using tasks requiring response selection (e.g, forced choice). I will discuss some of our recent experiments exploring the extent to which this effect is due to attentional cueing (rather than response-level effects). We show that spatially non-predictive and non-lateralised auditory cues affect visual detection, suggesting they induce shifts of visual attention. In other experiments, we find this effect is context dependent, and differs from reflexive attentional cueing effects.

12:15 – 12:30
Oliver Bauman – Cognitive & Behavioural Neuroscience Lab
Medial Parietal Cortex Encodes Perceived Heading Direction in Humans
The ability to encode and update representations of heading direction is crucial for successful navigation. In rats, head-direction cells located within the limbic system alter their firing rate in accordance with the animal's current heading. To date, however, the neural structures that underlie an allocentric or viewpoint-independent sense of direction in humans remain unknown. Here we used functional magnetic resonance imaging (fMRI) to measure neural adaptation to distinctive landmarks associated with one of four heading directions in a virtual environment. Our experiment consisted of two phases: a "learning phase," in which participants actively navigated the virtual maze; and a "test phase," in which participants viewed pairs of images from the maze while undergoing fMRI. We found that activity within the medial parietal cortex—specifically, Brodmann area 31—was modulated by learned heading, suggesting that this region contains neural populations involved in the encoding and retrieval of allocentric heading information in humans. These results are consistent with clinical case reports of patients with acquired lesions of medial posterior brain regions, who exhibit deficits in forming and recalling links between landmarks and directional information. Our findings also help to explain why navigation disturbances are commonly observed in patients with Alzheimer's disease, whose pathology typically includes the cortical region we have identified as being crucial for maintaining representations of heading direction.

12:30 – 12:45
Will Harrison – Remington Lab
Continuous coherent motion in the visual field can lead to reflexive eye movements called optokinetic nystagmus (OKN), where the eyes first pursue a moving element then saccade opposite to the direction of motion to pursue another. OKN can be suppressed by fixating on a stationary object. How is our perceptual organisation of the world affected during active suppression of OKN? After replicating previous findings that, during OKN suppression, briefly flashed targets are systematically mislocalised in the direction of motion, we showed, for the first time, that during OKN suppression eye movements were biased in the same direction. By varying the magnitude of OKN that needed to be suppressed, we found that mislocalisations occur mostly during more active OKN suppression, indicating that it is unlikely that visual motion alone explains these mislocalisations. We argue that distortions of visual space at least partly result from mechanisms invoked by OKN and its suppression.

12:45 – 13:00
Nonie Finlayson – Grove Lab
Taking a closer look at capture by stereomotion: is it attention to motion or depth?
Previous research has found that irrelevant motion in depth captures attention. However this research not only has conflicting results regarding attentional advantage and varying qualities of stimuli presentation, it also overlooks a major methodological confound. Using a search paradigm in which an irrelevant item moves forward or backward in depth to join other items in a search task, researchers have shown that motion in depth speeds reaction times to the target. This research overlooks the depth singleton nature of the motion in depth item before it starts moving, and any capture effects attributed the motion in depth may in fact be due to the unique depth of the item. My present research addresses this issue and also discusses the capture differences between approaching and receding motions.

Session 3, Thursday 2nd December
14:00 – 15:30
Chair: Greig de Zubicaray, CI: fMRI Lab

14:00 – 14:15
Daina Dickens – Psychophysiology Lab
The face in the crowd effect – are faces just crosses?
In visual search, angry faces are often detected faster than happy faces. This is known as the face in the crowd effect. Recently, Coelho, Cloete and Wallis (2010) provided evidence that lower-level features may mediate the effect. Schematic angry faces and graphics representing the essential feature of these faces (inward pointing lines) were found faster among happy schematic faces/graphics representing their essential features (oblique lines), than vice versa. However, this study confounded the effects of faster detection of angry targets with those of slower search through angry backgrounds. We employed constant, neutral backgrounds in a search for angry, sad, scheming or happy targets to confirm these findings. Across two experiments the graphics representing angry faces were found faster than the graphics representing sad, scheming or happy faces, replicating Coelho et al. This held for upright more face-like graphics and for less face-like graphics rotated by 45 degrees. However, when trying to replicate this finding using only the inward/oblique lines that distinguish emotions in the schematic faces, we did not find differences across different emotional expressions. Thus, whereas there is clear evidence for faster detection of inward pointing lines over oblique lines, it is less clear whether this can explain the differences in detection across emotional schematic faces.

14:15 – 14:30
Fika Karnadewi – Psychophysiology Lab
Stereotypical bias in face after-effects
Extended exposure to a human face can induce a 'facial after-effect', wherein the appearance of a subsequent face is altered. For instance, exposure to a male face can make a subsequent androgynous face look more female than it otherwise would. Thus far, investigations of these effects have been bound within a categorical dimension such as gender, race, or emotion. However, the multidimensional nature of facial coding allows for interactions between different facial dimensions. For instance, male faces adopting neutral expressions are often judged as being more angry than female faces, and androgynous happy faces can be judged as being more female than male. In Experiment 1 we replicated these subjective relationships using a rating task. We then examined whether these effects would impact of facial after-effects, We found that adapting to male and female faces adopting neutral expressions produced a facial after-effect when judging the expressions of subsequent androgynous faces (Exp2). Similarly, exposure to angry and happy faces produced an after-effect when judging the gender of subsequent androgynous faces (Exp3). These results show that the interdependent processing of gender and emotional expression cues shapes the level of processing responsible for generating facial after-effects. By implication, they show that facial adaptation can be used to explore which facial dimensions are perceptually interdependent.

14:30 – 15:00
Derek Arnold – Perception Lab
Recalibrating Time Perception
Our sense of timing is malleable. For instance, visual signals can seem synchronous with unusually *early* sounds after prolonged exposure to auditory signals that *precede* visual signals (Fujisaki et al., 2004, Nature Neurosci). Similarly, actions can seem to lag their own consequences if an artificial delay is imposed between action and consequence for a period, and then removed (Haggard et al., 2002, Nature Neurosci; Stetson et al., 2006, Neuron). These effects represent a recalibration of timing perception. Here we report a sequence of studies that illuminate these phenomena. First, we show that despite assertions to the contrary, recalibration of audio-visual timing perception is shaped by the spatial proximity of audio and visual inputs. Next, we establish that these data are best described by a shift in criteria used to differentiate simultaneous from asynchronous inputs, as opposed to a realignment of sensory signals (with the transfer of information concerning one input accelerated or delayed relative to another). We then show that our sense of timing for intra-modal signals is similarly pliant, by establishing that direction reversals can seem synchronous with unusually early or delayed colour changes after exposure to leading or lagging colours. Finally, we examine motor-sensory timing recalibration, and establish that people adjust to the delay between the completion of an action and its sensory consequence, rather than to the delay between motor planning and its consequence. Overall, our data are consistent with dynamic timing perception criteria, which could be used to resolve ambiguities that might arise due to variations in the physical and neural transmission of sensory signals.

15:00 – 15:30

Paul Dux – Attention & Control Lab

Different attentional blink tasks reflect distinct information processing limitations: An individual differences approach

To study the temporal dynamics and capacity-limits of attentional selection researchers often employ the attentional blink (AB) phenomenon: subjects' impaired ability to report the second of two targets in a rapid serial visual presentation (RSVP) stream if it appears within 200-500ms of the first target. The AB has now been the subject of hundreds of scientific investigations and a variety of different dual-target RSVP paradigms have been employed to study this fundamental failure of consciousness. The three most common are those where targets are defined categorically from distractors, those where target definition is based on featural information and those where there is a set switch between T1 and T2 with the first target typically being featurally defined and T2 requiring a simple detection or discrimination judgement (probe task). An almost universally held assumption across all AB theories is that these three tasks measure the same deficit, however here using an individual differences approach we demonstrate that AB magnitude is only related across categorical and featural tasks. Thus, these paradigms appear to reflect a distinct cognitive limitation from that observed under probe conditions.

Session 4, Friday 3rd December
09:00 – 10:30
Chair: Ottmar Lipp, CI: Psychophysiology Lab

09:30 – 10:00
Joyce Vromen – Psychophysiology Lab
Does the Spider always win the Fight for Attention? Top-Down Modulation in Fear-Relevant Interference
Fear-relevant stimuli have been shown to interfere with visual spatial attention. Previous studies have investigated the bottom-up, or stimulus driven, processes involved. The current study is one of the first to investigate the influence of top-down modulation on fear-relevant interference. In a spatial cueing task, we induced either a top-down set favoring the fear-relevant stimulus (experiment 1), or a top-down set disfavoring the same fear-relevant stimulus (experiment 2). With a top-down set disfavoring the fear-relevant stimulus, fear-relevant interference disappeared. Therefore, fear-relevant interference on spatial attention is not necessarily immune to top-down control, contradicting the notion of an encapsulated fear module as proposed in previous research.

10:00 – 10:30
Stefanie Becker – Remington Lab
How the relational properties of objects guide attention.
What factors guide visual attention? Traditionally, theories posit that attention is guided by activity in separate visual feature maps. Recent visual search studies support, instead, a relational account in which attention and eye movements are guided by information about target-distracter relationships (e.g., redder, larger; Becker, 2010, Becker, Folk, & Remington, in press). In the Relational Theory, features are represented in a continuous feature space (instead of, e.g., separate feature maps) and target-distracter relationships are described by the direction of vectors pointing from the target to the distracter features. If this view is correct, observers would be tuning attention to a direction in feature space rather than to a specific feature or feature category. Here, I will present some new evidence in support of this view, arguing that relational search can explain a multitude of findings that were previously attributed to a categorical or a saliency-based mechanism of visual search.

Session 5, Friday 3rd December
11:00 – 13:00
Chair: Jason Mattingley, CI: Cognitive & Behavioural Neurosci. Lab

11:00 – 11:15
David Butler – Early Cognitive Development Group
Mirror, mirror on the wall, how do we recognize ourselves at all? An ERP investigation comparing the brain processes underlying self-recognition using mirrors and pictures.
For decades researchers have used mirrors to study self-recognition (SR) in children and animals. However, attempts to identify brain processes underlying SR have used pictures instead. Here we compared Event Related Potentials (ERPs) during SR using mirrors and pictures. ERPs differed between conditions, raising concerns about generalizations from one medium to another.

11:15 – 11:30
Shashenka Milston – Brain & Action Lab
Can mu rhythms index mirror neuron activity?
An increasingly popular method of indexing mirror neuron activity is by using EEG to measure mu rhythm desynchronisation over the sensorimotor cortex. Typically associated with action execution, mu suppression has also been demonstrated to occur with action observation. This study aimed to test whether the mu rhythm could indeed reliably index mirror neuron activity. Based on fMRI evidence, if the same action is executed and/or observed twice in quick succession, repetition adaptation of mirror neurons should be evident. If mu suppression is a measure of mirror neuron activity, we would thus expect to see a similar repetition adaptation effect. It was hypothesised that there would be adaptation effects when two consecutive actions were the same, regardless of whether they were executed or observed, but not when the two actions were different. EEG was recorded while participants either executed or observed a precision grip or an index finger ring pull in trials of two consecutive actions. Results revealed significant mu suppression demonstrated for both action execution and action observation. However, repetition adaptation effects were not observed. This suggests that while mu suppression does register the modulation of the primary sensorimotor region by mirror neurons, it does not completely index mirror neuron activity. It is possible that this downstream modulation is simply not strong enough for repetition adaptation effects in mirror neurons to be detected by the mu rhythm.

11:30 – 11:45
Katherine Baker – Brain & Action Lab
Anticipatory brain activity preceding incidental and explicitly timed movements
Brain activity associated with the planning of voluntary actions can begin up to 2 s before the onset of muscle movement. When measured using EEG, this activity manifests as the readiness potential (RP), a slowly increasing pre-movement negativity seen in motor regions of the brain. Although the reason for such a long period of preparatory activity is unclear, a role for awareness and attention to movement has been suggested. In this study, we recorded EEG from 21 participants and used a time reproduction paradigm to manipulate the level of attention devoted to their movements. Participants heard two tones separated by a brief interval of silence, and then replicated this target interval by performing two button presses. The onset time of the first button press was seen as task-irrelevant, whereas the timing of the second button press required focused attention in order to replicate the target interval accurately. RPs prior to each button-press movement were averaged, and results showed significantly reduced RP amplitudes prior to the first (“incidental”) movement compared with the second (“timed”) one, over frontal and right frontal brain regions. This suggests that the processes reflected in the extended pre-movement RP are related to attention to movement and its timing.

11:45 – 12:00
Tarrant Cummins – Cognitive Neuroscience Lab
The dopamine transporter gene, DAT1
Response inhibition, a key component of executive function, refers to the ability to inhibit pre-potent responses. Behavioural measures of inhibitory control, such as stop-signal reaction time (SSRT) are highly heritable and have been proposed as endophenotypes for disorders of catecholamine dysregulation such as ADHD. In a sample of 405 non-clinical adults, we investigated the association between SSRT and a range of common catecholamine system gene variants, specifically Single Nucleotide Polymorphisms (SNPs) that are involved in the regulation and signaling of dopamine and/or noradrenaline. Markers on the Dopamine transporter gene, DAT1, accounted for significant variance in SSRT, after controlling for age

and gender, and survived corrections for multiple comparisons. The influence of the most significantly associated genetic variant, rs37020, was then further investigated in a targeted fMRI study of inhibitory control using a subset of the larger cohort (n=50). Isolating the neural correlates of response inhibition (successful stop – go contrast) revealed significant activations in frontal-striatal networks. Furthermore activation in a cluster that included frontal and caudate regions varied significantly with genotype. Thus our imaging genetic data indicate that DNA variation in dopaminergic genes modulates fronto-striatal circuits supporting inhibitory control, thereby providing further support for response inhibition as a candidate endophenotype for disorders such as ADHD.

12:00 – 12:15
Pascal Molenberghs – Cognitive & Behavioural Neuroscience Lab
The Influence of Context on Action Observation
A controversial topic is the role of the mirror system in action understanding. Some authors have suggested that the mirror system has an important role in action understanding (Rizzolatti and Sinigaglia, 2010) but others have claimed that direct evidence to support this view has been lacking (Hickok, 2009). If mirror neurons just have a passive role in action observation, they should always respond in a similar way to the observation of actions irrespective of the mindset of the observer. In this fMRI study, participants showed different patterns of activation in ventral premotor cortex and inferior parietal lobule during observation of identical actions, when the task was either to understand the actions, identify the physical features of the actions or passively observe the actions. Our results suggest that these areas, which have been previously associated with the mirror system, respond differently to perception of actions depending on the relevance to the observer.

12:15 – 12:30
Merryn Constable – Perception & Action Lab
Grasping the concept of personal property
The concept of property is integral to personal and societal development. Despite this, very little research has investigated ownership from a cognitive perspective. Here I outline evidence that suggests that the visuomotor system represents property at multiple stages of object processing. We first gave participants a mug to decorate, retain and use. We then compared their interactions with Participant-owned, Experimenter-owned and Unowned mugs. Participants lifted the Experimenter's mug with greater care compared with other mugs. Further, they lifted their own mug more forcefully and drew the in-flight mug closer to their own body. In a second experiment, we utilized a computer-based Simon task that showed that the usual compatibility effects elicited by graspable objects are absent for the Experimenter's mug - as if the action system is blind to the potential for action towards another person's property. This data provides the first evidence that the concept of ownership is represented in the visuomotor system.

12:30 – 12:45
Claire Naughtin – Perception & Action Lab
Linking Prior Emotional Behaviour to Face Identities: An fMRI Study
Faces can communicate a remarkable amount of information through a few simple features, and as social beings, we can use this knowledge to navigate social interactions. During social encounters, it is crucial that we not only perceive how others behave, but also remember this information and associate it with the relevant face identities. As a result, we can use knowledge from prior encounters to guide our behaviour towards the same people when they are re-encountered in future situations. For example, if someone displayed inappropriate facial expressions during your first encounter with them (e.g., smiling towards something unpleasant), it would be useful to associate this behaviour that person's identity so that you know to avoid them in subsequent situations. Behavioural studies provide evidence that peoples' judgements about others can be influenced by their prior experiences with them, however, the neural regions that mediate this ability are largely unknown. My presentation will discuss my honours research project which examined the neural structures that underlie our ability to associate prior social experiences with face identities by manipulating whether a face displayed appropriate or inappropriate emotional behaviour during initial social encounters.

12:45 – 13:00
James Retell. Remington Lab
No surprise, rare motion singletons capture attention
Understanding the role of top-down mechanisms in attentional capture has important consequences for understanding attentional control. Spatial cueing experiments have shown that involuntary shifts of attention are contingent on top-down attentional control settings. However, recent results suggest that task-irrelevant rare events can capture attention in the absence of active control settings for them. We explored this further by introducing a motion singleton into the cue frame of a spatial cueing experiment as a surprise event to see if it would override existing attentional control settings. The motion singleton was

presented in competition with a valid target-colour cue. Results (n=20) showed a motion singleton at a non-target location led to elevated response times to validly cued targets. It appears that surprising and rare motion singletons can capture attention even when they compete with a task-relevant colour cue.

Session 6, Friday 3rd December
14:00 – 15:30
Chair: Paul Dux, CI: Attention and Control Lab

14:00 – 14:30
Jason Mattingley, CI: Cognitive & Behavioural Neuroscience Lab
Role of selective attention in neural plasticity of human primary motor cortex
The adult brain is capable of structural and functional change well into adulthood. Such neuroplasticity is assumed to underlie normal processes of learning and memory, as well as recovery of function following brain injury. Several candidate mechanisms for neuroplasticity have been proposed. One influential model suggests that cortical plasticity reflects changes in synaptic efficacy induced by processes such as long-term potentiation (LTP) and long-term depression (LTD). Recent studies have suggested that LTP and LTD can be modulated by a variety of cognitive factors. Here we examined whether plastic changes in the primary motor cortex are influenced by visual selective attention. In two experiments, low-frequency stimulation of the median nerve was paired with a near-synchronous pulse of transcranial magnetic stimulation (TMS) over the hand area of the contralateral primary motor cortex. This 'paired associative stimulation' (PAS) protocol has been shown to alter cortical excitability for more than 30 minutes after stimulation. In Experiment 1, a group of healthy participants underwent a standard PAS protocol while performing a low- or high-visual load task at fixation. There was a significant PAS-induced increase in the amplitude of motor-evoked potentials (MEPs) recorded from the contralateral hand in the low-visual load condition, but not in the high-visual load condition. In Experiment 2, participants covertly monitored visual stimuli adjacent to the stimulated or non-stimulated hand. The magnitude of PAS-induced plasticity was significantly greater when spatial attention was focused close to the stimulated hand than when it was focused on the opposite (unstimulated) side. Taken together, these findings reveal a potent influence of selective visual attention on motor plasticity, and have important implications for approaches to rehabilitation following acquired brain injury.

14:30 – 15:00
Gabriella Blokland, fMRI Lab
Genetic Influences on Working Memory Brain Activation: A Twin fMRI Study
Using a genetically informative sample including both monozygotic (who share all their genes) and dizygotic (who share, on average, 50% of their genes) twins, we examined the extent to which task-related brain activation is influenced by genetic (heritability) and environmental factors. We did this separately for cerebrum and cerebellum and report maps of sources of variance in cognitive brain function. Whole-brain BOLD functional MRI (fMRI) data were acquired during the 0-back and 2-back conditions of a spatial *n*-back working memory task on a 4T scanner. We excluded twins with <30% accuracy on either *n*-back condition, and those with insufficient scan quality. The cerebrum sample consisted of 319 healthy twins; 75 MZ pairs (46F/29M), 66 DZ pairs (30F/11M/25FM), and 37 unpaired twins (22F/15M), aged 23.6±1.8 years. The cerebellum sample consisted of 189 twins; 27 MZ (25F/2 M) and 26 DZ pairs (18F/3M/5FM), and 83 unpaired twins (69F/14M), aged 22.6±3.4 years. Using SPM5, GE-EPI were realigned, co-registered with the twin's 3D T1-weighted scan, spatially normalised in MNI atlas space, smoothed with an 8 mm FWHM Gaussian kernel, and detrended. For the cerebellum processing, GE-EPI were realigned, smoothed, detrended, co-registered, and then spatially normalised using the SUIT Toolbox (Diedrichsen, 2006). Separately for the cerebrum and cerebellum, *t*-scores were extracted on a voxel-by-voxel-basis from 2>0-back contrast images generated at the single-subject level in each of the voxels comprising a mask created from a group random effects analysis irrespective of zygosity. We estimated maximum likelihood twin correlations, and genetic and environmental variance components, using structural equation modelling (Mx; Neale et al., 2004). Significant estimates at the voxel level are cluster thresholded based on Monte Carlo simulation (AlphaSim).

The group random effects analysis showed a significant increase in BOLD signal during the 2-back compared to the 0-back condition ($p < 0.05$, FWE-corrected) in the bilateral middle frontal, inferior frontal, supramarginal, superior parietal, and middle occipital gyri, right lateral orbitofrontal, superior frontal, middle and inferior temporal gyri, left insular cortex, bilateral precuneus, right angular gyrus, and bilateral caudate nuclei. In the cerebellum we found significant activation of the left Crus I, VI, and IX, bilateral Crus

II, right lobules VIIb, I_IV, and IX, and vermis lobule VI. Overall, the twin correlations for task-related brain activation were greater between MZ twins than between DZ twins, especially in frontal and parietal areas in the cerebrum, and in left Crus I and VI in the cerebellum, suggesting genetic control of brain function is greatest in those regions. Indeed, the genetic brain maps indicate several areas with a moderate to high genetic influence on working-memory-related cerebral activation, in particular in the left supplementary motor area, frontal and temporal gyri, middle cingulate cortex, superior parietal lobule, and precuneus (>40% of the variance), as well as a moderate heritability of activation in the cerebellar left hemisphere lobules VI and VIII, left Crus I, right Crus II and right lobule VII. The genetic influence on the cerebellum appears more modest than on the cerebral cortex, suggesting that the mechanisms underlying cerebellar activation during working memory may differ from those underlying the activation of the cerebral cortex. Although there are also sizeable environmental influences on brain activation, the genetic determination may be sufficiently strong for future studies to detect individual genes contributing to task-related brain activation.

15:00 – 15:30
Grieg de Zubicaray, CI: fMRI Lab
Mechanisms of cognitive control in language production
Despite several decades of research into spoken word planning, most theoretical models of speech production continue to omit a role for attentional control mechanisms. I will review evidence from neuroimaging and computational modelling investigations of interference paradigms indicating lexical selection is biased by top-down mechanisms in order to overcome competition introduced by lexical neighbours.