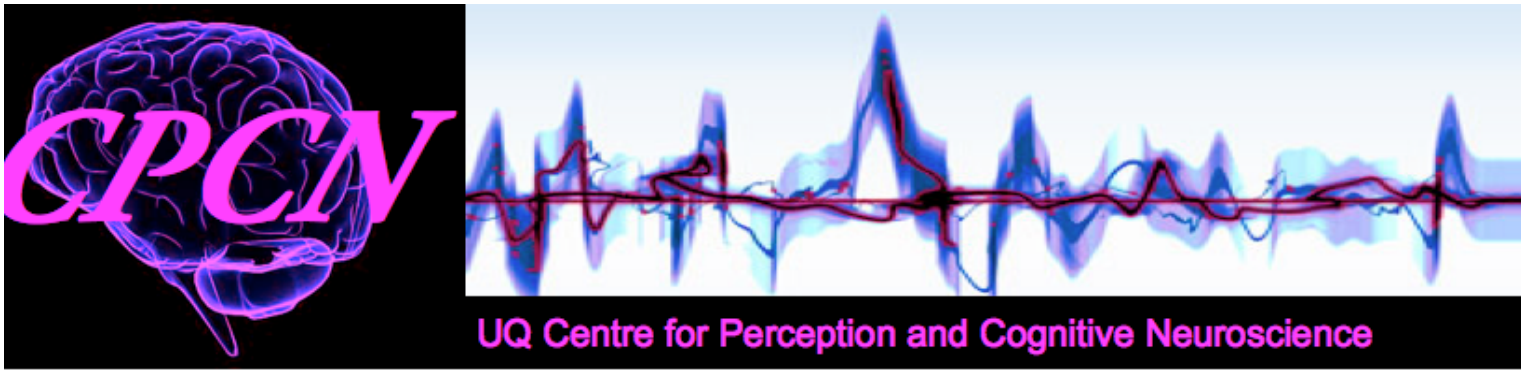

CPCN Workshop
1st – 2nd December 2011

School of Psychology
The University of Queensland

Contents…

Conference Schedule

Thursday

10:30–11:00	Talk Session 1
11:00–11:30	MORNING TEA
11:30–13:00	Talk Session 2
13:00–14:00	LUNCH
14:00–15:30	Talk Session 3
15:30–16:00	AFTERNOON TEA
16:00–17:00	**Keynote Address** **A. Prof Elenor McKone** *Special visual representation of faces in adults and children: What are the roles of nature and nurture?*

Friday

10:00–11:00	Talk Session 4
11:00–11:30	MORNING TEA
11:30–13:00	Talk Session 5
13:00–14:15	LUNCH
14:15–15:30	Talk Session 6
15:30–16:00	AFTERNOON TEA
16:00–17:00	**Keynote Address** **A. Prof. David Whitney** Crowding: the bottleneck of conscious vision
18:00 - …	Informal Dinner Pizza Café ***All Welcome!***

Keynote Speakers

Thursday 1st December
16:00 – 17:00, room s304

Elinor McKone

Department of Psychology
Australian National University, Canberra, Australia.

Assoc. Professor McKone completed her PhD, at the Australian National University, Canberra Australia, in 1996 before completing a post-doctoral research fellowship at Harvard University and subsequently returning to the Australian National University to take up a faculty position.

Assoc. Prof. McKones' research focuses on facial recognition, examining individual differences in facial recognition, the perceptual and neural components of face recognition, the development of facial recognition, the superior discrimination between own-race faces relative to other race faces, and clinical disorders of face recognition.

Assoc. Prof. McKone's research has featured in some of the world's leading general interest and specialist Experimental Psychology journals, such as PNAS, Cognition and JEP: HPP.

Abstract:
Special visual representation of faces in adults and children: What are the roles of nature and nurture?

The ability to recognise other people from their faces is crucial to normal social interaction. Most humans are remarkably skilled at this task, yet, from a computational perspective, discriminating an individual face's identity over image changes in viewpoint, lighting and expression is a very difficult problem for the visual system to solve. This talk reviews the evidence of a network of specialised cortical regions involved in face recognition, and what is known about the association of different stages of this network with the various cognitive processing mechanisms specialised for faces (including holistic processing and face-space coding). I then discuss the extent to which these face mechanisms, present in typical adults, derive from lifetime experience versus the extent to which they are innate and/or genetically driven. I review recent evidence from childhood development, twin studies, family studies, critical periods, perceptual narrowing (e.g., for other-race faces), and babies without face experience. Overall, I argue that 'nature' plays a strong role in the development of specialised visual representations of faces, and that the tuning of ability by experience primarily occurs only in infancy and early childhood.

Keynote Speakers

Friday 2nd December
16:00 – 17:00, room s402

David Whitney
Department of Psychology, UC Berkley, USA

Assoc. Prof. David Whitney completed his PhD at Harvard University before completing a post-doctoral fellowship at the University of Western Ontario and taking up a faculty position at the University of California, Davis. More recently he has taken up a faculty position at the University of California, Berkley.

Assoc. Prof. Whitney's has used behavioural and fMRI measures in human subjects to examine motion perception, perceived object location, crowding and visual control of hand movements.

Assoc. Prof. Whitney's research is frequently published in some of the world's leading general interest and specialist Neuroscience journals, such as Nature, Science, Nature Neuroscience and Psychological Science.

Abstract:
The bottleneck of conscious vision

Everyday experience gives us the impression that our visual world is rich, accurate, and seamless. Objects in our peripheral vision might seem somewhat blurry, but we nonetheless think we know what they are. In fact, this intuition is misleading. At any given time in natural scenes, most of the objects we see are in the visual periphery, and these peripheral objects are crowded-blocked from individual recognition and awareness-because of clutter. Outside the center of our gaze, crowding imposes a fundamental bottleneck on our ability to consciously recognize individual objects. Despite this, we still have the impression of a rich environment across the entire visual field, which is a testament to the usefulness of the information our visual system manages to extract from the periphery, even when individual objects are crowded from recognition. Here, we present three sets of studies on the mechanism of crowding, the scope of its influence, and its development from infancy. First, we show that crowding occurs at multiple, distinct stages of visual processing-from the lowest to the highest levels of visual analysis. We also show that, contrary to the dominantly held view, crowding does not dismantle or destroy object-level information; objects that are unrecognizable in clutter can nonetheless influence the perception of scenes by generating emergent ensemble percepts. Finally, we show the developmental trajectory of crowding from infancy, which reveals how the resolution of conscious perception improves slowly with age. Together, our results help elucidate one of the most essential mechanisms of spatial vision, a mechanism that defines the spatial resolution of conscious vision and mediates our subjective experience of the visual world.

Talk Sessions

Session 1, Thursday 1st December
10:30 – 11:00, room s402
Chair: Sam Pearce

10:30 – 10:45
Assoc. Prof. Jenny Burt
Sandwich anyone? Masked sandwich priming and lexical competition in word reading.
Models of visual word reading must address evidence that orthographic similarity effects are obtained for word pairs with letter transpositions, like *salt* and *slat*. Davis and Lupker suggested that nonword primes with all letter pairs transposed would produce a priming benefit, provided that competition from other similar words was controlled via their "sandwich" priming paradigm. With 5-letter words we examined standard and sandwich masked priming as a function of the number of Davis neighbors (DN) of the target, that is, words sharing 4 of the 5 letters in any position. Consistent with D & L, facilitation was observed for high- and low-DN words in sandwich priming, and only for low-DN words in standard priming. In a second experiment DN word primes produced inhibition in standard masked priming. The results are generally consistent with claims that transposed-letter neighbor words are activated in visual word identification.

10:45 – 11:00
Assoc. Prof. Grieg de Zubicaray
fMRI evidence for rival models of spoken word production Forty years of psycholinguistic research have demonstrated that saying a word, the most fundamental task in speaking, requires selecting from among a set of activated word candidates. Theories of spoken word production need to identify the nature of these candidates as well as the degree to which they interfere with target word production. We tested hypotheses from rival input and output accounts in two fMRI experiments using the picture-word interference (PWI) paradigm, in which participants named pictures with superimposed distractors that were high or low in frequency or varied in terms of age-of-acquisition (AoA). The distractor frequency effect (Experiment 1) was associated with increased activity in premotor and posterior superior temporal cortices, consistent with the operation of an articulatory response buffer and verbal self-monitoring system. Conversely, the distractor AoA effect (Experiment 2) was associated with increased activity in the left mid- and posterior-middle temporal cortex, consistent with the operation of lexical level processes such as lemma and phonological word form retrieval. The results support a post-lexical locus for the distractor frequency effect (Miozzo & Caramazza, 2003), and a lexical locus for the distractor AoA effect (Belke, Brysbaert, Meyer, & Ghyselinck, 2005). Thus, although hypotheses from two rival accounts of distractor interference in PWI were supported in each experiment, neither account is capable of providing a complete explanation.

Session 2, Thursday 1st December
11:30 – 13:00, room s402
Chair: Katherine Storrs

11:30 – 11:45
Dr. Derek Arnold
The world's spinning backwards because it's too fast to track
Illusory motion reversals can happen when looking at a repetitive pattern of motion, such as a spinning wagon wheel. To date these have been attributed to either a form of motion after-effect seen while viewing the adapting stimulus or to the visual system taking discrete perceptual snapshots at a rate of ~10Hz. Here we present evidence that is inconsistent with both proposals. First we explore what adaptation TF is optimal for inducing illusory reversals. We find that this conforms to a low-pass function that is not tuned for direction, ruling against a motion after-effect account. We also show that the optimal test TF for illusory reversals is stimulus dependent, being lower for colour relative to luminance-defined motion. This rules against an account based on a constant rate of discrete perceptual snapshots. Instead we posit that illusory reversals happen when an attention tracking system intermittently fails to keep up with a stimulus, due to adaptation of a band-pass TF channel, resulting in erroneous signals in the opposite direction as it defaults to tracking elements at a slower TF. According to this the maximal rate at which repetitive elements can be tracked via attention should be subject to adaptation. We show that this is true, with participants better able to track elements after adapting to relatively fast motion and worse after adapting to slower movement. Overall our data are consistent with human motion perception being driven by two relatively independent systems, which at times can provide conflicting signals.

11:45 – 12:00
Dr. Trevor Hine
Motion processing deficits in migraine are related to contrast sensitivity and noise

Background: There are conflicting reports concerning the ability of people with migraine to detect and discriminate visual motion. Enhanced coherent motion detection, yet impaired global motion discrimination, have been reported and attributed to functional differences in extrastriate cortex in migraine. Previous studies have used different types of motion displays and none has adequately assessed other parameters that could affect performance.

Methods: Motion-direction detection, discrimination and relative motion thresholds (with an without noise) were compared using the same observers (28 migraine: 14 with visual aura, 14 without; 14 control). Potentially relevant visual covariates were included (contrast sensitivity: CS, acuity, stereopsis, discomfort, stress, triggers and dyslexia).

Results: For each motion task, both migraine groups were less accurate than the control group, except for relative motion discimination in noise. Both migraine groups also had impaired CS, greater visual discomfort, stress and visual triggers. Only CS correlated with performance on each motion task, it also mediated performance.

Conclusions: Impaired performance on certain motion tasks can be attributed to impaired CS, which probably arises early in the visual system. There were additional differences between the groups for global and relative motion thresholds suggesting changes in extrastriate cortex. Tasks that can distinguish different effects of noise on performance at different levels of the visual system are recommended.

12:00 – 12:15
Dr. Philip Grove
Examining occlusion-based stereopsis with alternating presentation of the stereo half images
Stereoscopic depth normally results from the simultaneous and cooperative comparison of the slight differences between images formed in the left and right eyes. Binocular rivalry results from the simultaneous and competitive interaction between grossly different images formed in the two eyes. Recently, Ludwig, Pieper and Lachnit (2007) showed that stereoscopic depth perception and a form of binocular rivalry result when the left and right eyes' images are compared sequentially across time. They presented alternating dichoptic stimuli to the left and right eyes at various rates. They found that stereoscopic depth was perceived at lower alternation rates than rivalry, indicating better temporal

integration for stereopsis than for rivalry. I will present a recent study in which I employed a similar paradigm to explore temporal integration of occlusion-based stereoscopic phenomena, in which depth is perceived as a result of a cooperative comparison of dissimilar inputs in the two eyes, called monocular occlusion zones. Monocular occlusion zones are regions on more distant surfaces or objects that are visible to one eye but not the other owing to differential occlusion by a nearer object or surface. I observed differences in alternation rates supporting depth perception across several versions of occlusion based stereoscopic phenomena. Alternation rates ranged from low values similar to those observed for stereoscopic stimuli to higher values similar to those observed for rival stimuli. These observations correlate with existing data suggesting contamination of occlusion based phenomena with conventional disparities. Therefore, this paradigm is a promising technique for testing claims of novel forms of stereopsis free of conventional binocular disparities.

12:15 – 12:30
Luis Contreras
Racism in our brains? Race bias in neural empathic responses is not modulated by general in-group/out-group biases
Recent studies have shown that perceiving the pain of others activates part of the pain matrix in the observer, principally the anterior cingulate cortex, medial cingulate cortex and anterior insula. The amplitude of these empathic neural responses can be modulated by race bias, such that stronger neural activation is elicited by the perception of people of the same race compared with another race in pain. The aim of the present study was to extend this finding, to examine whether or not a more general social category could modulate the race effect in empathic neural activation. Using the minimal group paradigm, we assigned participants to one of two mixed-race teams. Then, using fMRI, we measured their empathic neural activation in response to members of their own and the other team in pain. We found that, even though participants displayed implicit and explicit identification with their own group regardless of race, greater empathic activation was associated with the same race than other race members in pain, in-group bias having any effect in this modulation. Taken together, these results suggest that race may be an automatic and unconscious mechanism not easily suppressed by other factors.

12:30 – 12:45
Nonie Finlayson
Visual search in depth: Longer shifts or larger space?
Voluntary attention is the cognitive selection process that focuses and enhances the cortical processing resources on the most relevant visual information. Depth information has been shown to influence attention; however there are still only a small number of studies employing 3D displays, although such displays closely resemble our natural visual environment. We present a set of visual search studies on the depth organisation of items within a display, investigating how the attentional system interacts with this depth information to affect the deployment of attention to a search target. First, we show that attention is adversely affected by adding depth information to a display. We then show that this reduction in response times is a result not of the number of depth planes but of the volume of depth that items are spread within. Finally, we discuss the ramifications of this data for the shifting and spread of attention over depth. Is this slowing of response times due to attention being diffused over a greater volume, decreasing the processing efficiency for stimuli? Or does the temporal deployment of voluntary attention vary in the depth dimension, in contrast to its neighbouring 2D directions?

12:45 – 13:00
Dr. Welber Marinovic
Time perception and anticipatory interceptive actions
Reliable estimates of time are essential for initiating interceptive actions at the right moment. However, our sense of time is surprisingly fallible. For instance, time perception can be distorted by prolonged exposure (adaptation) to movement. Here, we make use of this to determine if time perception and anticipatory actions rely on the same or on different temporal metrics. Consistent with previous reports, we find that the apparent duration of movement is mitigated by adaptation to more rapid motion, but is unchanged by adaptation to slower movement. By contrast, we find symmetrical effects of motion-adaptation on the timing of anticipatory interceptive actions, which are paralleled by changes in perceived speed for the adapted direction of motion. Our data thus reveal that anticipatory actions and perceived duration rely on different temporal metrics.

Session 3, Thursday 1st December
14:00 – 15:30, room s304
Chair: Nonie Finlayson

14:00 – 14:15
Assoc. Prof. Guy Wallis
Object Recognition in man, machine, and fish
Many important advances in our understanding of visual processing in humans have come not from humans themselves, but from the study of other life forms. Much of the early work on our visual recognition system was carried out in macaque monkeys, and fundamental advances in our understanding of motion processing emerged from work on fruit flies. In collaboration with a group of marine biologists, I have subjected the precocious, territorial damselfish Pomacentrus Amboinensis to classical conditioning using food reward, to test their visual abilities. I describe how these fish rapidly learn to discriminate colours; 2D and 3D forms; and complex binary patterns. I describe what we can deduce about the recognition abilities of these animals and then place these results in the context of machine learning and models of human visual recognition.

14:15 – 14:30
Thai Nguyen
Application of concurrent EEG-fMRI: Investigate neural face processing
EEG and fMRI studies have reliably identified a face-selective neural signal, respectively the N170 component and at least two regions in the fusiform gyrus - the fusiform face area (FFA) and the occipital face area (OFA). However, most neuroimaging studies have studied ERP and fMRI face-selective process separately, so the relationship between N170 and the network of the fusiform gyrus is not yet completely understood. In this study, we measured EEG and fMRI concurrently in response to upright faces, inverted faces and objects to investigate the correlation between the variation of ERP face-selective responses and BOLD signals. The estimate of N170 amplitudes in single trials was used to construct additional regressors in the general linear model to calculate BOLD responses. We found no activations in the fusiform gyrus to correlate with single-trial N170 amplitudes for upright faces. On the other hand, we identified widespread activations in the parietal, occipital and fusiform regions correlating with N170 amplitudes of inverted faces. Our result suggests that brain activity of the FFA and OFA is more consistent in response to upright faces compared with inverted faces.

14:30 – 14:45
Billy Sung
When pretty girls turn ugly: The boundary effect of the flashed face distortion effect
Tangen, Murphy, and Thompson (2011) have recently discovered a novel face distortion effect named the Flashed Face Distortion Effect. When eye-aligned human faces are presented in a rapid and continuous sequence, they will appear to be deformed or even grotesque. Tangen et al. uploaded a demonstration of the effect on YouTube < http://www.youtube.com/watch?v=wM6lGNhPujE> and it has attracted more than five million views. Given that the FFDE is a novel effect, we conducted a series of experiments to investigate the optimal conditions and the possible theoretical explanations for the effect. By examining different presentation conditions, we found that faces were more distorted in a sequence that lasted longer, presented in the peripheral visual field, and flashed at a rate of 350ms per face. Furthermore, we found similar distortions on shapes and faces that differed on simple visual attributes such as colour, brightness, and saturation. Our results showed that faces are not special in the Flashed Face Distortion Effect.

14:45 – 15:00
Ruth Savage
In search of the emotional face
Previous research has suggested that in crowds of neutral faces angry faces are detected fastest, whereas other research suggests that happy faces are found fastest. The current study aimed to explain some of these differences. Experiment 1 examined the effect of search strategy on search performance. Angry faces were found faster than happy faces during both fixed and variable target searches. Experiment 2 comprised a series of follow-up tasks assessing the effect of emotional non-targets and teeth displays on search performance. Faster detection of angry faces was still evident after the removal of emotional non-

targets from the fixed target searches and when using closed-mouth faces in variable target searches. A third follow-up task revealed faster detection of happy faces when faces from different stimulus set were used. These results suggest that differences in the literature cannot be entirely explained by search strategy, teeth display, or presence of emotional non-targets, and suggest the influence of stimulus materials on the pattern of results.

15:00 – 15:15
Sam Pearce
The lighter side of face perception

Human face recognition is disproportionately impacted by image rotation, becoming very difficult when an image is viewed upside down. The reasons for this remain a topic of heated debate. One factor might be that variations in three-dimensional (3d) structure are very important for facial coding. Inverting a facial image would therefore result in critical 3d shape from shading cues being viewed from an unfamiliar angle. Here we test this proposition via another manipulation, which eliminates 3d shape from shading cues altogether. We contrast peoples' ability to categorize cars and faces when images vary in luminance and when images only contain differences in colour (isoluminance, which eliminates all shape from shading cues). We find that isoluminance impairs performance disproportionately on a facial classification task relative to car classifications. This was true even though the two tasks were behaviourally matched for difficulty when images contained luminance differences. Nor could this effect be due to facial coding being selectively impacted by image blur at isoluminance, as performance dropped off equally for cars and faces as blur was added to images containing luminance differences. Our data therefore demonstrate that 3d shape from shading cues can be more important for facial coding than for analyses of other object categories.

15:15 – 15:30
Katherine Storrs
Not all high-level categorical aftereffects are equal, and perhaps none are opponent coded

After prolonged exposure to a female face, faces that had previously seemed androgynous are more likely to be judged as male. Research into such high-level categorical aftereffects has predominantly focussed on human faces, but more recent evidence suggests that such effects are generic, impacting judgments involving multiple object classes. It is thought that high-level categorical aftereffects are driven by adaptation within a norm-based opponent code, akin to low-level analyses of colour. While a good deal of evidence is consistent with this, some recent data is contradictory, motivating a more rigorous test. In behaviourally matched tasks we compared the characteristics of aftereffects generated by adapting to colour, to expanded or contracted faces, to facial gender, and to different species of animal. In our experiments opponent coding predicted that the appearance of the adapting image should change and that adaptation should induce symmetrical categorical boundary shifts. This combination of predictions was firmly supported for colour adaptation, but not for any other condition. Interestingly the two face aftereffects tested were caused by a distinctly different pattern of response shifts relative to colour adaptation, and relative to each other. Our data suggest that high-level categorical aftereffects are not caused by adaptation within a generic opponent code. Instead, superficially similar aftereffects seem to ensue from several different combinations of visual adaptation within a population coding scheme, contrast effects, and/or changes in decision-making criteria.

Session 4, Friday 2nd December
10:00 – 11:00, room s402
Chair: David Painter

10:00 – 10:15
Jelena Stosic
Force synchrony enhances the stability of rhythmic multi-joint coordination
Although rhythmic coordination has been extensively studied in the literature, questions remain about the correspondence of constraints that have been identified in the related contexts of inter-limb and intra-limb coordination. Here we used a 2-DOF robot arm which allows flexible manipulation of forces to investigate the effect on coordination stability of intra-limb coordination of: (i) the synchrony of force requirements and (ii) the involvement of bi-functional muscles. Ten subjects produced simultaneous rhythmic flexion–extension (FE) and supination-pronation (SP) elbow movements in two coordination patterns: (1) flexion synchronized with supination/extension with pronation (in-phase pattern) and (2) flexion synchronized with pronation/extension with supination (anti-phase pattern). The movements were produced with five different settings of the robot arm: a neutral setting that imposed balanced force requirements, and four other settings that increased the force requirements for one direction in both DOF. When combined with specific coordination patterns, these settings created conditions in which either synchronous or alternate patterns of forcing were necessary to perform the task. Results showed that synchronous tasks were more stable than asynchronous tasks ($P<0.05$). Within the synchronous tasks, some robot settings were designed to either increase or decrease the use of bi-functional muscles. Although there was no difference for the bi-functional muscle biceps brachii, the coordination was more stable for the condition in which the greatest force requirements corresponded to the mechanical action of the bi-functional pronator teres ($P<0.05$). In conclusion, force synchrony increases the stability of rhythmic intra-limb coordination, but further research is needed to clarify the role of bi-functional muscles in this effect.

10:15 – 10:30
Megan Campbell
High resolution fMRI of the basal ganglia and thalamus during motor control.
The means by which an animal acts on its environment is reliant on motor control function, and the basal ganglia-thalamo-cortico circuits which underlie this. Instances of motor dysfunction (e.g. Parkinson's disease) reveal the crucial interactions between cortical motor areas and the sub-cortical structures in the basal ganglia and thalamus. Here, the complexity of sub-movement sequencing and timing will be varied to investigate the activation of both cortical regions and subcortical structures (in particular the striatum and thalamus). A novel paradigm for functional imaging of subcortical activation was developed in order to obtain a very high resolution (1.5x1.5mm) measure of BOLD signal changes using a standard clinical field strength (3 Tesla). Widespread cortical activation across premotor, supplementary motor, and primary motor areas were recorded during motor control. Sub-cortically, multiple significant clusters of activation were detected in striking detail, across the putamen, caudate and thalamus. Our findings suggest that the sequencing and timing of sub-movements are mediated by common motor areas.

10:30 – 10:45
Dr. Steve Cloete
Extra-visual information supports heading control when visual feedback is removed.
The control of self-motion is one of the most widely studied instances of visually-guided behaviour, but comparatively little is known about the contribution of sensory systems other than vision. Depriving participants of visual feedback when they are engaged in visually-guided activities serves two purposes; 1) it helps to elucidate the nature of the motor control mechanism for the behaviour, i.e., open or closed-loop, and 2) it assesses the extent to which signals from other sensory modalities - vestibular, somatosensory and proprioceptive - can be integrated over time to support the execution of the behaviour. Previous studies conducted in fixed-base and moving-platform driving simulators (Wallis et al., 2002; 2007; Cloete & Wallis, 2009) showed that participants commit highly systematic errors when attempting complex steering movements (such as lane changes and obstacle avoidance) without visual feedback. These errors are consistent with a broad misunderstanding of steering dynamics, which leads to a startling inability to predict the effect of steering wheel manipulations on locomotor trajectory. To better understand the role of linear and angular accelerations which normally accompany steering movements, we conducted an experiment in an instrumented passenger car. Participants were required to undertake lane-change manouevres on a 10,000sqm asphalt skidpan, with sustained visual occlusion achieved with a pair of LCD

shutter goggles. Without visual feedback, participants initially produced large and systematic errors in heading similar to those found in previous studies. However, over the course of only 10 trials, most participants were able to produce an approximation of the correct movement sequence. The results suggest that rapid utilisation of extra-visual feedback can result in the successful execution of complex steering movements, which may have implications for theories of dynamic re-weighting in multisensory integration.

10:45 – 11:00

Dr. Oliver Baumann

Neural Correlates of Categorical and Coordinate Encoding of Object Locations during Active Navigation.

It had been proposed that spatial relations can be encoded in two different ways: categorically, where the relative position of objects can be described in prepositional terms (to the left/right, in front/behind, etc.) and coordinately, where a precise distance between the objects is assessed. The mechanisms underlying the processing of these two types of relationships are commonly thought to be dissociable at the neural level. In humans a left hemisphere advantage has been found for categorical processing, while the right hemisphere is thought to show preponderance for coordinate processing. However, previous imaging studies investigated categorical and coordinate encoding processes only in table-top environments and not in the context of active spatial navigation. In the present study, we used functional magnetic resonance imaging (fMRI) to identify neural circuits underlying these potentially distinct processes during active spatial navigation in a virtual environment. In the encoding phase of each trial, participants navigated to the location of a target object and encoded either its spatial quadrant relative to a reference landmark (Categorical) or its distance to a reference landmark (Coordinate). After a short delay, participants reentered the arena and were required to navigate back to either the remembered distance or the spatial quadrant of the target. Comparing fMRI data trials in which participants were engaged in categorical encoding with the analogous coordinate condition, we found stronger activity bilaterally in the posterior and medial parietal cortex and the left middle temporal gyrus. Using the complementary contrast, we found stronger activity during coordinate encoding in the right hippocampus, parahippocampus and dorsal striatum. Our results confirm analogous findings from previous studies using a similar task in rodents and are in favor of a model assuming different processing systems for categorical and coordinate encoding of object locations during active spatial navigation.

Session 5, Friday 2nd December
11:30 – 13:00, room s402
Chair: Will Harrison

11:30 – 11:45
Prof. Ottmar Lipp
Fear relevance and prepared learning: Dissociation between animal- and social-fear relevant stimuli
Prepared learning, learning that is resistant to extinction, selective, evident after one CS-US pairing, and encapsulated from cognition, is said to underlie the fear of snakes and spiders and of threatening conspecifics (angry faces or faces that look different - other race faces). Whereas there is considerable evidence that fear conditioned to sakes and spiders fulfills all four criteria of prepared learning, fear conditioned to angry or other race faces has only been shown to be resistant to extinction. We present evidence across a series of experiments using the instructed extinction paradigm that, unlike fear conditioned to snakes and spiders, fear conditioned to angry or other race faces is not encapsulated from cognition. Instructed extinction did not affect fear conditioned to pictures of snakes and spiders but abolished fear conditioned to angry or other race faces. This finding is inconsistent with the proposal that the same mechanism, prepared learning, underlies the resistance to extinction that is observed for fear conditioned to snakes and spiders and for fear conditioned to angry or other race faces. We suggest that in contrast to fear conditioned to animals, fear conditioned to social stimuli like angry or other race faces is better explained as an extension of an individual's social learning about pervasive negative stereotypes rather than as an instance of prepared learning.

11:45 – 12:00
Dr. Tim Carroll
Use-dependent learning is represented in extrinsic rather than muscle-based coordinates
Human motor learning involves both error-based corrections and a use-dependent component that biases subsequent movements towards those repeated during practice. In an isometric forearm aiming task, we tested for bias in force direction in various areas of the workspace in response to a single training direction, and determined whether this bias is represented in an extrinsic or muscle-based reference frame. Training consisted of 40 repetitions of 2s maximal-force ballistic contractions toward a single directional target. The effects of training were tested in a low-force task that required subjects to move a cursor from the centre of a two-dimensional display towards radial targets (movement time = 150 - 250ms). During the low-force task, subjects received online feedback of the magnitude of force, but not the direction, via an expanding circle. Angular deviation from the target direction was calculated at 95% of the target distance. In experiment 1 (n=10), we found that aiming direction was biased towards the training direction across a large area of the workspace (approximately +/-90o; tested for 16 targets spaced 22.5° apart). In experiment 2 (n=12), each participant completed three different training sessions in a crossover, counter balanced order. In two sessions, both the aiming task and training were conducted in the same (neutral) forearm posture. In one of these sessions, the training involved weak forces (slow ramp to 10% maximum contraction) in order to determine whether the production of strong neural drive during training influences the degree of bias. In the third session, the high-force training contractions were performed in a 90o pronated forearm posture, whereas the low-force aiming task was performed in a neutral forearm posture. By comparing aiming errors to targets surrounding the training direction in extrinsic space with errors to targets close to the preferred direction of the muscles involved in training, we were able to assess if the learning effect was represented in extrinsic or muscle-based coordinates. We found systematic bias in aiming toward the training direction defined in extrinsic space, even for targets where this resulted in errors away from the pulling direction of the trained muscles, and that bias towards the training direction was larger after high-force than weak contractions. Our findings suggest that the effects of use-dependent learning in isometric aiming generalise broadly to untrained movement directions, are represented in an extrinsic rather than muscle-based reference frame, and are facilitated by training involving strong neural drive.

12:00 – 12:15
Chris Little
Do positive emotions necessarily improve attentional focus?
There is a growing body of research that suggests that positive affect improves cognitive processes, including broadening attention and enhancing cognitive switching. One such process that is influenced by positive affect is the attentional blink (AB). The AB describes a robust phenomena in which the ability to identify the second of two targets is impaired when they are presented among distracters in a rapid visual sequence. Interestingly, this impairment has been shown to be reduced by presenting emotionally positive

images prior to each sequence. The authors of this research suggest that positive affect leads to a more diffuse attentional state, which allows greater accuracy in identifying the second target. This is supported by the surprising results of another study, which found that reducing attentional focus by instructing participants to concentrate less also reduced the AB. Previously the influences of positive affect and attentional focus on the AB have been studied separately. However, the present study investigated the influence on the AB of combining manipulations of affect and attentional focus. Results indicated that positive emotions attenuated the AB when concentrating hard, but not when concentration was already reduced. Furthermore, reduced concentration attenuated the AB when in a neutral state of mind, but not when in a positive state of mind. These results shed light into the processes that underlie the results of the previous studies, as well as highlighting the importance of investigating how cognitive processes may vary with emotion.

12:15 – 12:30
James Retell
The role of reward in driving attention shifts
Attending to visual stimuli associated with a high probability of procuring rewards is greatly adaptive. Exactly how reward interacts to guide visual attention is presently unclear. Recent research suggests high-value but contextually irrelevant stumili capture attention as a consequence of reward learning. Here we investigated whether stimulus-value associations learned in a visual search task, would influence performance in a subsequent spatial cueing task. The aim was to investigate whether value learning was attached to specific objects (*object hypthesis*), or contexts (*context hypothesis*). We further explored how value attaches to stimuli by examining whether value learning requires the rewarded feature to be a part of the attentional search set (*explicit-reward hypothesis*), or if reward attaches to all features of an attended object (*implicit-reward hypothesis*). High-value cues were found to elicit a significant cueing effect across both experiments. These data provide evidence for the *object hypothesis* and the *implicit-reward hypothesis*.

12:30 – 12:45
Veronika Halasz
Attentional modulation of action perception
When we observe an action performed by another individual the brain rapidly processes that action to provide an understanding of "who", "how", "what" and "why". Observation of even the simplest movements involves the recruitment of several brain areas that are collectively called the action observation network. Brain processes underlying action observation seem very quick and nearly effortless, thus for a long time the processing of biological movements has been assumed to be automatic. Here we asked participants to perform either a high-load or low-load attention-demanding task while passively observing video clips depicting simple object-directed hand movements. Using an fMRI repetition suppression paradigm we found that during action observation the different aspects of actions (e.g. goals, kinematics, agency) recruit the action observation network nearly identically, showing only very small additional effects related task-specific areas of the brain. Additionally, attention seems to effect how actions are represented even during passive observation. Our data suggest that, even though low-level action-understanding might be processed very quickly and effortlessly, top-down attention can modulate these processes, contradicting the fully automatic nature of motion processing.

12:45 – 13:00
Joyce Vroomen
Top-Down Modulation of Threat-Related Interference: Attentional Capture and Disengagement.
We are generally able to exert control over what we attend to (e.g. **Error! Reference source not found.**. However, threat stimuli have been proposed to interfere with this top-down (i.e. goal-driven) allocation of visual attention in a purely bottom-up (i.e. stimulus-driven) manner (**Error! Reference source not found.**. In a previous study (Vromen, Lipp, & Remington, 2011) we provided evidence that this claim is incorrect by demonstrating that task goals modulate slowed disengagement from a threat stimulus (spider silhouette). In the current set of experiments we investigate whether the later disengagement component of attention is more susceptible to top-down modulation than the earlier capture component. We use a spatial cueing task in which the locus of attention is manipulated and tightly controlled by pairing cues (four dots) and targets (animal pictures) defined by the same color. Again, slowed disengagement from the non-target, threat stimuli (spider pictures) was observed only when the spider was included in the target set. When the spider was not included in the target set, capture by the non-target, threat stimuli was still observed. This suggests that potent threat stimuli (pictures) do not override top-down attentional control. Moreover, it suggests that later attentional components (e.g. disengagement) may be more affected by top-down control than earlier components (e.g. capture).

Session 6, Friday 2nd December
14:00 – 15:30, room s402
Chair: Joyce Vromen

14:00 – 14:15
David Painter
On the role of parietal cortex in contingent capture
The parietal cortex is important for combining featural and spatial information, but the contribution of distinct subregions remains unclear. Emerging evidence suggests that the right intraparietal sulcus (rIPS) may prioritise task-relevant features, while the right temporoparietal junction (rTPJ) may highlight locations with relevant features. To test this, we applied continuous theta-burst (cTBS) transcranial magnetic stimulation (TMS) to rIPS, rTPJ, and the right middle temporal area (rMT). Observers fixated centrally and made speeded responses to red or green letters appearing in rapid streams (5 Hz) in the left and right visual hemifields. Target and distractor events were preceded by cues that appeared in either the same or opposite hemifield and in either the target or distractor colour. Responses were faster to targets preceded by cues in the same compared with opposite hemifield, but only when cues possessed the target colour. This supports the contingent capture hypothesis, that only locations with task-relevant features are prioritised. Preliminary data (N = 9) suggests that rTPJ is most critical in this process. cTBS to rTPJ reduced the spatial effect of target-coloured cues and increased the spatial effect of distractor-coloured cues. These data reveal, for the first time, the causal involvement of rTPJ in highlighting locations with relevant features and also in suppressing locations with irrelevant features. cTBS to rIPS and rMT had little effect, suggesting that the critical locus of feature-based enhancement resides elsewhere in the cortex.

14:15 – 14:30
Chase Sherwell
Neural processes underlying temporal allocation of attention
Orienting attention to the expected time of events speeds responses and enhances the perception of stimuli at the attended time (Griffin, Miniussi, & Nobre, 2001). Temporal orienting is reflected in the modulation of a slow-rising negative potential over the motor cortex, known as the contingent negative variation (CNV). Previous studies have primarily used speeded motor responses to examine temporal orienting effects, making it difficult to disentangle temporal orienting effects from motor or perceptual processes. We aimed to studied the effects of temporal orienting on the CNV in the absence of overt motor preparation, in order to examine cortical activity underlying temporal attention independently of motor processes. A novel temporal orienting paradigm was devised using a two-alternative forced-choice discrimination task. Participants judged target Gabor patch stimuli as being rotated clockwise or counter-clockwise in comparison to standard stimuli, and gave delayed verbal responses to avoid motor preparation preceding target onset. The ability to orient attention to the time of target onset was manipulated between blocks, with targets appearing predictably after a short (1000ms) or long (1750ms) interval following standard stimuli, or unpredictably appearing after either interval. Cortical activity was recorded using electroencephalography (EEG). When target onset was predictable, neural activity associated with target processing was enhanced (greater visual N1 component) and participants were more accurate in discerning target orientation. Crucially, the ability to orient attention to an expected time increased CNV amplitude, similar to that seen during motor planning prior to speeded motor responses. Findings suggest that the slow increase in neural activity seen in the CNV, beginning up to 1 s prior to a critical expected event, reflect processes involved in the temporal allocation of attention independent of motor preparation.

14:30 – 14:45
Oscar Jacoby
Is the whole really more than the sum of its parts? Estimates of average size and orientation are not resistant to object substitution masking.
We have a remarkable ability to accurately estimate average featural information across groups of objects, such as their average size or orientation. It has been suggested that, unlike individual object processing, this process of *feature averaging* occurs automatically and relatively early in the course of perceptual processing, without the need for prolonged recurrent processing of each individual object. Here, we probed the processing stages involved in feature averaging by examining whether feature averaging is resistant to

object substitution masking (OSM). Participants estimated the average size (Experiment 1) or average orientation (Experiment 2) of groups of briefly presented objects. Masking a subset of the objects using OSM reduced the extent to which these objects contributed to estimates of both average size and average orientation. Contrary to previous findings, these results suggest that feature averaging benefits from recurrent processing stages subsequent to the initial registration of featural information.

14:45 – 15:00
Dr. Kelly Garner
General and Specific Bottlenecks: Training differentiates the Attentional Blink from the Psychological Refractory Period.
It remains under debate whether the attentional blink (AB) and the psychological refractory period (PRP) represent unified or distinct bottlenecks in human information processing. The impact of training upon PRP reduction is well documented. The current study investigated the overlap of the PRP and AB by determining whether training would produce similar performance benefits. Participants completed a PRP task, an AB task and a hybrid-AB task. Participants were allocated to relevant training (PRP T1 practice), irrelevant training (comparable sensorimotor training) or control groups. Subsequent to training or a two-week interval, participants re-completed the PRP and the two AB tasks. For the PRP, only the relevant training group showed reductions in magnitudes. For the AB task, both training groups showed a significant reduction in magnitude relative to the control group. This indicates that while stimulus specific sensorimotor training is required to reduce the PRP and hybrid-AB, general sensorimotor training reduces the AB. This indicates that the PRP results from a capacity-limited resource for coordinating specific sensorimotor responses, whereas the AB is reflective of general sensory processing limitations. Overlap between the two occurs to the extent that both rely upon speed of task one processing.

15:00 – 15:15
Claire Naughtin
A Neural Dissociation of Repetition Blindness and Repetition Suppression.
Visual objects are attended to and encoded via two stages of processing. Namely, 'object individuation' where episodic information is used to register an object as a discrete unit and 'object identification' where identity information becomes available. When two repeated objects are presented, however, an observer must rely purely on episodic information, as identity information cannot distinguish between the objects. Due to capacity limitations at the object individuation stage, an observer often fails to consciously report the second occurrence of two repeated items if they are presented in close proximity (known as 'repetition blindness'). To date, no research has isolated repetition blindness at a neural level, but general decreases in neural activity associated with repetition processing have been shown through repetition suppression. Does repetition blindness simply reflect repetition suppression? In the present fMRI study, participants completed a modified repetition blindness task that created conditions where they successfully and unsuccessfully individuated two repeated or non-repeat scene photographs. Here we identified neural regions that reflect conditions under which objects fail to be individuated as seen in repetition blindness, and neural regions that reflect general repetition-related declines in activity as seen in repetition suppression. We show that these two processes can be dissociated in the brain, to some extent, suggesting that these two phenomena have separate neural mechanisms.

15:15 – 15:30
Will Harrison
Non-retinotopic crowding via predictive remapping reveals visual stability mechanisms
As we move our eyes around, visual objects are displaced on the retinas, requiring that different populations of neurons in the retinas and visual cortex encode each object with each saccade. Remarkably, however, we perceive the visual world as stable. We tested how visual stability is achieved by exploiting the phenomenon "crowding", where the identity of an object in the periphery is degraded by nearby visual clutter. We had observers execute a saccade and identify a probe letter presented in the periphery at a known location, and at various times just prior to the saccade. Although standard crowding occurs when visual clutter closely surrounds the probe, we presented the visual clutter in the opposite hemifield to the probe, but at a screen position that corresponded to the predicted post-saccadic location of the probe. We found that observer's ability to recognise the probe depended strongly on the presence of visual clutter that shared low-level features with the probe, and the proximity of the visual clutter to the probe's predicted post-saccadic location. Furthermore, the time course of this interference closely followed the time course of activity in neurons that predictively remap spatial information as previously reported in single-cell studies. This "remapped crowding" effect reveals that trans-saccadic visual stability is achieved by increasing the gain of responses to specific features at locations that are remapped just prior to each saccade to compensate for the impending retinal displacement of visual objects.