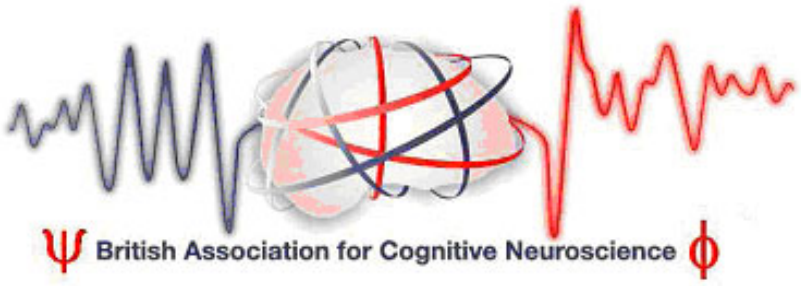

2014 BACN
Annual Scientific Meeting
11th and 12th of September

THE UNIVERSITY of York

Dear colleague,

Welcome to the 2014 Annual Conference of the British Association for Cognitive Neuroscience!

I would like to begin by thanking the Department of Psychology at the University of York for hosting this year's meeting and the Organising Committee, particularly Daniel Baker and Martin Edwards, for their efforts. I hope that you agree with me that the programme that they have put together is excellent.

We have a Founders lecture by Peter Venables (University of York) and two keynote lectures by Masud Husain (University of Oxford) and Matthew Lambon-Ralph (University of Manchester). In addition there will be four symposia during the meeting: EEG correlates of reward prediction errors: A biting challenge, by Deborah Talmi and Clay Holroyd; The neurochemistry of human cognition in health and disease, by Stephen Jackson; MEG studies of language and semantics, by Beth Jefferies, and; Neural synchronisation: From perception to representation, by Paul Sauseng and Simon Hanslmayr.

In addition to the symposia presentations we have a packed schedule of 19 open talks and more than 50 posters from both early career and leading researchers in the field of cognitive neuroscience. Also, the York Organising Committee have organised a conference dinner at the historic Merchant Adventurers' Hall followed by a ceilidh. I hope to see you there!

I very much hope you enjoy the conference.

Stephen Jackson,
University of Nottingham

Thursday 11th September 2014

8:00 Conference registration

8:45 Welcome and conference introduction

Invited Founders Lecture

9:00 Peter Venables
It was all so simple…. but

Open Session 1

9:30 Toby Nicholson, Linda Solbrig, Matt Hudson, Patric Bach & Steve Tipper
I feel what you are doing: differential effects of observed and predicted touches

9:50 Isabel Parsons & Jeremy Goslin
Electrophysiological study of action-affordance priming between object names

10:10 Jeremy Goslin & Caroline Chapman
μ and β wave suppression when reading the names of manipulable tools

10:30 Johnny King L. Lau, Glyn Humphreys, Wai-ling Bickerton & Pia Rotshtein
Everything our brain can do with objects: from recognition to utilization: A large-scale VBM study in sub-acute stroke

10:50 Poster Session 1, with tea & coffee

Symposium: EEG correlates of reward and prediction errors: a biting challenge.
Chair: Deborah Talmi

11:10 Clay Holroyd
The reward positivity ERP signal

11:25 Deborah Talmi, Emily Hird & Wael El-Deredy
ERP markers for surprising physical pain and bitter taste

11:40 Tobias Hauser
A multimodal investigation of the Feedback-Related Negativity: Insights into the localization, meaning and network organization

11:55 Sara Garofalo, Martin E. Maier & Giuseppe di Pellegrino
Mediofrontal negativity signals unexpected omission of aversive events

12:10 Thomas D. Sambrook & Jeremy Goslin
Time of the signs: Event-related potentials code unsigned and positive reward prediction errors in different intervals

12:30 Poster Session 1, with lunch

Open Session 2

13:30 Aidan J Horner, Wen-Jing Lin, James Bisby & Neil Burgess
Pattern completion for multi-element events in the human hippocampus

13:50 Eleanor Loh, Marc Guitart-Masip, Zeb Kurth-Nelson, Emrah Duzel & Ray Dolan
Parsing the role of the hippocampus in avoidance and exploration

14:10 Howard Bowman, Abdulmajeed Alsufyani, Marco Filetti & Alexia Zoumpoulaki
Breakthrough percepts – (Sub)liminal salience search and EEG deception detection on the fringe of awareness

14:30 Barbara Berger, Annette Sterr & Paul Sauseng
The role of frontal EEG theta activity in voluntary resource allocation in working memory

14:50 Julia C. Teale & Malcolm D. MacLeod
Age-related deficits or individual differences in inhibitory control: The importance of working memory capacity in a dual-task retrieval-induced forgetting paradigm.

15:10 Poster Session 1, with tea & coffee

Symposium: The neurochemistry of human cognition in health and disease.
Chair: Stephen Jackson

15:40 Frederic Boy
Integrative approach to individual differences in decision-making: anatomical, neurochemical, and neuromodulatory perspectives

16:00 Velicia Bachtiar
Metabolite changes by transcranial direct current stimulation in the human primary motor cortices

16:20 Soyoung Kim
tDCS-induced alterations in GABA concentration within primary motor cortex predict motor learning and motor memory

16:40 Amelia Draper
A multi-modal exploration of GABA concentration changes in young people with Tourette Syndrome

Keynote Lecture
17:00 Masud Husain
The inattentive, forgetful and apathetic brain

18:00 Drinks
19:30 Conference Dinner at the Merchant Adventurer's Hall
21:00 Ceilidh with Fiddler's Wreck

Friday 12th September 2014

Open Session 3

9:00 Sagar Jilka
Brain network interactions after traumatic brain injury

9:20 Amanda Marshall, Nicholas Cooper & Nicolas Geeraert
The effect of long-term stress exposure on ageing cognition

9:40 Emma Holmes, Padraig Kitterick & Quentin Summerfield
Do children with hearing loss show atypical attention during 'cocktail party' listening?

10:00 Abigail Dickinson, Myles Jones, Michael Bruyns-Haylett & Elizabeth Milne.
Visually-induced peak gamma frequency is higher in individuals with high levels of autistic traits

10:20 Volker Thoma & Elley Wakui
ERP repetition effects indicate processing of unattended objects under load

10:40 Poster Session 2, with tea & coffee

Symposium: MEG studies of language and semantics.
Chair: Beth Jefferies

11:10 Piers Cornelissen
The first 500 ms in visual word recognition: who is talking to whom?

11:30 Olaf Hauk
Finding meaning in the brain

11:50 Giovanna Mollo, Piers Cornelissen & Elizabeth Jefferies
Oscillatory dynamics in semantic cognition: Neural processes underlying semantic representation and automatic/controlled semantic retrieval revealed by MEG

12:10 Alex Clarke & Lorraine K. Tyler
Dynamic information processing states during meaningful object recognition

12:30 Poster Session 2, with lunch

Keynote Lecture

13:30 Matthew Lambon Ralph, University of Manchester
Semantic cognition and its disorders: Insights from convergent neuroscience methods

Symposium: Neural synchronisation: from perception to representation.
Chairs: Paul Sauseng and Simon Hanslmayr

14:30 Vincenzo Romei
Individual alpha peak frequency predicts and drives the temporal profile of the sound-induced double-flash illusion

14:50 Mark Stokes
Role of alpha oscillations in visual cortex in attention and working memory

15:10 Paul Sauseng
To encode or not to encode: the role of fronto-parietal EEG theta activity in storing visual information in working memory

15:30 Simon Hanslmayr
Does alpha/beta desynchronization represent information in human long-term memory?

15:50 Poster Session 2, with tea & coffee

Open Session 4

16:20 Charles Leek, Mark Roberts, Zoe Oliver & Alan Pegna
The time course of three-dimensional object recognition in human vision

16:40 Geoffrey M. Boynton
Integrating visual information over time

17:00 Tessa R. Flack, David M. Watson, Richard J. Harris, Mark Hymers, Andre D. Gouws, Andrew W. Young & Timothy J. Andrews
Distinct representations for rigid and non-rigid facial movements in face-selective regions of the human brain

17:20 David M. Watson, Tom Hartley & Timothy J. Andrews
Patterns of response in scene-selective regions of the human brain are affected by low-level manipulations of spatial frequency.

17:40 Ione Fine & Jason Webster
Data driven identification of functional organization

18:00 Conference End

Invited Founders Lecture

It was all so simple…. but

Peter Venables

What as measures of human physiological activity of interest to psychologists did we have after WWII? EEG, cardiovascular activity and electrodermal activity (EDA). It is the last I want to concentrate on. The first two were at that time the province of the medical profession but the last could be ours.

We had known about EDA since the turn of the century but there was not very much work going on (or that we knew of on this side of the Atlantic). Remember, no internet, no computers, no easy search of the literature. If your library did not have the paper, then tough (even if you knew what the reference was)!

EDA, (PGR, GSR) could be a window on autonomic activity and hence, perhaps, very much more interesting to central activity. But first a lot of work to get the transducers right and not get a lot of noise in the way en route to the brain.

So with little noise, perhaps we could proceed. We looked at relations to stress, personality and psychopathology. With some interesting results! And along the way, we founded the British Psychophysiological Society, and we talked to each other.

But then along came PET and MRI and friends and better access to EEG by psychologists. We suddenly had computers to collect the data, computers to analyse the data and journals specialising in psychophysiology and the internet to know what was going on elsewhere. And there were those conferences in faraway places. And then we changed our name.

What about poor old EDA? The method still has a role! You can do it when you are in the MRI tin can and you can still get interesting results.

Keynote Lecture

The inattentive, forgetful and apathetic brain

Masud Husain [1,2]

1. Nuffield Department of Clinical Neurosciences, Oxford
2. Department of Experimental Psychology, Oxford

Cognitive disorders are a real challenge – to understand and treat. They are often complex, crossing several domains of brain function and academic pursuit. But they also present a great opportunity to test emerging theories in cognitive neuroscience as well as to apply them to clinical problems with a huge unmet need. I'll argue that it's "pay back time" for neuroscience. We have sufficient knowledge to attempt treatment in some conditions such as those which affect attention, memory and motivation.

Inattention is pervasive. It affects you and me several times a day. More notably, it impacts severely on a range of neurological and psychiatric conditions, from focal lesions to neurodegenerative and developmental disorders. In people with these diagnoses, inattention rarely occurs in isolation but is often associated with other cognitive deficits: of working memory as well as motivation. Indeed, there is now considerable evidence to suggest that deficits in short-term memory might even contribute to the seemingly inattentive state.

I'll discuss studies on attention, working memory and decision-making in healthy people and neurological patients, including new means to measure the precision of recall [1, 2] and how motivated people are to act [3]. I'll attempt to show how findings from such investigations, in concert with imaging data, allow us to build hypotheses regarding the contribution of brain regions to attention, working memory and behavioural control. In addition, I hope to demonstrate how it might be possible to modulate inattention and apathy with neuromodulators.

- (1) Bays, P. M., and Husain, M. (2008). Dynamic shifts of limited working memory resources in human vision. *Science, 321*, 851–854.
- (2) Ma, W. J., Husain, M., and Bays, P. M. (2014). Changing concepts of working memory. *Nat. Neurosci. 17*, 347–356.
- (3) Bonnelle, V., Veromann, K.-R., Burnett Heyes, S., Lo Sterzo, E., Manohar, S., and Husain, M. (2014). Characterization of reward and effort mechanisms in apathy. *J. Physiol.* Paris.

Keynote Lecture

Semantic cognition and its disorders: Insights from convergent neuroscience methods

Matthew Lambon Ralph [1]

[1.] School of Psychological Sciences, University of Manchester

Semantic cognition (semantically-driven behaviour) is a crucial, core element in verbal and nonverbal activities. Many different neurological disorders generate semantic impairment as a result of damage to one or more aspects of semantic cognition, including representation, control and access. Using convergent clinical and basic neuroscience methods (including neuropsychology, computational modelling, function and structural neuroimaging, TMS, etc.) we are beginning to map out the various key neural networks and their connectivity, and understand how the computations in this kind of distributed neural network give rise to semantic cognition.

Symposium: EEG correlates of reward and prediction errors: a biting challenge.
Chair: Deborah Talmi [1]

[1.] University of Manchester, UK

A dominant theory (Holroyd & Coles, 2002, Psychological Review) suggests that a component of the event-related brain potential (ERP) called the feedback error-related negativity (FRN) indexes a reward prediction error signal. The theory is predicated on the assumption that dopamine-related reward prediction error signals modulate on-going neurophysiological activity produced in anterior cingulate cortex, where the reward positivity is generated.

Recent studies, however, provide a strong challenge for this theory by suggesting that the FRN reflects salience rather than reward prediction errors. Should the dominant theory be revised – or even discarded? Do the new findings mean that it is impossible to study reward prediction error in humans with adequate time resolution? Or do they teach us something about the specific experimental conditions that elicit the FRN, and shed light on how it should be measured?

In this symposium researches that challenge the dominant theory and the author of this theory will have a chance to debate these issues.

The reward positivity ERP signal

Clay Holroyd [1]

[1.] University of Victoria, Canada

The feedback-related negativity is a negative deflection in the event-related brain potential elicited by negative feedback stimuli but not by positive feedback stimuli in trial-and-error learning and guessing tasks. I will present evidence that this negative deflection is in fact a common N200 ERP component that is elicited by improbable task-relevant stimuli such as by infrequently occurring stimuli in an oddball task. Further, unexpected positive events produce a positive-going ERP component called the reward-positivity that cancels out the N200, giving rise to the difference in the ERPs between positive and negative feedback. The reward positivity is best isolated with a difference-wave approach that a) removes the confound of component overlap, and b) captures variance in the ERP related to reward feedback. Individual differences in reward processing are reflected in the amplitude of the reward positivity on correct trials rather than in the amplitude of the N200 to error trials.

ERP markers for surprising physical pain and bitter taste

Deborah Talmi [1], Emily Hird [1] & Wael El-Deredy [1]

[1.] University of Manchester

Holroyd's dominant theory contends that the Feedback Related Negativity ERP reflects the operation of the neural system underlying reinforcement learning in humans. We

tested this theory by investigating whether FRN will also be observed for an inherently aversive outcome: physical pain. In another session, the outcome was monetary reward instead of pain. As predicted, unexpected reward omissions (a negative reward prediction error) yielded a more negative deflection relative to unexpected reward delivery. Surprisingly, unexpected pain omission (a positive reward prediction error) also yielded a negative deflection relative to unexpected pain delivery. If the FRN expresses aversive prediction errors with the same sign as reward prediction errors then it does not signal reward prediction error in humans. A follow-up experiment will be discussed where we replicated our previous design but matched the modality of the positive and negative rewards.

A multimodal investigation of the Feedback-Related Negativity: Insights into the localization, meaning and network organization

Tobias Hauser [1]

1. UCL

Reward prediction errors (RPEs), signals which indicate expectation violations, are well known to drive learning and decision making in the human brain. Numerous studies using functional magnetic resonance imaging (fMRI) showed that many areas along the medial cortical wall encode RPEs. In electroencephalography (EEG), the Feedback-Related Negativity (FRN) is the main component which has been suggested to reflect RPE processing. However, recent findings questioned the FRN to reflect pure RPE signals. Moreover, the localization and its role within the RPE network is still unclear. In my talk, I will show data from simultaneous EEG-fMRI in which we tried to address these open questions. We found that the FRN reflected unsigned, rather than signed prediction errors. Moreover, our analysis confirmed that the FRN most possibly originated from the dorsal anterior cingulate cortex. In the latter part of the talk, I will present a novel approach to integrate EEG and fMRI which allows us to disentangle the time course of several areas which are involved in RPE processing and may overcome the analysis of single event-related components.

Mediofrontal negativity signals unexpected omission of aversive events

Sara Garofalo [1], Martin E. Maier [1,2] & Giuseppe di Pellegrino [1]

1. Center for Studies and Researches in Cognitive Neuroscience, University of Bologna, Italy
2. Catholic University of Eichstätt, Germany

Research based on event-related potential (ERP) reported mediofrontal negativities following unexpected negative feedback or performance error. Some authors proposed that these signals reflect reward prediction error for worse than expected outcomes, while others suggested that mediofrontal negativities express medial prefrontal cortex coding for unexpected non-occurrence of a predicted outcome, whether worse or better than expected. Moreover, studies reported mediofrontal negativities as depending on feedback valence (worse vs. better than expected events), while others proposed that valence might be irrelevant and that other features of the unexpected event might be

responsible for such neural response (such as, delivery vs. omission and timing of feedback). To shed light on the still debated role of mediofrontal negativities, two studies will be presented which investigated ERPs during Pavlovian aversive conditioning. In the first work the focus is on the neural response consequent to the unexpected-omission of electric shocks; in the second work a similar paradigm is used to look at the neural response consequent to the presentation of an expected feedback at an unexpected time. In both cases, ERP analysis evidenced stronger mediofrontal negativities for unexpected events. Methodological and theoretical implications will be discussed.

Time of the signs: Event-related potentials code unsigned and positive reward prediction errors in different intervals

Thomas D. Sambrook [1] & Jeremy Goslin [1]

[1.] School of Psychology, University of Nottingham. lpxsk1@nottingham.ac.uk

Models of reinforcement learning represent reward and punishment in terms of reward prediction errors (RPEs), quantitative signed terms describing the degree to which outcomes are better than expected (positive RPEs) or worse (negative RPEs). An effective reinforcement learning system should be capable of representing both kinds of RPE to allow the computation of net worth. An electrophysiological component known as feedback related negativity (FRN) occurs at frontocentral sites 200 – 350 ms after feedback on a reward or punishment is obtained, and has been claimed to neurally encode an RPE. An outstanding question however, is whether the FRN is sensitive to the size of both positive RPEs and negative RPEs. Previous attempts to answer this question have examined the simple effects of RPE size on positive RPEs and negative RPEs separately. However, this methodology can be compromised by overlap from components coding unsigned prediction errors, or "salience", which are sensitive to the absolute size of a prediction error but not its sign. In our study rewards and punishments were parametrically modulated using both reward likelihood and magnitude, with principal components analysis used to separate out overlying components. This revealed a single component responsive to the size of positive RPEs at ~330 ms and components responsive to unsigned prediction errors at approximately 250, 410 and 530 ms. No component sensitive to negative RPEs was found.

Symposium: The neurochemistry of human cognition in health and disease.
Chair: Stephen Jackson

Integrative approach to individual differences in decision-making: anatomical, neurochemical, and neuromodulatory perspectives

Frederic Boy [1]

[1.] Swansea University

Having the ability to quickly override prepotent response and to select alternative choices is key to rapid but flexible decision-making. In this talk we will examine this issue from various angles and show that differences in how one produces an oriented behaviour are deeply rooted, and already present at the neuroanatomical and neurochemical levels.

Metabolite changes by transcranial direct current stimulation in the human primary motor cortices

Velicia Bachtiar [1]

[1.] University of Oxford

Modulation of the human primary motor cortex (M1) using transcranial direct current stimulation (tDCS) has been shown to improve motor performance and motor learning behaviour in healthy populations and after stroke. Despite the increasing use of tDCS as a potential clinical tool, little is known about the neurobiological mechanisms underlying its effects. In patients post-stroke, widely distributed task-related activity can be observed when moving the paretic hand. Evidence from functional MRI studies suggest that tDCS is capable of modulating this activity at sites distant to the stimulating electrode, and these distant effects are likely to be important in understanding the beneficial effects of stimulation. However, studies have largely focused on the stimulated cortex and very few have looked at the neurochemical changes occurring in the non-stimulated hemisphere. The use of ultra high field (7T) spectroscopy allows for data from two voxels to be acquired simultaneously, with excellent spatial and temporal resolution. We investigate the neurochemical changes induced by tDCS to the right M1 in both the stimulated and non-stimulated hemispheres of healthy controls. The timing of changes in GABA with tDCS in both human primary motor cortices will also be discussed.

tDCS-induced alterations in GABA concentration within primary motor cortex predict motor learning and motor memory

Soyoung Kim [1]

[1.] School of Psychology, University of Nottingham

Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique which modulates cortical excitability in a polarity specific manner. The effects

last longer than the stimulation duration and these aftereffects are thought to be based on tDCS-induced alterations in neurochemistry and synaptic function. We investigated the neurochemical changes of tDCS delivered to the left primary motor cortex (M1) using ultra-high-field (7 Tesla) magnetic resonance spectroscopy (MRS) allowing the measurement of neurochemical concentrations in the defined brain area. Also we investigated if MRS-measured GABA levels can predict individuals' motor learning performances as motor cortex plasticity is known to be dependent on GABAergic activity. Participants' motor learning capacity was measured using a robotic force adaptation and de-adaptation task. As a result, we found that anodal tDCS can reduce GABA concentrations in left M1, and the magnitude of GABA concentration changes predict individual's motor learning and motor memory on the robotic force adaptation and de-adaptation task which is a form of a model-based learning.

A multi-modal exploration of GABA concentration changes in young people with Tourette Syndrome

Amelia Draper [1]

[1.] University of Nottingham

Tourette syndrome (TS) is a developmental neurological disorder characterised by vocal and motor tics and is associated with cortical-striatal-thalamic-cortical circuit dysfunction and hyper-excitability within cortical motor areas. GABA, the main inhibitory neurotransmitter in the brain, is altered in TS, as demonstrated by reduced short-interval-cortical inhibition response and post-mortem findings of reduced GABA-ergic inter-neurons. This reduction in GABA has been reasoned to accentuate hyper-excitability of cortical motor areas. We used ultra-high-field (7 Tesla) magnetic resonance spectroscopy to investigate in-vivo concentrations of GABA within the supplementary motor area (SMA) of individuals with TS, a region strongly associated with the cortical genesis for motor tics. We demonstrate that GABA concentrations within the SMA are paradoxically elevated in individuals with TS compared to a matched control group. GABA concentrations in the SMA were inversely related to 2 measures of cortical excitability: fMRI BOLD activation, and motor evoked potentials to TMS stimulation pre-ceding a volitional movement in the TS group. GABA concentrations were also positively related to the integrity of white matter of the corpus callosum connecting the SMA across hemispheres (as measured by Diffusion Tensor Imaging). By combining information from different techniques, we can conclude that tonic levels of GABA in the SMA relate to cortical excitability, and inter-hemispheric connectivity, in Tourette Syndrome.

Symposium: MEG studies of language and semantics.
Chair: Beth Jefferies

The first 500 ms in visual word recognition: who is talking to whom?

Piers Cornelissen [1]

1. Psychology Department, Faculty of Health and Life Sciences, Northumbria University (e-mail: piers.cornelissen@northumbria.ac.uk).

The ability to fluently and, seemingly effortlessly, read words is one of few uniquely special human attributes, but one which has assumed inordinate significance because of the role that this activity has come to have in modern society. Visual word recognition results from a dynamic interplay between multiple nodes in a distributed cortical and sub-cortical network. To fully understand how it is achieved, we need to identify not only the necessary and sufficient compliment of nodes that comprise this network, but also how information flows through the nodes over time. Of particular interest are those parts of the network which support phonological access during visual word recognition. Recent magnetoencephalography (MEG) studies of reading have highlighted surprisingly early (~100ms) neural activity in the Left Inferior Frontal Gyrus (LIFG), activity which can be modulated by pseudohomophone priming tasks ('brein' primes 'BRAIN' more strongly than 'broin') and which is also sensitive to the masked onset priming effect ('gilp' primes 'GAME' more than 'dilp' for word naming, but not for lexical decision). These findings are consistent with rapid phonological access, mediated by fast computation of articulatory output codes from letter representations in higher order visual areas. However, the alternative possibility of modulation of LIFG driven by top-down control processes cannot be excluded. We therefore explored time sensitive directed connectivity between visual areas and the LIFG during reading. If LIFG activity reflects early access to phonology, we hypothesized that there should be early directed coupling from visual areas to LIFG.

Finding meaning in the brain

Olaf Hauk [1]

1. MRC Cognition and Brain Sciences Unit (e-mail: Olaf.Hauk@mrc-cbu.cam.ac.uk).

To what degree is semantic information processing dependent on classical language areas or semantic hubs, and to what degree on distributed brain systems including sensory-motor areas? In order to separate different stages of semantic information retrieval in time, and different brain networks in space, the spatio-temporal information from EEG/MEG measurements is required. We used EEG/MEG to address two issues: 1) If a brain area is a semantic hub, it should activate at the earliest stages of semantic information retrieval. 2) If sensory-motor areas play a role in semantics, their activation levels should affect language performance. We addressed these issues in EEG/MEG experiments using visual word recognition paradigms. With respect to issue 1), we only found effects of lexico-semantic variables before 250 ms in ATL, but not in AG and IFG. We conclude that the ATL serves as a semantic hub, linking word forms to distributed brain networks representing semantic information. With respect to issue 2), we used a

novel movement paradigm to investigate the effect of pre-activation of motor cortex on spatio-temporal brain dynamics and behaviour. Pre-activation by means of hand and foot movements reduced activation in posterior superior temporal cortex for hand- and foot-related words, respectively. However, we did not observe priming effects in our behavioural data. Our data support ATL's role as a semantic hub. However, characterising the contribution of sensorimotor areas to semantics, and especially establishing their behavioural relevance, remains a challenge.

Oscillatory dynamics in semantic cognition: Neural processes underlying semantic representation and automatic/controlled semantic retrieval revealed by MEG

Giovanna Mollo [1], Piers Cornelissen [1] & Elizabeth Jefferies [1]

[1.] Department of Psychology, University of York (e-mail: giovanna.mollo@york.ac.uk).

Semantic cognition entails the interaction of conceptual knowledge with control processes that shape retrieval. Conceptual knowledge involves modality-specific information in motor/perceptual "spokes", plus convergence in an amodal "hub" in anterior temporal lobes (ATL). In contrast, controlled semantic retrieval involves co-activation of inferior frontal (LIFG) and posterior middle temporal (pMTG) regions. Two MEG experiments explored these components and their interaction. First, we examined the retrieval of general and specific knowledge of tools and animals. Time-frequency analysis revealed early effects of both category and specificity in ATL (around 100ms). Power changes in visual and motor spokes were initially insensitive to specificity, but from 200ms, they responded more strongly to relevant categories when specific identification was required (e.g., animals>tools in visual areas; tools>animals in hand area). Thus, early coarse semantic processing of inputs in ATL might help to recruit an appropriate semantic network for ongoing processing. The second experiment contrasted relatively automatic and more controlled forms of semantic retrieval by comparing semantic decisions to strongly or weakly related word pairs, presented serially. ATL initially showed a stronger response to weak associates (around 100ms), suggesting it may trigger controlled retrieval when required; however, from 250ms, the response was greater for strong associations. A transient response to weak associations was also observed in LIFG at 250ms, while in pMTG this response was sustained. Thus, from 250ms, there was a double dissociation in temporal cortex, with ATL showing a stronger response to strong associates and pMTG showing a stronger response to weak associates (i.e., controlled retrieval).

Dynamic information processing states during meaningful object recognition

Alex Clarke [1] & Lorraine K. Tyler [1]

[1.] Department of Psychology, University of Cambridge.

Understanding the meaning of visual objects is an extremely rapid and effortless cognitive ability. Recognising objects relies on highly dynamic, interactive brain networks to process multiple aspects of object information to establish a coherent semantic representation. To fully understand how different forms of object information are represented and processed in the brain requires a neurocognitive account of object

recognition that combines cognitive accounts of semantics knowledge with a neurobiological model of visual object processing. Here we ask whether specific kinds of semantic information are reflected in neural activity recorded with MEG, and how semantic processing changes over time. Our MEG research across three studies converges to suggest that coarse semantic information, based on generic shared semantic knowledge, is rapidly extracted from visual inputs and may drive rapid category decisions. Subsequent recurrent neural activity between the anterior temporal lobe and posterior fusiform supports the formation of object-specific semantic representations - a conjunctive process primarily driven by the perirhinal cortex. These object-specific representations require the integration of shared and distinguishing object properties and support the unique recognition of objects. Our research shows clear evidence that semantic information plays a key role in the temporal formation of visual object representations, with the transition of information processing from a perceptual to conceptual form relying on feedforward and recurrent processing mechanisms.

Symposium: Neural synchronisation: from perception to representation.
Chairs: Paul Sauseng [1] & Simon Hanslmayr [2]

1. University of Surrey
2. University of Birmingham

Synchronicity of neuronal activity has been discussed as one of the key mechanisms in orchestrating and coordinating brain processes underlying human cognition. In this symposium findings from electrophysiological, neuroimaging and brain stimulation studies will be presented that highlight synchronisation of brain activity at different spatial scales as neural signature of perception, multisensory integration, attention and representation of sensory information in memory. The studies presented by the four speakers will allow insights as to how brain oscillatory activity is relevant for information processing at different cognitive levels.

Vincenzo Romei will present recent findings employing a novel methodological approach: "Oscillatory entrainment" of off-peak frequencies via tACS/EEG will provide direct evidence for a causal role of alpha-band oscillations during multisensory (audio-visual) interactions. **Mark Stokes** will present results from recent EEG and MEG experiments exploring the role of alpha power and phase in spatial attention and working memory. **Paul Sauseng** will discuss how fronto-parietal EEG theta activity is associated with encoding of visuospatial information into working memory. **Simon Hanslmayr** will present studies using MEG/EEG, EEG-fMRI, and rTMS-EEG which suggest that a local desynchronization in the alpha and beta frequency range is a prerequisite to represent information in the human long-term memory system.

Individual alpha peak frequency predicts and drives the temporal profile of the sound-induced double-flash illusion

Vincenzo Romei [1]

1. Centre for Brain Science, Department of Psychology, University of Essex.
vromei@essex.ac.uk

When two beeps are presented within an interval of ~100ms together with a visual flash, a second illusory flash is often perceived. This illusion vanishes for inter-beep intervals exceeding ~100ms, with substantial inter-individual variability. We observed that ~100ms correspond to an average oscillatory alpha-band cycle, which similarly shows inter-individual variability with alpha-peaks ranging between 8-14Hz. We therefore hypothesized that these two measures might be tightly linked. We tested this hypothesis by correlating in 22 participants the maximal temporal interval between two beeps that induced the perceived illusory flash and the inter-individual alpha-peak frequency recorded during task performance. We found that these two measures were strongly and significantly correlated ($r=.697$; $p<0.001$). We then tested whether this relationship was causal using an interventional approach. In 12 participants, we delivered transcranial Alternating Current Stimulation (tACS) over the occipital pole either at each Individual's Alpha Frequency (IAF) or at IAF±2Hz, to entrain oscillatory activity at IAF vs. far from IAF within the alpha-band. If IAF plays a causal role in this illusion, we hypothesised that modifying IAF to slower/faster frequencies should bias

the temporal window of the illusion in expected directions. Crucially, occipital tACS at IAF+2Hz significantly shrunk whereas IAF-2HZ significantly expanded the temporal window of the illusion providing direct evidence that IAF causally determines this temporal window. We suggest that crossmodal alpha phase-reset is the most likely mechanism mediating this illusion (Romei et al., 2012; Curr Biol). We conclude that alpha oscillations represent the temporal unit of visual processing that cyclically gates perception.

Role of alpha oscillations in visual cortex in attention and working memory

Mark Stokes [1]

[1.] Oxford Centre for Human Brain Activity, University of Oxford.
mark.stokes@ohba.ox.ac.uk

During the delay period of working memory tasks it can be difficult to disentangle working memory maintenance from preparatory activity in anticipation of the upcoming memory probe. This study was designed to decouple the contribution of these two processes by investigating changes in the time-frequency spectrum (especially 10Hz 'alpha' activity) during the delay period by orthogonally manipulating the working memory load and need for top-down preparatory attention. Participants were presented with one, two or four memory items, and after a 2.5second interval, were probed for memory of a randomly selected item. Importantly, the contrast of the probe stimulus was also manipulated, with easy high contrast and hard low contrast blocks. This manipulation had a profound effect on memory response times, confirming the increased attentional demand of low contrast probe stimuli. EEG was analysed to track lateralised alpha over visual cortex during the delay period. When memory stimuli were lateralised, there was a relative decrease in alpha power at contralateral occipital electrodes. There was also an overall reduction in alpha power in preparation for the memory probe. Thus, alpha power in a working memory delay period reflects memory load and the expected demands of the memory probe. We consider these findings within a prospective coding framework, in which working memory is conceptualised as a forward model of expected task demands, rather than a temporary buffer for maintaining previous input, conceptually integrating classic working memory functions with preparatory attention. Delay activity reflects future processing demands that are determined by past experience.

To encode or not to encode: the role of fronto-parietal EEG theta activity in storing visual information in working memory

Paul Sauseng [1]

[1.] School of Psychology, University of Surrey, p.sauseng@surrey.ac.uk

Working memory is a system with limited capacity. When a vast amount of information is presented to the brain only a fraction can be selected for the temporary storage and further usage by this memory system. But not only the selection and successful encoding of information but also the efficient de-selection of irrelevant sensory input has been shown to be crucial for working memory processes. Here we present data from an EEG

study in healthy participants in which visuospatial memory items were displayed in a rapid serial presentation. This stream of visual information contained items which had to be encoded into working memory as well as items that had to be actively ignored and should not be encoded into memory. A fronto-parietal brain network was identified which coherently oscillated at theta frequency, and which selectively responded with transient amplitude increase to items that needed to be stored in working memory. This target-specific theta network response was positively correlated with inter-individual working memory capacity. Its response to distractor items, i.e. those which were to be ignored, on the other hand, was negatively correlated with working memory capacity. This indicates that coherent fronto-parietal theta oscillations are crucially involved in encoding of visuospatial information in working memory. If this activity is strictly tuned to relevant sensory input then working memory will not be over-flowed with irrelevant information. This fronto-parietal theta network responding to distracter items, however, indicates encoding of irrelevant information into working memory leading to a decrease in working memory capacity.

Does alpha/beta desynchronization represent information in human long-term memory?

Simon Hanslmayr [1]

[1.] School of Psychology, University of Birmingham, s.hanslmayr@bham.ac.uk

An important question in current memory research is how episodic memories are coded in the human brain and whether oscillatory brain signals can be used to decode these memories. A currently prevailing view states that episodic memories are coded in synaptic connections within neural assemblies, which are being formed by neural synchronisation, mostly in the theta and gamma frequency band. This view led to a strong focus on the role of theta/gamma synchronization in memory research. However, these ideas are challenged by recent studies showing that successful formation and retrieval of memories are accompanied by massive desynchronization within local neural assemblies. Such desynchronization effects manifest themselves in decreases of oscillatory activity in the alpha (8-12 Hz) and beta (15-30 Hz) frequency band. In a recent paper we proposed the *Information via Desynchronization Hypothesis*, which states that information is represented by desynchronized alpha/beta oscillatory activity. In this talk I will present evidence for this idea by showing data from MEG/EEG and intracranial EEG recordings where we adopted a new approach which applies temporal pattern similarity (TPSim) analysis to time-frequency data. The reported results suggest feasibility of this approach and show that TPSim analysis can be used to predict memory retrieval of visual memories and the reinstatement of contextual features of episodic memories. Together, these results support the Information via Desynchronization Hypothesis in showing that information about contents in episodic memories can be indeed extracted from desynchronized alpha/beta activity.

Open Session 1

I feel what you are doing: differential effects of observed and predicted touches

Toby Nicholson [1], Linda Solbrig [1], Matt Hudson [1], Patric Bach [1] & Steve Tipper [2]

1. University of Plymouth
2. University of York

Previous research has provided evidence that action observation is influenced by processes involved in action production. What is debated are the relative contributions of bottom up information and top down expectancies on these processes. Here, we tease both aspects apart by investigating the influence of action observation on tactile perception. In two experiments, participants watched hands reaching for objects or into empty space (mimed reaches), with the action either fully visible or obscured by an occluder, while having to detect stimulation on their own fingers. Experiment one measured the speed with which tactile stimulation was detected, and found that detection was facilitated by object presence, irrespective of occlusion. Experiment two used a signal detection paradigm to further investigate these processes. The data revealed that facilitated detection in the occluded and non-occluded conditions is driven by dissociable underlying processes, with one affecting tactile sensitivity and the other response bias. Together these findings reveal that both visual information and prior expectations concerning object-directed action alter tactile perception. More importantly, they show that both processes have different effects on the resulting action simulations.

Electrophysiological study of action-affordance priming between object names

Isabel Parsons [1] & Jeremy Goslin [1]

1. School of Psychology, University of Plymouth

There is increasing currency in the idea that linguistic meaning is grounded in embodied experience, evidenced by a growing body of behavioural and neuroimaging studies showing close integration of motor and language processes. We investigate this relationship by examining the perception of object names, primed with names of objects affording a similar type of action. We then compared the electrophysiology of this affordance-related priming with abstract category-based semantic priming (e.g. apple and banana) to isolate the embodied component of object-related representations. The experiment consisted of a go/no-go categorical decision task where participants decided whether a target word was a natural or man-made object. This target word (e.g. grape) was preceded by a masked prime word representing either a semantically related object (e.g. banana), an object affording a similar grip (e.g. tweezers), or an unrelated object (e.g. hammer). Analyses of the Go-responses revealed shorter reaction times and negative ERP between 428 and 708ms in the semantic priming condition compared to affordance or unrelated conditions. However, in the no-go trials the ERP for affordance priming was found to be significantly more negative than both semantic and unrelated priming conditions, with greater activity from 176ms after target onset in right prefrontal electrodes. These results suggest that while the motor program shared

between words did not appear to be of benefit when a motor response was required, it did require greater inhibitory control when participants were required to withhold their response. This further illuminates the role of motor processes during comprehension, supporting language embodiment.

μ and β wave suppression when reading the names of manipulable tools

Jeremy Goslin [1] & Caroline Chapman [1]

1. School of Psychology, University of Plymouth

Supportive evidence of the mirror neuron hypothesis and other related sensorimotor theories in humans have been provided by analyses of EEG mu (μ) and (β) beta rhythms, as they become desynchronised during both the execution and observation of motor actions. These findings have also been extended to show μ suppression when observing manipulable tools, thought to have special status due to their associated motor affordances. Other studies also provide evidence of motor involvement in speech perception, with action verbs suppressing μ and β rhythms. In this study we bring these two strands of research together to discover whether the comprehension of written nouns describing manipulable tools (e.g. hammer) would lead to greater suppression than nouns describing non-manipulable objects (e.g. star) or objects that are manipulable but not tools (e.g. strawberry). To this end wavelet analysis of spectral power between 8 Hz and 30 Hz were calculated on ERPs recorded over central electrode sites, with a cluster-randomisation procedures used to compare the spectro-temporal space between conditions. These revealed that tool words resulted in very similar cluster of frequency-power suppression when compared to the non-manipulable tools or manipulable non-tool objects, spanning 10-14Hz and occurring 200-400ms after word onset. Tool words were also found to suppress power in the beta (β) frequency range when compared with non-tool manipulable objects, spanning 24-30Hz between 110 and 220ms. This shows that sensorimotor activation during speech perception goes beyond the perception of action verbs to encompass the stored motor affordances associated with the names of manipulable tools.

Everything our brain can do with objects: from recognition to utilisation: A large-scale VBM study in sub-acute stroke

Johnny King L. Lau [1], Glyn Humphreys [2], Wai-ling Bickerton [1] & Pia Rotshtein [1]

1. School of Psychology, University of Birmingham
2. Department of Experimental Psychology, University of Oxford

Object processing is a multi-faceted function. Specifically, neuropsychological and imaging research suggests that object-related actions are supported by dorsal brain structures whilst object identification involves ventral structures (R1, R2). The current study examined the neural substrates underlying various aspects of object processing: i) object recognition from physical form (OFormR) and ii) from demonstrated 'use' gestures (OGestR) as well as iii) actual (AU) and iv) pantomimed use (PU) of objects. Four corresponding object-involved tasks taken from BCoS battery (R3) were administered to 247 stroke patients (119M, 70.4±14.5yrs). Clinical CT scans were

obtained to assess patients' grey matter (GM) integrity. A principal component analysis (PCA) was performed on the behavioural scores of the 4 tasks to isolate the underlying cognitive components. PCA identified a shared component (61.3% variance explained), a component isolating AU from the other 3 tasks (17.4%), a component separating mainly OFormR from ObjGestR (12.2%), and a component isolating PU from the other 3 tasks (9.1%). Correlations of GM and performances were tested using the raw task scores and also the identified principal component scores. OFormR was correlated to left (L) fusiform; deficit at AU could be predicted by lesions to L parieto-occipital fissure; deficit at PU was related to lesions to right posterior occipital lobe; lastly, poor OGestR ability was correlated to less GM in L parietal lobe covering infraparietal sulcus, bimedial frontal lobes and thalamus. This large-scale patient study provides further evidence for dissociation between object-directed actions in dorsal (parietal) structures and object form identification in ventral (temporal) structures respectively.

- (1) Yoon, E.Y., Humphreys, G.W., Kumar, S. & Rotshtein, P. (2012), The neural selection and integration of actions and objects: an fMRI study, *Journal of Cognitive Neuroscience, 24,* 2268-2279.
- (2) Goodale, M.A. & Milner, A.D. (1992), Separate visual pathways for perception and action, *Trends in Neurosciences, 15*, 20-25.
- (3) Humphreys, G. W., Bickerton, W.L., Samson, D. & Riddoch, M.J. (2012), *BCoS Cognitive Screen,* London: Psychology Press.

Open Session 2

Pattern completion for multi-element events in the human hippocampus

Aidan J Horner [1], Wen-Jing Lin [1], James Bisby [1] & Neil Burgess [1]

1. UCL Institute of Cognitive Neuroscience, London
2. UCL Institute of Neurology, London

The elements of episodic events, represented in neocortex, are thought to be bound into 'event engrams' by the hippocampus (1, 2), allowing for their retrieval via pattern completion, and 'reinstatement' in the neocortex (3). We have shown behavioural dependency between retrieval of different associations from the same event (4). For location-person-object events, if we remember the location we are more likely to remember the person and object from that same event. Further, this dependency is due to pattern completion at retrieval, rather than fluctuations in encoding strength (5). Pattern completion was also seen when the overlapping pairwise associations of an event were presented separately, but only when all possible within-event pairs were encoded, forming a 'closed-loop' associative structure, but not when incomplete 'open-loop' sets of pairs were encoded.

Using fMRI, we asked whether pattern completion is related to hippocampal activity and whether it results in the reinstatement of event elements in the neocortex. Participants learned events consisting of multiple distinct elements via separate presentation of

overlapping pairwise associations. At retrieval, all pairs from each event were tested. During encoding of the third pair from closed-loop events, hippocampal activity predicted subsequent memory performance for all within-event elements, supporting the idea that the hippocampus binds all event elements into an 'event engram'. During retrieval of a pair, hippocampal activity was greater for 'closed-loop' than 'open-loop' events, and correlated with reinstatement activity in the neocortex. Thus, we provide evidence for the reinstatement of event elements in the neocortex following hippocampal pattern completion.

- (1) Tulving E (1983) *Elements of episodic memory*, Clarendon Press, Oxford.
- (2) Damasio AR (1989) The Brain Binds Entities and Events by Multiregional Activation from Convergence Zones. *Neural Comput 1:*123–132.
- (3) Marr D (1971) Simple Memory: A Theory for Archicortex. *Philos Trans R Soc London B 262:*23–81.
- (4) Horner AJ, Burgess N (2013) The associative structure of memory for multi-element events. *J Exp Psychol Gen 142:*1370–1383.
- (5) Horner AJ, Burgess N (2014) Pattern Completion in Multielement Event Engrams. *Curr Biol 24:* 988–992.

Parsing the role of the hippocampus in avoidance and exploration

Eleanor Loh [1, 2], Marc Guitart-Masip [3], Zeb Kurth-Nelson [1], Emrah Duzel [1, 2] & Ray Dolan [1]

1. Wellcome Trust Centre for Neuroimaging, University College London, London
2. UCL Institute of Cognitive Neuroscience, London
3. Karolinska Institutet, Stockholm University, Stockholm, Sweden

While evidence points towards a prominent role for the hippocampus in the anxiety, avoidance and exploration, previous studies have not been able to map hippocampal contributions to more specific component processes (such as the tracking of aversive conditions, the generation of exploratory behaviours, or instrumental avoidance). To examine this issue in detail, we combined fMRI with a novel decision-making paradigm that invoked conflict between approach and avoidance. Subjects evaluated gambles that probabilistically indicated gain or loss, and decided whether to accept or reject them. Subjects were also given the option to 'explore' before making this decision – doing so would reveal, for a fee, a hint that reduced outcome uncertainty on that trial. By separating the options of 'rejecting' and 'exploring' gambles (i.e. performing risk assessment), we were able to parse hippocampal involvement to this process more finely than in previous experiments on aversive choice. The bilateral anterior hippocampus alone showed a greater response to gambles that subjects chose to reject, and activation of these regions was additionally correlated with state and trait anxiety scores across all subjects. In contrast, the decision to explore (i.e. perform risk assessment) was associated with activation a fronto-striatal network, as well as with decreased activation of additional clusters in the anterior hippocampus. Our findings suggest that the hippocampus plays an active role in the decision to avoid threatening conditions, rather than in the passive tracking of aversive conditions or the generation of risk assessment behaviours.

Breakthrough percepts – (Sub)liminal salience search and EEG deception detection on the fringe of awareness

Howard Bowman [1,2], Abdulmajeed Alsufyani [2], Marco Filetti [2] & Alexia Zoumpoulakiand [2]

1. School of Psychology, University of Birmingham
2. Centre for Cognitive Neuroscience & Cognitive Systems, University of Kent

We use the term (Sub)liminal Salience Search (SSS) to describe humans' extraordinary capacity to preconsciously "locate" stimuli that are salient to them [2]. A particularly compelling demonstration is Rapid Serial Visual Presentation, in which the vast majority of stimuli are not perceived sufficiently to encode into working memory (hence the term (sub)liminal), but ones that are salient breakthrough into consciousness and are encoded (hence the term search). In addition, the P3 is an EEG correlate of such breakthrough, giving a means to determine what a participant finds salient.

We will discuss how theories, such as the Simultaneous Type/ Serial Token model [1], explain SSS, and how it can be used in deception detection [2]. We will review our experiments showing that this Fringe-P3 identity detector is resilient against countermeasures, e.g. artificially elevating the response to the control stimulus [3]. Then we will present our new findings that famous names presented in RSVP break into awareness and that such breakthrough can be detected with EEG on a per-individual basis. This suggests that our Fringe-P3 method can be generalised beyond the exquisite salience of own-name, allowing its broad application in Forensics.

- [1] Bowman and Wyble (2007) The Simultaneous Type, Serial Token Model of Temporal Attention and Working Memory. *Psychological Review, 114(1).* 38-70.
- [2] Bowman et al (2013) Subliminal Salience Search Illustrated: EEG Identity and Deception Detection on the Fringe of Awareness. *PLoS-ONE, 8(1)*. 1-21.
- [3] Bowman et al. (2014) Countering Countermeasures: Detecting Identity Lies by Detecting Conscious Breakthrough. *PLoS-ONE, 9(3).* 1-17.

The role of frontal EEG theta activity in voluntary resource allocation in working memory

Barbara Berger [1], Annette Sterr [1] & Paul Sauseng [1]

1. Brain and Behaviour Research Group, School of Psychology, University of Surrey

Working memory (WM) consists of various cognitive processes and maintains and manipulates information no longer available in the environment. Individual processes are co-ordinated by a central monitoring component ensuring their efficient interaction. On cortical level frontal-midline theta (FMT, a slow EEG frequency found in prefrontal brain areas) was repeatedly found to be a prime candidate for serving as such monitoring component. FMT was shown to orchestrate local activity as well as distant brain areas in visual WM by synchronising fast oscillations (gamma, 30-80 Hz) in posterior brain areas into specific phases of the FMT cycles. This mechanism has been shown to be sensitive to task demands (the more demanding the task the closer to the excitatory phase of the FMT cycle) and causally linked to behavioural performance. Aim of the current study was to investigate whether this fronto-parietal theta-gamma

synchronisation reflects voluntary executive control in WM. We designed a dual-task delayed-match-to-sample EEG experiment where participants retained visuospatial and figural information simultaneously. Most importantly, they were instructed to either prioritise the visuospatial or the figural information in alternating blocks. We found that in brain areas sensitive to visuospatial information gamma activity was locked to the excitatory phase of FMT when participants prioritised visuospatial information. In contrast, when participants prioritised figural information the visuospatial-sensitive areas locked gamma to the inhibitory FMT phase. This suggests that FMT-phase acts as a central relay orchestrating distributed neuronal activity according to the subjective importance of task specific information to be retained in WM.

Age-related deficits or individual differences in inhibitory control: The importance of working memory capacity in a dual-task retrieval-induced forgetting paradigm

Julia C. Teale [1] & Malcolm D. MacLeod [1]

[1.] University of St Andrews

Recent research has established a relationship between measures of working memory capacity (such as the Operation Word Span) and memory inhibition (as measured by the Retrieval Induced Forgetting, RIF). Current research has also suggested that older adults may experience an age-related inhibitory deficit, although evidence for this remains mixed. The present study examined individual differences in memory inhibition in young and older participants who were first pre-screened and separated into high and low working memory capacity (WMC) groups. Our study indicated that whilst high and low WMC young adults still showed a significant forgetting effect consistent with an inhibitory account (RIF), only high WMC older adults demonstrated such a RIF effect. This may indicate that WMC, rather than age alone, determines whether an individual will have difficulty in effectively inhibiting inferring items in memory in later life.

Open Session 3

Brain network interactions after traumatic brain injury

Sagar Jilka [1]

[1.] Goldsmiths College, University of London

Interactions between the Salience Network (SN) and the Default Mode Network (DMN) are thought to be important for cognitive control. However, evidence for a causal relationship between these networks is limited. Previous work has shown that traumatic damage to white matter tracts within the SN predicts DMN dysfunction (Bonnelle et al., 2012). Here we investigate the effect of this damage on network interactions that accompany changing motor control. We initially used functional MRI of the Stop Signal Task to study response inhibition. In healthy subjects, functional

connectivity (FC) between the right anterior insula (rAI), a key node of the SN, and the DMN transiently increased during stopping. This change in FC was not seen in a group of traumatic brain injury (TBI) patients with impaired cognitive control. Furthermore, the amount of SN tract damage negatively correlated with FC between the networks. We confirmed these findings in a second group of TBI patients. Here, switching rather than inhibiting a motor response: (1) was accompanied by a similar increase in network FC in healthy controls; (2) was not seen in TBI patients; and (3) tract damage after TBI again correlated with FC breakdown. This shows that coupling between the rAI and DMN increases with cognitive control, and that damage within the SN impairs this dynamic network interaction. This work provides compelling evidence for a model of cognitive control where the SN is involved in the attentional capture of salient external stimuli, and signals the DMN to reduce its activity when attention is externally focused.

- Bonnelle VV, Ham TET, Leech RR, Kinnunen KMK, Mehta MAM, Greenwood RJR, Sharp DJD (2012) Salience network integrity predicts default mode network function after traumatic brain injury. *Proc Natl Acad Sci USA 109:*4690–4695.

The Effect of long-term stress exposure on ageing cognition

Amanda Marshall [1], Nicholas Cooper [1] & Nicolas Geeraert [1]

[1.] University of Essex

In a progressively ageing society there is a growing need to understand the processes impacting on age related cognitive and bodily decline in order prolong well-being and independence in old age. Therefore, a large field of research is engaged in exploring the numerous factors that may impact on the human ageing process. However, despite studies detailing the adverse effects of stress hormones on areas of the brain integral to successful cognitive performance, the possible effect of long-term stress exposure on cognitive ageing has received comparatively little scientific interest. We will present behavioural and EEG data gathered from a total of 120 participants (ages ranging from 18 to 85) over four experiments investigating the impact of experienced stress on cognitive functions such as spatial memory, working memory and inhibition. Data gathered from these tasks indicate that higher amounts of experienced stress among elderly individuals are related to poorer cognitive performance in working memory tasks. Furthermore, elderly participants reporting higher amounts of experienced stress exhibit reductions of event-related synchronisation in oscillatory dynamics linked to successful cognitive functioning, particularly in the alpha and gamma frequency bands. Observed oscillatory changes will be discussed in light of the insight they can offer into the cognitive processes impaired by heightened long-term stress exposure.

Do children with hearing loss show atypical attention during 'cocktail party' listening?

E. Holmes [1], P.T. Kitterick [2] & A.Q. Summerfield [1]

1. Department of Psychology, University of York
2. NIHR Nottingham Biomedical Research Unit

Individual differences in cocktail-party listening could arise from differences in either central attention or peripheral transduction. We aimed to isolate differences in attentional processing between children with normal hearing and children with hearing loss. During the presentation of acoustical stimuli, we expected to see differences in brain activity as a result of differences in peripheral processing of speech. Differences before the onset of acoustical stimuli were expected to reflect differences in attentional preparation for an upcoming talker.

Participants were 24 normally-hearing children and 11 children with moderate sensorineural hearing loss, all aged 7-16 years. We recorded brain activity using 64-channel electroencephalography. Two sentences spoken by adult talkers (one male and one female) were presented simultaneously from loudspeakers at two spatial locations (one left and one right) and a third 'child' talker was presented from straight ahead. Participants were cued, in advance of the acoustic stimuli, to either the location (left/right) or the gender (male/female) of the target talker. The task was to report key words spoken by that talker.

In normally-hearing children, cue-specific preparatory attention started approximately 950 ms after the onset of the visual cue and spanned posterior scalp locations. Sustained cue-specific selective attention started approximately 350 ms after the onset of acoustical stimuli. Children with hearing loss did not display cue-specific activity in either phase. This result suggests that hearing-impaired children do not utilise location or gender information systematically to prepare for an upcoming talker. This deficit may contribute to their difficulty following speech in noisy environments.

Visually-induced peak gamma frequency is higher in individuals with high levels of autistic traits

Abigail Dickinson [1], Myles Jones [1], Michael Bruyns-Haylett [1] & Elizabeth Milne [1]

1. Department of Psychology, University of Sheffield

Individuals with autism spectrum disorder (1) and those with a high amount of autistic traits (2) have been found to demonstrate superior orientation discrimination thresholds. Visually-induced peak gamma frequency has also previously been shown to be correlated with orientation discrimination thresholds (3). This study aimed to see whether individual differences in peak gamma frequency are correlated with individual differences in level of autistic personality traits. We used a psychophysical task to measure orientation discrimination in a neurotypical sample (N=33), and recorded electroencephalography in a separate session to measure visually induced gamma activity. Autistic personality traits were measured using the autism quotient (4). We found a significant relationship between peak gamma frequency and level of autistic

personality traits (r=.489, p=.004). We also found a significant relationship between orientation discrimination thresholds and both level of autistic personality traits (r=-.492, p=.004) and peak gamma frequency (r=-.544, p=.001). These results provide evidence that individuals with a higher level of autistic personality traits show both lower orientation discrimination thresholds and higher peak gamma frequency. In light of previous work which has associated higher peak gamma frequency with higher levels of inhibition (5) and higher levels of the inhibitory neurotransmitter, GABA (3), our results suggest that there may be an imbalance in levels of excitation and inhibition associated with the presence of autistic personality traits.

- [1] Bertone, A., Mottron, L., Jelenic, P., & Faubert, J. (2005). Enhanced and diminished visuo-spatial information processing in autism depends on stimulus complexity. *Brain, 128(10),* 2430-2441.
- [2] Dickinson, A., Jones, M., & Milne, E. (in press). Oblique Orientation Discrimination Thresholds Are Superior in Those with a High Level of Autistic Traits. *Journal of autism and developmental disorders.*
- [3] Edden, R. A., Muthukumaraswamy, S. D., Freeman, T. C., & Singh, K. D. (2009). Orientation discrimination performance is predicted by GABA concentration and gamma oscillation frequency in human primary visual cortex. *The Journal of Neuroscience, 29(50),* 15721-15726.
- [4] Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, malesand females, scientists and mathematicians. *Journal of autism and developmental disorders, 31(1),* 5-17.
- [5] Brunel, N., & Wang, X. J. (2003). What determines the frequency of fast network oscillations with irregular neural discharges? I. Synaptic dynamics and excitation-inhibition balance. *Journal of neurophysiology, 90(1),* 415-430.

ERP repetition effects indicate processing of unattended objects under load

Volker Thoma [1] & Elley Wakui [1]

[1.] School of Psychology, University of East London

Two short-lag repetition-priming experiments investigated the ERP correlates in processing (overtly) unattended objects. Previous studies have found view-dependent priming effects for repeated objects that were independent of spatial attention [1], whereas load theory [2] predicts that perceptual processing of irrelevant objects ceases once attentional resources have been depleted by a central task [3]. In Experiment 1 we used a central perceptual task while presenting line drawings of common objects in the periphery. Seventeen participants had to find one of two designated target letters under low load (among five identical non-target letters) or high load (different non-targets). The peripheral object image was either an object in an upright canonical orientation or an inverted (upside down) image. This was followed by a "probe" display with a single object – the 'prime object' repeated or a novel object - that was covertly named. Results revealed behavioural priming effects for 'unattended' images as well ERP repetition effects (RE) as indicated by deflections in N1 amplitudes (at 170 ms after probe onset) for upright objects only, independent of load. In Experiment 2 (n=18) both load and spatial attention were manipulated: Upright or rotated objects appeared pre-cued left or

right of fixation, while a second (irrelevant) object was presented at the other side. Again, repetition effects were observed at N1 for unattended objects under high load. Despite effective load manipulations at prime, the results challenge some predictions of capacity-based models and show surprising robustness of object processing without attention.

- [1] Thoma, V., Henson, R.N. (2011). Object representations in ventral and dorsal visual streams: fMRI repetition effects depend on attention and Part-whole Configuration. *NeuroImage, 57,* 513-525.
- [2] Lavie, N., 1995. Perceptual load as a necessary condition for selective attention. *Journal of Experimental Psychology: Human Perception and Performance 21,* 451-468.
- [3] Lavie, N., Zokai, N., Zhicheng, L., Thoma, V. (2009). The role of perceptual load in object recognition. *Journal of Experimental Psychology: Human Perception and Performance, 35 (5),* 1346-1358

Open Session 4

The time course of three-dimensional object recognition in human vision

Charles Leek [1], Mark Roberts [1], Zoe Oliver [1] & Alan Pegna [2]

1. Wolfson Centre for Clinical and Cognitive Neuroscience, School of Psychology, Bangor University
2. University of Geneva, and University Hospital of Geneva

One of the great mysteries of the human brain is how we are able to perceive and identify three-dimensional (3D) objects rapidly and accurately despite variability in viewing conditions and sensory input. While some kinds of image classification have been reported to occur as quickly as 80-150ms post stimulus onset (Thorpe et al., 1996, Nature), we know relatively little about the time course of different perceptual processes supporting object shape recognition. We investigated this issue using 1000 Hz, 64 channel event-related potentials (ERPs). Participants completed a perceptual matching task in which they had to make shape equivalence judgments about two sequentially presented 3D surface rendered multi-part novel objects. There were three types of different object trials: [1] Stimulus pairs could share local parts but differ in global spatial configuration; [2] contain different local parts but share global configuration; or [3] share neither local parts or global configuration. Analyses of the ERP waveforms showed no differences between conditions on the early P1 component – indicating that the conditions were well- matched in terms of low level image properties. In contrast, we found evidence of early differential sensitivity to local and global shape similarity. This was reflected in modulations of negative amplitude deflections on the N1 component approximately 170ms post stimulus onset on posterior sites. These findings are consistent with the hypothesis that object recognition is mediated by parallel perceptual processes operating at local and global spatial scales, and that rapid image classification may be accomplished using partial shape information based on the early outputs of these processing systems.

Integrating Visual Information Over Time

Geoffrey M. Boynton [1]

[1.] Department of Psychology, University of Washington, USA

Perceptual decisions often require integration of information across time. Even a static scene is effectively sampled over time via saccades. We are interested in how humans combine serially presented information into overall judgments of simple visual stimuli. For the first experiment, subjects viewed a sequence of 10 dots flashed at spatial positions drawn from a 2D Gaussian distribution. Subjects then used a mouse to indicate the perceived center of the sequence. A set of 10 weights was obtained for each subject that reflects the relative influence that dots in each temporal interval had on the overall judgment. The results show a much stronger weight for early dots-a 'primacy' effect. In a second experiment, subjects judged the mean size of serially presented discs that varied in size. Unlike judging the mean of the center of dots, judging mean size shows stronger weighting for discs presented later in the sequence – a 'recency' effect. We hypothesize that our results reflect different underlying neural mechanisms. Specifically, judging the center of a group of dots may be supported by the dorsal 'where' pathway that makes quick, heuristic decisions. Judging size, however, may tap into the ventral 'what' pathway associated with visual awareness and deliberate decision making. This hypothesis was tested with two further experiments: a motion direction task and a facial expression judgment task. As predicted, these prototypical 'dorsal and 'ventral' stimuli resulted in primacy and recency effects, respectively.

Distinct representations for rigid and non-rigid facial movements in face- selective regions of the human brain

Tessa R. Flack [1], David M. Watson [1], Richard J. Harris [1], Mark Hymers [1], Andre D. Gouws [1], Andrew W. Young [1] & Timothy J. Andrews [1]

[1.] Department of Psychology and York Neuroimaging Centre, University of York

Movements of the face play an important role in social communication. However, it is not clear whether there are distinct neural representations for different types of facial movement. In this study, we used fMRI to investigate the neural representations underlying changes caused by rigid and non-rigid movements of the face. In the first experiment, participants (n=83) viewed sequences of faces that varied in facial expression (non-rigid change) or viewpoint (rigid change). Each sequence of images could be from the same identity or contain different identities. Patterns of response were restricted to face-selective regions, defined by the contrast faces > scrambled faces. Using correlation-based MVPA, we found distinct patterns of response for facial expression and viewpoint within face-selective regions. A regression analysis showed that the patterns of response to expression and viewpoint were largely invariant to changes in identity and were consistent across participants. In the second experiment, we used an fMRI-adaptation paradigm to further explore these patterns. Participants (n=31) viewed sequences of faces in which both expression and viewpoint were varied. We found adaptation to expression (lower responses in conditions when expression was unchanged) and adaptation to viewpoint (lower responses when viewpoint was unchanged) occurred in largely non-overlapping regions of the face-selective network.

Together, these results reveal distinct topographic patterns of response for rigid and non-rigid movements in face-selective regions of the human brain. The segregation of regions involved in neural responses to changeable aspects of faces fits with the distinct social information that is conveyed by these different movements.

Patterns of response in scene-selective regions of the human brain are affected by low-level manipulations of spatial frequency

David M. Watson [1], Tom Hartley [1] & Timothy J. Andrews [1]

[1.] Department of Psychology and York NeuroImaging Centre, University of York

Neuroimaging studies have found distinct patterns of response to different categories of scene (e.g. indoor or natural scenes). However, the role of image properties in generating these different patterns of response is not fully understood. To address this issue, we directly manipulated the low level properties of images and investigated the effect on patterns of fMRI response. In the first experiment, a horizontal-pass or vertical-pass orientation filter was applied to images of indoor and natural scenes. The orientation filters did not affect participants' capacity to identify image categories. Moreover, orientation filtering did not influence patterns of neural response. For example, vertical-pass filtered indoor images and horizontal-pass filtered indoor images generated similar patterns of response. In the same way, vertical- and horizontal-pass filtered natural images generated similar patterns of response. In the second experiment, low-pass or high-pass spatial frequency filters were applied to the images. Again, the spatial frequency filters did not affect participants' ability to categorize images. However, in this case, the filters did have an effect on the patterns of neural response. Across scene-selective cortex, the similarity of patterns of response to different scene categories could be predicted by the spatial frequency filter applied to the images. For example, low-pass indoor images generated similar patterns of response to low-pass natural images, whereas high-pass indoor images generated similar patterns to high-pass natural images. These results suggest that patterns of response to scenes are sensitive to the low-level properties of the image, particularly the spatial frequency content.

Data driven identification of functional organization

Ione Fine [1] & Jason Webster [1]

[1.] Department of Psychology, University of Washington, USA

Current fMRI methods for examining cortical functional organization require experimental assumptions about stimulus categories or the region of interest (ROI). Conventional fMRI localizers rely on statistical contrasts between predefined stimulus conditions. Representational similarity analysis (Kriegeskorte et al., 2008), which quantifies the similarity of responses within a region of interest to a set of stimuli, requires a predefined ROI that has a homogenous selectivity profile. Here, we describe a method for identifying cortical regions that does not require assumptions about either the stimulus categorical structure or the ROI. Subjects passively viewed 72 3s video clips. In Experiment 1 clips were movies of faces, bodies, scenes, objects, scrambled

objects, and uniformly coloured screens (Julian, et al., 2012). In Experiment 2 clips were selected from public sites such as Vimeo and were selected to represent normal visual experience. For each vertex on the cortical surface, we calculated a vector of 72 beta-weights representing the response to each clip. The dissimilarity matrix for these beta-weights, was sorted using optimal leaf ordering for hierarchical clustering (Bar-Joseph, et al., 2001) to identify vertices with similar beta-weight vectors. When projected onto the cortical surface, vertex clusters reproducibly formed spatially contiguous regions. A subset of these regions almost perfectly matched conventionally identified category selective regions (e.g. FFA and PPA), while others were novel. Thus, this method successfully identifies functionally coherent cortical ROIs with similar responses without a priori assumptions about stimulus categorical structure.

Poster Session 1

Poster 01: Detecting deception in event related potentials using individual's weight template

Abdulmajeed Alsufyani [1], Alexia Zoumpoulaki [1], Marco Filetti [2] & Howard Bowman [1,3]

1. Centre for Cognitive Neuroscience and Cognitive Systems (CCNCS), School of Computing, University of Kent
2. Helsinki Institute for Information Technology, Aalto University, Finland
3. Department of Psychology, University of Birmingham

We propose a method for classifying Event related potentials (ERPs), which we call the Weight Template (WT). In this study, EEG data from two P300-based lie detection experiments were analysed to demonstrate the efficiency of the WT method in detecting deception [1, 2]. Typically, P300-based lie detection systems employ the P300 component to detect concealed information. They present three stimulus types: Probes (P), which represent concealed information, Irrelevants (I), which are frequent and task-irrelevant, and Targets (T), which are irrelevant items, but participants are asked to do a task whenever they see a Target. The principle underlying the WT method is that as the Target stimulus is task-relevant, it will evoke a robust P300 pattern for each subject, which we hypothesize is characteristic in form and polarity of that individual's P300. Accordingly, this T ERP can serve as an individual-specific template, with which to search for the Probe P300. A comparison was made with a common method used to measure P300 presence, called Peak-to-Peak, which is believed to be more accurate than other methods in measuring P300 amplitudes [3]. Using simulated EEG data [4], Receiver Operating Characteristic (ROC) curves were also generated to examine the efficiency of the proposed method in detecting deception in low signal-to-noise (SNR) ERPs. Our results revealed that the WT outperformed the Peak-to-Peak method in terms of sensitivity and specificity. ROC curve analysis using artificial EEG data also showed that WT performed better even in ERPs with low SNR.

- [1] H. Bowman, M. Filetti, A. Alsufyani, D. Janssen, and L. Su, "Countering countermeasures: detecting identity lies by detecting conscious breakthrough.," *PLoS One*, vol. 9, no. 3, p. e90595, Jan. 2014.
- [2] H. Bowman, M. Filetti, D. Janssen, L. Su, A. Alsufyani, and B. Wyble, "Subliminal Salience Search Illustrated: EEG Identity and Deception Detection on the Fringe of Awareness," *PLoS One*, vol. 8, no. 1, p. e54258, Jan. 2013.
- [3] M. Soskins, J. P. Rosenfeld, and T. Niendam, "Peak-to-peak measurement of P300 recorded at 0.3 Hz high pass filter settings in intraindividual diagnosis: complex vs. simple paradigms.," *Int. J. Psychophysiol.*, vol. 40, no. 2, pp. 173–80, Mar. 2001.
- [4] N. Yeung, R. Bogacz, C. B. Holroyd, and J. D. Cohen, "Detection of synchronized oscillations in the electroencephalogram: An evaluation of methods," *Psychophysiology*, vol. 41, no. 6, pp. 822–832, Nov. 2004.

Poster 02: Gaze cueing effect: Visual attention and group effect

Nazli Altin [1], Samantha Culpeck [2] & Jamie Ward [2]

1. University of Sheffield
2. University of Sussex

Eye gaze gives information about other people's focus of visual attention. Furthermore, perceiving the direction of gaze in others causes reflexive attentional shifts in the participant's attentional system. Here we examined whether belonging to a group would cause faster response and whether or not seeing a face gives an overall alertness for attention system. We hypothesized that seeing a face will call the attention and help them to locate the target independently from congruency. This will affect the timing but not the amount of the error. Making the error will be relevant to the congruency (congruent/incongruent) and group factor (in-group/out-group). Eye tracking were recorded while 29 participants viewed four different conditions (face fixation and face cue, face fixation and arrow cue, plus sign fixation and face cue, plus sign fixation and arrow cue), which were mixed and randomised in each block. To examine the within subject effect of faces, we did 3 way repeated measures analysis of variance for faces. As within participant factors we looked at congruency (congruent/ incongruent), pre-cue stimuli (no-cue/direct gaze) and faces (in-group/out-group). We have found that congruency were effective on both response time and errors. At congruent trials people tend to locate the target quicker and more correctly. We also found that pre-cue was significantly effective on responding time. Pre-cued (with face) trials cause quicker response on both correct responses and incorrect responses. We conclude that seeing face as pre-cue causes a general alertness in attention system and participant were able to response faster whether they are correct or not. There was no significant difference between response time to eyes and arrows as cue for locating the target and we did not find any effect of in-group/out-group.

Poster 03: The understanding of everyday object directed actions relies primarily on object, not movement information

Patric Bach [1], Toby Nicholson [1] & Matt Roser [1]

1. School of Psychology, University of Plymouth

Action goal understanding lies at the heart of social interaction. Prior research has primarily focused on motoric matching processes to explain this capacity, while largely ignoring the contribution of object information. Here we utilized fMRI to (a) identify regions involved in encoding the goal of others' actions, and (b) to compare the contributions of object or movement information to deriving these goals. Participants watched sequences of object-directed actions and either identified the action goals, the movements performed or the objects used. Three left hemispheric regions, the inferior frontal gyrus, middle temporal gyrus and medial frontal gyrus were more strongly activated in the goal task than in either the object or movement task, revealing a specific role in action understanding. More importantly, direct comparisons revealed that goal processing shares temporal and prefrontal activation with object processing, but not with movement identification. Subsequent parametric analysis showed that classic mirror neurons and motion sensitive regions become activated only when actions are

unfamiliar, or their goal is not clear. These data reveal that objects, not movements, may be the primary contributor to action understanding during everyday action observation.

Poster 04: Emotion affects prefrontal cortex activity during cognitive task performance: A change blindness functional near-infrared spectroscopy study

Robert Bendall [1] & Catherine Thompson [1]

[1.] Directorate of Psychology & Public Health, University of Salford

Research is increasingly demonstrating that emotional processes interact with our cognitions and that the prefrontal cortex (PFC) is heavily involved during such tasks. Higher naturalistic negative mood relates to reduced PFC activity during working memory tasks (Aoki et al., 2011). In addition increases in PFC activity have been observed when attending to visual art of positive valence (Kreplin & Fairclough, 2013). How emotion influences attentional processes and what the underlying role of the PFC is during attentional tasks warrants investigation. This study aimed to investigate if changes in PFC activity were evident during a change detection task following induction of positive and negative affect. PFC activity was measured during a change detection task with functional near-infrared spectroscopy. In a repeated measures design participants completed a change detection flicker task (Rensink, O'Regan, & Clark, 1997) immediately after viewing positive, neutral and negative stimuli. Changes in blood oxygenation were recorded throughout. Self-reported mood ratings demonstrated significant changes in psychological affect after viewing the differing stimuli. No changes in PFC activity were detected during the presentation of positive, neutral and negative stimuli. However, PFC blood oxygenation increased during the change detection task following the presentation of positive images. These results demonstrate that when completing an attentional task positive affect increases PFC activity. This suggests an increased recruitment of the PFC during attentional tasks under positive mood conditions relative to neutral, and builds upon research demonstrating increased PFC activity when viewing positively valenced visual art (Kreplin & Fairclough, 2013).

Poster 05: Focusing on happy faces facilitates working memory performance in an emotional n-back task in older participants

Natalie Berger [1] & Eddy J. Davelaar [1]

[1.] Department of Psychological Sciences, Birkbeck, University of London

Research indicates that ageing is associated with reduced working memory performance. However, prior studies have mainly used neutral material to investigate this age-related change. As ageing is associated with changes in attention and memory for emotion, it is an intriguing question how emotion interacts with working memory performance in ageing. The present research examined updating of emotional and neutral material in an n-back task in younger (20-34 years) and older adults (63-80 years). Participants responded to emotional and neutral faces and task relevance of emotion was manipulated by instructions to make same-different judgments based on the emotion of the face (i.e., task-relevant) or on the age of the face (i.e., task-irrelevant).

Results showed that older adults responded faster to happy relative to neutral faces when emotion was task-relevant and cognitive load was low (i.e., 1-back). In contrast, older adults responded marginally slower to happy relative to neutral faces when emotion was task-irrelevant. This pattern of results was not observed for younger adults who showed similar reaction times for happy and neutral faces. Results also revealed that increased cognitive load (i.e., 2-back) attenuated the effects of emotion on performance in older adults. These findings indicate that positive information can facilitate updating in older adults but only when emotion is task-relevant and when cognitive resources are available. However, this focus on positive information may interfere with cognitive performance in the presence of irrelevant emotional material.

Poster 06: Imitation performace subsequent to brain stimulation using tACS

Monica Berntsen [1], Nick Cooper [1] & Vincenzo Romei [1]

[1.] Department of Psychology, University of Essex. mbernt@essex.ac.uk

Attenuation of the mu rhythm in response to action observation is well established and is associated with mirror neuron activity. The extent to which this finding reflects human mirror neuron system (hMNS) involvement in action understanding remains controversial and causal evidence is indispensible to support the concept. Therefore, a neuromodulatory protocol using electroencephalogram (EEG) and transcranial alternating current stimulation (tACS) was designed to investigate whether hMNS can be causally linked to observable behaviour. tACS is an efficient and non-invasive tool used to modulate on-going rhythmic brain activity, and has been used to affect motor action execution. It is hypothesized that tACS applied to the parietal node of the hMNS network at individual alpha frequency (IAF) will modulate the mu rhythm and affect performance on a simple hand-movement learning task. Results will be discussed in hMNS framework.

Poster 07: The neural parcellation of visual search: A VBM approach

Magdalena Chechlacz [1] & Glyn W. Humphreys [1]

[1.] Department of Experimental Psychology, University of Oxford

The ability to search efficiently for visual targets amongst distractors can breakdown after a variety of brain lesions but the specific processes affected by the lesions are unclear. We examined spatial and temporal search tasks (conjunction and preview search) in a consecutive series of patients with acquired brain lesions who were also assessed on standard neuropsychological measures of visuo-spatial short-term memory (Corsi Block), sustained attention and memory updating (the contrast between forward and backward digit span) and visual neglect. Voxel-based morphometry and tract-wise lesion deficits analyses revealed regions in the occipital (middle occipital gyrus), posterior parietal (angular gyrus) and temporal cortices (superior and middle temporal gyri extending to the insula), along with underlying white matter pathways, associated with poor spatial and temporal search. These different brain regions showed contrasting correlations with the different neuropsychological measures of visuospatial deficits, suggesting that they play functionally different roles in visual search. We conclude that

neuropsychological disorders of search can be linked to necessary and distinct cognitive functions, according to the site of lesion.

Poster 08: Memory in middle age: hippocampal and midbrain contributions to performance

Francesca Cormack [1], Sally Butterfield [1], Marta Corriera [1] & Susan Gathercole [1]

1. MRC Cognition and Brain Sciences Unit, Cambridge

The substantia nigra/ventral tegmental area (SN/VTA) is a major source of dopaminergic neurons, innervating both prefrontal cortex and hippocampus. There is growing evidence that dopamine modulates the encoding and consolidation of declarative memory, and that age-related degeneration of the dopaminergic system may play an important role in cognitive decline. We used magnetisation transfer imaging (MTI) and a 3D T1 weighted MRI sequence to index structural integrity of the SN/VTA and hippocampus in middle age (40-60 years, mean age 51), a time when age-related decline in executive function and episodic memory begins to emerge. 32 participants underwent imaging and standardised assessment of episodic memory (Doors and People), working memory (AWMA) and intelligence (WASI). MRI data were analysed using SPM8 and MRIcron. Using voxel based analysis of the MTI and T1 sequences we found that the integrity of both the SN/VTA and left hippocampus were associated with measures of episodic memory, visual working memory and non-verbal intelligence. Volumetric analysis of the hippocampus showed more restricted correlations between left hippocampal volume and recall performance. Integrity of the dopaminergic system in middle age is associated with performance on tasks sensitive to age-related decline and may therefore be an important target for early interventions to improving cognition. However, the pattern of results suggests that the impact of SN/VTA on episodic memory in the present study may be mediated by the general effects of dopamine on motivation, executive function and processing of novel information, rather than on up-regulation of memory consolidation.

Poster 09: The brain consequences of heart surgery: frequency and spatial distribution of MRI identified brain lesions

Francesca Cormack [1], Leonardo Bevilacqua [2], Alex Shipolini [3] & Alexandra M. Hogan [3,4]

1. MRC Cognition and Brain Sciences Unit, Cambridge
2. The Anna Freud Centre, London
3. The London Chest Hospital, Barts Health/Queen Mary University, London
4. Developmental Cognitive Neuroscience Unit, UCL Institute of Child Health, London

Brain pathology is a recognised complication of cardiac surgery. We conducted a systematic review to explore MRI-identified neuropathology prevalence in patients before and after coronary artery bypass graft surgery. A literature search was conducted for studies published since 2000 with brain-imaging as an end-point. Abstracts were reviewed by two authors (F.C., L.B.) to confirm appropriateness of inclusion. Data were then extracted by L.B. and checked for discrepancies/data entry errors by F.C. The main outcomes were 1) white matter hyperintensities (WMH); 2) lesion presence/ location

on diffusion weighted imaging (DWI); 3) clinical stroke. Prevalence rates were analysed using meta-analytic methods. Spatial distribution of lesions was analysed using MRIcron software, with lesions overlaid in stereotactic space. 23 studies are included, containing data from 3810 patients. Pre-operative neuropathology was reported in 9 studies. The pooled prevalence of was 50% [44-64] for WMH, and 20% (95%CI [7-34]) for DTI lesions. Post-operative neuropathology was reported in 18 studies. Clinical stroke affected 2% (95%CI [1-3]) of patients, while clinically-silent DTI lesions occurred in 24% (95%CI [19-44]). Ten studies provided sufficient data on lesion location to permit mapping. The frontal lobes, particularly the areas served by the anterior cerebral artery, had the highest density of lesions. The relationship between brain pathology and cognitive outcome was explored in 8 studies, with an equal number of studies reporting positive and negative findings. These data provide important new insights into the frequency and spatial distribution of brain lesions before and after surgery.

Poster 10: Semantic control in semantic dementia

Eddy J. Davelaar [1] & Jeremy T. Tree [2]

1. Birkbeck, University of London
2. University of Swansea

We present findings from two patients with semantic dementia, suggesting that these patients exhibited semantic processing capability despite being impaired on several neuropsychological tests of semantic cognition. Through computational modelling, we show that control processes that have previously been unidentified may be masking the patients' true semantic processing power. The insights come from the failure of two models in capturing the data of control groups who have intact semantic memory and intact control processing. The results point to ways of developing more sensitive measures for semantic control in dementia patients.

Poster 11: The dissociated self: Realistic threats to one's own body reveals suppression in autonomic emotional reactivity in those predisposed to dissociative hallucinatory experiences of the self

Hayley Dewe [1] & Jason J. Braithwaite [1]

1. School of Psychology, University of Birmingham

This study investigated whether those predisposed to signs of anomalous dissociative/hallucinatory experiences pertaining to (i) one's 'self' (Depersonalization), and (ii) one's surroundings (Derealization), would also show aberrant emotional reactivity towards a perceived physical threat to their own body. The magnitude of emotional responses to the threat, and their habituation across repeated threats were explored. Ninety participants completed the Cambridge Depersonalization Scale (Sierra & Berrios, 2000) to provide a measure of predisposition to Depersonalization / Derealization experiences. Participants took part in a newly devised illusory body-threat task on their real hands ('Real-Hand' Illusion). This consisted of a simulated blood-giving procedure using a highly realistic syringe and retractable needle. Once the needle was "inserted", the experimenter pulled the plunger back and the syringe seemingly fills

with realistic blood. Emotional arousal of three threats were measured; (i) phenomenologically via exit questionnaires; and (ii) more objectively via anxiety responses (threat-related skin conductance responses; SCRs, and body-temperature). The SCR data were standardised via Z-score transformations to facilitate an individual-differences analysis. Participants predisposed to Depersonalization / Derealization experiences revealed; (i) significantly attenuated SCRs towards the first threat, and (ii) reduced habituation across the three threat-SCR responses, compared to those with a low predisposition (Controls). No significant differences were observed for body-temperature. Findings demonstrate evidence for aberrant emotional processing in those predisposed to dissociative bodily experiences. This lack of emotional colouring in human experience may help to explain some of the phenomenological aspects of dissociative experience where the "self" and one's surroundings are typically described as being unreal, lifeless, and dulled.

Poster 12: ERP evidence of reduced spatial selectivity in those with high levels of self-reported autistic traits

Stephanie Dunn [1], Megan Freeth [1] & Elizabeth Milne [1]

[1.] The University of Sheffield

Selective attention is atypical in those with autism and those with high levels of autistic traits when compared to typically developing controls / those with fewer autistic traits. We investigated the neural basis of this by comparing ERP components reflecting the allocation of spatial attention (N2pc), target processing (NT) and distractor suppression (PD) in individuals with high or low levels of self-reported autistic traits. Neurotypical students with either high or low levels of autistic traits as measured via the Autism-Spectrum Quotient (AQ) were recruited to participate in one of two experiments. In experiment one (n = 33), the N2pc ERP component was elicited and compared between groups. Experiment two (n = 41) elicited the N2pc, the PD and NT (Luck et al., 1997; Hickey et al., 2009). Participants with more autistic traits had significantly larger N2pc amplitude than participants with fewer autistic traits. In experiment two those high in autistic traits also showed attenuated distracter positivity (PD). There was no difference in the amplitude of the NT. These results suggest that the allocation of spatial attention differs in those with high levels of autistic traits compared to those with fewer autistic traits. Specifically, an attenuated PD in those with higher levels of autistic traits suggests reduced distractor suppression, which could be a by-product of an enhanced perceptual capacity (c.f. Remington et al. 2009).

Poster 13: Individual variability in response to transcranial Direct Current Stimulation (tDCS)

Katherine Dyke [1] & Stephen Jackson [1]

[1.] School of Psychology, University of Nottingham

Transcranial direct current stimulation (tDCS) is an increasingly popular neuro-stimulation technique, which can be used to influence cortical excitability both during and after stimulation. Typically these effects are short lived, but it is theoretically

possible that tDCS may be able to induce long lasting changes in the brain. This has led to exploration of the therapeutic potential of tDCS, and yielded some encouraging results, however, tDCS is relatively far from being an established therapeutic technique.

One of the major challenges for therapeutic tDCS will be to address individual variability. tDCS is often cited to have polarity specific effects on cortical excitability; anodal stimulation is thought to increase excitability whereas cathodal decreases it. However, recent work suggests both the size and direction of tDCS induced changes may vary between individuals. In this piece of research individual variability in response to different intensities and polarities of tDCS is investigated. tDCS was applied to the motor cortex area of the brain for 20 minutes at 1mA or 2mA. Resultant changes in cortical excitability were then measured using Transcranial Magnetic Stimulation (TMS). High levels of inter individual variability were found for both anodal and cathodal stimulation at both 1 and 2mA. The results suggest that the established pattern of polarity specific effects may not be as stable as previously expected.

Poster 14: Motor imagery during action observation increases prefrontal and primary sensorimotor activity in EEG, and can enhance automatic imitation in rhythmical actions

Daniel L. Eaves [1,2], Lawrence P. Jr. Behmer [3] & Stefan Vogt [2]

1. Teesside University
2. Lancaster University
3. Washington State University, USA

Action observation (AO) and motor imagery (MI) are typically used separately for enhancing both motor learning and rehabilitation. Instead, instructing MI during AO (i.e., 'AO+MI') can enable the learner/client to better 'embody' an observed action (Eaves et al., 2014). Here we studied the behavioural and neurophysiological effects of two combined AO+MI instructions, relative to both pure AO and pure MI alone. In both AO+MI conditions participants saw an instructed action (picture), then a rhythmical distractor (movie), wherein cycle time was manipulated. They then executed the instructed rhythmical action. When MI was synchronised with distractor AO (synchronised AO+MI) subsequent rhythmical actions were closer to the distractor speeds, compared to either imagining a static hand posture during AO (static AO+MI), or pure MI of the instructed action. This suggests sensorimotor couplings were tighter during synchronised AO+MI, relative to the other two execution conditions. High-resolution electroencephalographic (EEG: 128 electrodes) revealed stronger mu and beta suppression (i.e., increased mirror neuron activity) for synchronised AO+MI, relative to both pure AO and pure MI. Furthermore, alpha suppression in the prefrontal cortex (BA9 / BA10) was more pronounced for synchronised AO+MI compared to the other three conditions. This suggests additional supervisory control and monitoring processes might have underpinned the behavioural advantage obtained for synchronised AO+MI. In other words, perhaps this activation supports the cognitive processes that provide a gateway to embodying an observed action. Based on these findings, we propose motor learning and rehabilitation programmes should incorporate combined AO+MI instructions.

Poster 15: The role of event structure in memory for event duration

Myrthe Faber [1] & Silvia Gennari [1]

[1.] Department of Psychology, University of York

In everyday life, we use our ability to remember and estimate how long actions take in the real world. Previous studies have shown that our memory of duration can be distorted. Here, using behavioural and fMRI methods, we investigate what cognitive abilities underlie our ability to remember and estimate duration, and how the complexity of what happened in an interval of time affects how long we remember that interval to be. Using 30 triads of short animations of simple shapes interacting with each other, we investigate the effect of event complexity on estimates of duration. We manipulate the underlying causal structure of each animation within each triad in order to obtain three conditions of increasing event complexity but equal clock duration. Each participant is presented with one condition of each triad. While studying the animations, participants are unaware that they will have to estimate duration. Our results suggest that duration estimates are significantly affected by complexity, i.e., as complexity increases, so do duration ratings. Furthermore, activity in the hippocampus linearly increases as a function of complexity while people estimate durations in the fMRI scanner. We argue therefore that manipulating the underlying event structure could be a fruitful way of investigating distortions in memory of duration, and that systematically manipulating these structures could be a step forward in investigating the cognitive and brain mechanisms underlying memory for duration.

Poster 16: Characterising emotion processing in the Amygdala

Jess Fielding [1], A. McNamara [1] & A. Sterr [1]

[1.] Department of Psychology, University of Surrey

Appraisal theories propose that emotions are adaptive responses to environmental cues relating to well-being. An organism receives incoming stimuli, assesses the nature of the stimuli and reacts accordingly. This framework allows for individual differences in response to the same stimuli and potentially enhances understanding of maladaptive emotion processing (e.g. phobias, or post-traumatic stress syndrome). With the present study we aimed to investigate amygdala characteristics using fearful and happy faces as exemplar emotions. FMRI data was collected from forty-nine healthy volunteers (aged 19-45, mean 24.18) during a backwards masking paradigm subliminally presenting happy and fearful faces in a block design. Masked face blocks passively observed by participants were interleaved with rest blocks. Whole brain analysis revealed significant global activation of bilateral amygdala for happy and fearful face stimuli. Additional analysis showed greater reduction in activity over time in female participants compared to male participants. Moreover, activity was greater in the right over the left amygdala in participants. Findings support the suggestion that the amygdala is not specialised for fear processing as we observed no significant differences between the two emotion conditions. Furthermore, results suggest habituation and lateralisation of amygdala activation in emotion processing is modulated by gender. Through systematic investigation we demonstrate how careful consideration of contributing factors (e.g. group demographics) can reveal a more complex and comprehensive explanation of

such processes. Ultimately, deeper understanding allows us to tease apart typical mechanisms and enhance understanding of atypical emotion processing.

Poster 17: The neural response to social and non-social cues in those with high/low autistic traits

Megan Freeth [1] & Elizabeth Milne [1]

[1.] University of Sheffield

Individuals with autism process social information in an atypical manner. In particular although they are generally interested in social information, attention tends not to be rapidly captured by such stimuli. In addition, although both social and non-social cues have been shown to direct attention in those with autism, behavioural tasks have suggested that attention is not captured as strongly at a cued location as it is for typically developing individuals. Here we investigated the neural signatures of social/non-social stimulus discrimination, attention cueing, attention capture and target anticipation in participants who were either high or low in autistic traits using an ERP paradigm. The neural correlates of stimulus-type discrimination, attention capture and target anticipation were observed but no differences between groups were found in terms of attention capture and target anticipation. However, significant differences between groups were observed in terms of social/non-social discrimination. Results indicated that increased attentional resources were allocated to stimulus discrimination in the low autistic traits group (evidenced by significantly larger N1s overall) and there was a larger N170 observed in the high autistic traits group. A potential explanation being that although fewer resources were allocated to discrimination in the high autistic traits group, this group exhibited a more effective discriminatory response in terms of social/non-social stimulus processing.

Poster 18: Are fixation-related potentials related to blank stares and change detection differ only in case of highly confident decisions?

Agnieszka Fudali-Czyz [1]

[1.] Department of Experimental Psychology, The John Paul II Catholic University of Lublin, Poland

Attentive blank stares mean a failure to notice changes in a visual scene, despite looking at the area of change [1]. In previous research, I and my colleagues demonstrated by means of the EFRP method that the cases of attentive blank stares are accompanied by lower amplitude of the lambda response compared to cases involving change detection [2]. It is considered that the lambda response can be modulated by attention [3]. In this research I compared eye fixation-related potentials on the changing locations under conditions where a change was noticed or not (blank stares), taking into account different level of decisions' confidence. There were 30 subjects (17 female, 13 male, M=21,7 years). Due to problems maintaining a satisfactory calibration results from nine subjects was eliminated. Subjects decided whether there was a change in the size of an object and rated their confidence about their decisions. The change detection task was performed just after saccadic eye movement and was based on flicker task in which

sequential exposure of two scenes - original (100 ms) and modified (100 ms) - was separated by blank screen (400 ms). There was lower amplitude of the lambda response at occipital electrodes and N400-like component at parietal electrodes for blank stares than fixations ended with change detection. However N400-like effect was significant only for answers with great deal of confidence. It seems that the true blank stares effect occurs only when person is highly confident that there was no change when in fact it took place.

- [1] Caplovitz, G. P.; Fendrich, R.; and Hughes, H. C. (2008) Failures to see: Attentive blank stares revealed by change blindness. *Consciousness and Cognition, 17*. 877–886.
- [2] Fudali-Czyz, A.; Francuz, P.; Augustynowicz, P. (2014) Determinants of attentive blank stares. An EFRP study. *Consciousness and Cognition* (accepted 2014).
- [3] Takeda, Y.; Sugai, M.; and Yagi, A. (2001) Eye fixation related potentials in a proof reading task. *International Journal of Psychophysiology, 40.* 181-186..

Poster 19: The dynamic modulation of the action observation network by movement familiarity

Tom Gardner [1], Nia Goulden [1] & Emily S. Cross [1,2]

1. School of Psychology, Bangor University
2. Department of Social & Cultural Psychology, Donders Institute for Brain, Cognition and Behaviour, Radboud University, The Netherlands

When watching another person's actions, a network of sensorimotor brain regions collectively termed the action observation network (AON) is engaged. Previous research suggests the AON is more engaged when watching familiar compared to unfamiliar actions. More recent evidence suggests the relationship between AON engagement and action familiarity might not be as straightforward as previously thought, leading to revised hypotheses of how unfamiliar actions are understood. Here we examine how observed movement familiarity modulates AON activity by using dynamic causal modelling (DCM), a type of effective connectivity analysis. Twenty-one subjects underwent fMRI scanning whilst viewing whole-body movements that varied in terms of their familiarity. Participants' task was to either predict the next posture the dancer's body would assume or to respond to a non-action related attentional control question. To assess individuals' familiarity with each movement, participants rated each video on a measure of visual familiarity outside the scanner. Parametric analyses showed more activity in left middle temporal gyrus, inferior parietal lobule and inferior frontal gyrus as the videos were rated as increasingly familiar. These clusters of activity formed the regions of interest for DCM analyses. DCM analyses suggest stronger top-down modulation (information flowing from anterior to posterior nodes of the AON) when participants observed more familiar videos. The findings provide support for a dynamic feedback model of the AON, as well as illuminate how action familiarity manipulations can be used to explore simulation-based accounts of action understanding.

Poster 20: Event-related alpha suppression in response to facial motion

Christine Girges [1], Michael J Wright [1], Janine V Spencer [1] & Justin M D O'Brien [1]

1. Department of Psychology, Brunel University

While biological motion refers to both face and body movements, little is known about the visual perception of facial motion. We therefore examined alpha wave suppression as a reduction in power is thought to reflect visual activity, in addition to attentional reorienting and memory processes. Nineteen neurologically healthy adults were tested on their ability to discriminate between successive facial motion captures. These animations exhibited both rigid and non-rigid facial motion, as well as speech expressions. The structural and surface appearance of these facial animations did not differ, thus participants decisions were based solely on differences in facial movements. Upright, orientation-inverted and luminance-inverted facial stimuli were compared. At occipital and parieto-occipital regions, upright facial motion evoked a transient increase in alpha which was then followed by a significant reduction. This finding is discussed in terms of neural efficiency, gating mechanisms and neural synchronization. Moreover, there was no difference in the amount of alpha suppression evoked by each facial stimulus at occipital regions, suggesting early visual processing remains unaffected by manipulation paradigms. However, upright facial motion evoked greater suppression at parieto-occipital sites, and did so in the shortest latency. Increased activity within this region may reflect higher attentional reorienting to natural facial motion but also involvement of areas associated with the visual control of body effectors.

- Girges, C., Wright, M. J., Spencer, J. V, & O'Brien, J. M. D. (2014). Event-related alpha suppression in response to facial motion. *PloS One, 9(2),* e89382.

Poster 21: Atypical neural processing of face and eye gaze stimuli correlates with ASD symptoms in children with ADHD

Madeleine J. Groom [1], Puja Kochhar [1,3], Chris Hollis [1,3],
Antonia Hamilton [2], Marina Simeou [1] & Suzanne Maton [1]

1. Division of Psychiatry & Applied Psychology, Institute of Mental Health, University of Nottingham
2. Institute of Cognitive Neuroscience, University College London
3. Nottinghamshire Healthcare NHS Trust

Many children with ADHD show co-occurring symptoms of autism spectrum disorder (ASD). The basis of overlap between these two conditions is poorly understood (Rommelse et al., 2011Neuroscience & Biobehavioral Reviews 35). In the Social Cognition in Children and Adolescents with ADHD/ASD (SOCCA) study, we set out to identify the neural mechanisms of social impairment in ADHD and to measure the effect of co-occurring ASD symptoms on these parameters. Children aged 9 to 15 years with either ADHD or ASD were assessed for symptoms of ADHD and ASD using the Conners ADHD Rating Scale and Social Communication Questionnaire (SCQ). All children completed a visual-spatial cueing paradigm in which a left or right lateralised target was preceded by a non-predictive directional cue. The cue was either an arrow (non-social) or eye gaze (social). EEG data were recorded simultaneously. We predicted that the

degree of differentiation between arrow and gaze stimuli, reflected in amplitudes, latencies and topographies of event-related potentials (ERPs), would be related to the severity of ASD symptoms in children with ADHD. Preliminary analysis identified significant amplitude enhancement of the P2 ERP and greater right hemisphere lateralisation of the Early Directing Attention Negativity (EDAN) ERP, to eyes than arrows. Both parameters correlated negatively with SCQ scores, regardless of diagnostic status. These results suggest that children with ADHD demonstrate atypical processing of face and eye gaze stimuli and this is related to the degree of co-occurring ASD symptomatology. Further analysis of the final sample is on-going.

Poster 22: Investigating body perception in healthy and eating disordered females.

Katie Groves [1], Steffan Kennett [1] & Helge Gillmeister [1]

1. University of Essex

There is growing evidence to suggest that bodies are processed distinctively from other stimuli in the brain. In particular, event related potential studies have shown that the visual observation of human bodies elicits an enhanced N190 component over occipito-parietal electrodes. However, little research has addressed whether the way people think and feel about their own body and those of others', modulates the N190. Therefore, the aim of the present study was to explore the relationship between electrophysiological body perception, cognitive body perception and body image. Electroencephalography (EEG) was used to assess the prevalence of the body-specific N190 component and the 'Eating Disorders Inventory 2' (EDI2) was used to assess unhealthy attitudes and behaviours relating to one's body including body image. Cognitive body perception was measured with body size estimation tasks and tactile estimation tasks. Three groups of females were recruited; those had had experienced either Anorexia or Bulimia at least once in their life, and those who reported no history of body perception disorders or body image disturbances. Task responses and N190 amplitude were correlated and compared between groups, with findings indicating a close link between the early visual processing of human bodies and the observers' thoughts about their own body. Additionally, an enhanced body-specific N190 in response to same-sex stimuli was found, with a more pronounced effect in clinical groups. Such findings therefore suggest a relationship between the visual analysis of human bodies and the observer's body image during very early stages of cortical processing.

Poster 23: Lateral occipital complex encodes objects non-holistically irrespective of attention

Matthias Guggenmos [1], Volker Thoma [1], Radoslaw Martin Cichy [1], John-Dylan Haynes [1], Philipp Sterzer [1] & Alan Richardson-Klavehn [1]

1. School of Psychology, University of East London

A fundamental issue in visual cognition is the representational format of objects in high-level visual cortex and the role of attention therein. Behavioural studies have found viewpoint-invariant priming effects for attended object primes, indicating that the visual

system flexibly codes objects in terms of parts if attention is directed to the object. In the absence of attention this invariance of priming effects diminishes, suggesting view-based object coding. In this fMRI study (with 18 participants) we probed the representational format of objects in human lateral occipital complex (LOC) in dependence of attention by presenting objects either intact or half-split and either attended or unattended. Participants had to fixate at the centre of a screen while judging whether an object (out of a set of three, e.g. a chair) or a noise stimulus at a cued location (left or right of fixation) was changing to a lower brightness (4 repetitions for 283 ms each). Eye-tracking was used to control for deployment of overt attention to the uncued location. Using multivariate pattern analysis we found that the category-related information encoded in activation patterns of intact objects is preserved in the patterns from (minimally) scrambled objects in LOC (but not in V1). Although there was superior decoding accuracy for the attended objects the generalization between intact and split objects in LOC did not depend on attention. Our findings provide strong support for a model in which distributed activation patterns in LOC are not reliant on appearance-based templates.

Poster 24: Potentiation of the N170 event-related potential to danger signals in adolescents and adults

Philippa Howsley [1], Liat Levita [1] & Pat Johnston [2]

1. Department of Psychology, University of Sheffield
2. Department of Psychology and York Neuroimaging Centre, University of York

The reinforcing effects of aversive outcomes on avoidance behaviour are well established. However, their influence on perceptual processes is less well explored, especially during adolescence. Using electroencephalography, we examined whether learning to avoid harm can modulate early visual responses in adolescents and adults. The task included two avoidance conditions, active and passive, where two different warning stimuli predicted the imminent, but avoidable, presentation of an aversive tone. To avoid the aversive tone, participants had to learn to emit (active avoidance) or omit (passive avoidance) a button press response while they could see the warning stimuli on the screen. All participants completed the task with a high degree of accuracy. For adolescents and adults, increased N170 event-related potential amplitudes were found for both the active and the passive warning stimuli compared with the control conditions. Moreover, potentiation of the N170 to the warning stimuli was stable and continued throughout the task. Developmental differences were also observed; adolescents showed greater potentiation of the N170 component to danger signals. These findings demonstrate that learned danger signals in an instrumental avoidance task can influence early visual sensory processes in adolescents and adults.

Poster 25: I expect you to do as I say! Prior intentional attributions bias the perceived kinematics of other's actions

Matthew Hudson [1], Toby Nicholson [1] & Patric Bach [1]

1. Department of Psychology, University of Plymouth

Predictive coding theories propose that prior expectations regarding perception and action are generated at higher cognitive levels and feedback to lower levels where they meet incoming sensory input. Correctly predicted stimuli require minimal further processing whereas contradictory stimuli elicit a prediction error which is fed forward to modify expectations. Using a Representational Momentum paradigm (RM) we investigated the effect of top-down expectations on the prediction of other people's actions. A static image of a hand and an object that was either safe or dangerous to grasp was presented. Participants said an action related word that was compatible with the type of object (e.g. "Forward!" for safe objects, "Backward!" for painful objects). The arm then reached toward or away from the object, making the action either congruent or incongruent with the verbal response. A static probe stimulus of the action either in the same position as the final frame, forward along the observed trajectory or behind the final position was then presented. Participants judged whether the final position of the action and the probe were the same or different. Accuracy was higher for backward probes than forward probes (RM effect), suggesting an anticipatory response. Importantly, the RM effect was larger for actions congruent with the prior expectation than when incongruent. This was evident for expectancies related to low-level movement (Forward), high-level goals (Take It), object properties (Safe) or movement expectancies alone independent of object type. These results are compatible with a top-down influence of prior expectations on action prediction.

Poster 26: Look left but attend right: an ERP investigation of the effects of covert attention and saccadic eye movement on visual processing

Nicola Johnstone [1] & Elena Gherri [2]

1. School of Psychology, University of Surrey
2. Department of Psychology, University of Edinburgh

Close coupling between saccade preparation and shifts of visual attention are frequently demonstrated by more efficient processing of visual stimuli presented close to the target of an intended saccade than at other locations. However, recent evidence has individuated an 'independent' attentional component that can be directed away from the saccadic target (Montagnini & Castet, 2007). We tested the independence of this attentional component with event related potentials. Participants were cued to simultaneously direct covert spatial attention (Attention task) and prepare a saccadic eye movement (Saccade task) toward either the same target (Same side condition) or to targets located on opposite sides (Opposite sides condition). ERPs elicited by peripheral visual stimuli at cued and uncued locations showed that visuo-spatial attention initially shifted towards the cued target of the Attention task in both Same and Opposite side conditions as indexed by similar enhancement of the N1 component (150-190 ms post-stimulus). Crucially, attentional effects were drastically reduced in the Opposite sides condition beyond 250 ms post-stimulus. This observed reduction suggests spatial

attention was first allocated to the Attention task target, and following initial processing of the visual stimulus, attentional resources were at least partially shifted towards the saccade target. Thus, in Opposite sides condition, visuo-spatial attention is not directed simultaneously and in parallel towards opposite target locations but is serially allocated to the Attention task target first, then subsequently re-directed towards the Saccade task target closer to movement onset. These findings support the idea of shared mechanisms between covert attention and saccade preparation.

- Montagnini, A., & Castet, E. (2007). Spatiotemporal dynamics of visual attention during saccade preparation: Independence and coupling between attention and movement planning. *Journal of Vision, 7(14),* 1–16.

Poster 27: ERN amplitude predicts error correction

Çığır Kalfaoğlu [1,2], Tom Stafford [1], Elizabeth Milne [1]

1. University of Sheffield, Sheffield, UK
2. Eastern Mediterranean University, Famagusta, Cyprus

Performance errors are associated with robust behavioural and EEG effects. However, there is an active debate about the nature of the relationship between these effects and error awareness. Our aim was to study the relationship between error related electrophysiological effects, such as the error related negativity (ERN), and error awareness in typing. Typing has an advantage as a behaviour paradigm in that detected errors are quickly and habitually signalled by the participant using the backspace, allowing separation of detected from undetected errors without interruption in behaviour. Touch-typist participants were asked to copy-type 100 sentences as EEG was recorded. Continuous EEG data were analysed using independent component analysis (ICA). Time-frequency and ERP analyses were applied to the independent components returned by ICA. The results show that 1) Certain error-detection-related EEG changes such as Pe and increased theta band power are weakly but reliably present during many uncorrected typing errors, 2) Temporal synchrony between an error response and fronto-medial theta band oscillations are crucial for engagement of error correction behaviour, 3) ERN amplitude is predictive of error correction. We conclude that fronto-medial theta band oscillations are an integral part of performance monitoring mechanisms in skilled actions. Importantly, our data show investigations of theta band oscillations may provide novel insights into the relationship between ERPs such as ERN and error awareness and adaptive post-error behavioural changes.

Poster 28: Assessing the potential effects of self-control depletion with the antisaccade eye movement task

Claire Kelly [1], Sandra Sünram-Lea [1] & Trevor Crawford [1]

1. Department of Psychology, Lancaster University

Self-control and inhibitory ability, part of the self's executive control system, and connected to the frontal brain regions are involved in the regulation of behaviour, helping to ensure one adheres to societal norms and expectations. Self-control is thus considered a highly complex cognitive process, important for everyday life and evidently, poor self-control has been linked to social problems such as violence, and crime. Despite its importance for daily functioning, research shows that one's ability to exercise self-control is resource limited and following an initial self-control act successive efforts are impaired. Although growing evidence suggests glucose – a vital energy source for the brain - is that resource, recent research is now beginning to dispute this claim. Our current research aimed to expand on this and to examine the effects of glucose on self-control performance in the antisaccade task following self-control exertion in the Stroop task. The antisaccade task requires self-control through suppressing an automatic response and generating a voluntary eye-movement away from a target. This novel implementation within a self-control study permitted the more precise and accurate measurement of self-control. Results of this research failed to show an enhancing effect of glucose on antisaccade performance or reduction in blood glucose levels following the initial application of self-control in the Stroop task. Findings support more recent research, which questions the metabolic role of glucose in self-control and suggests that other factors, such as motivation may have modulating effects on self-control performance.

Poster 29: EEG evidence for sustained meaning activation for polysemous but not homonymous words

Ekaterini Klepousniotou [1], Lucy MacGregor [2] & Jenny Lines [3]

1. Institute of Psychological Sciences, University of Leeds
2. Brain Sciences MRC Unit, University of Cambridge
3. Department of Psychology, University of Stirling

Using a 64-channel EEG (electroencephalography) system, the present study investigated the time-course of meaning activation of different types of ambiguous words. Under the theoretical assumption that lexical ambiguity is not a homogeneous phenomenon, but rather that it is subdivided into homonymy and polysemy, the differential patterns of meaning activation of these words were explored. The two categories of lexical ambiguity (i.e., homonymy and polysemy) were further subdivided into two types each: balanced homonymy (e.g., "panel") and unbalanced homonymy (e.g., "pen"); metaphorical polysemy (e.g., "lip") and metonymic polysemy (e.g., "rabbit"). These four types of ambiguous words were used in a visual single-word priming delayed lexical decision task employing a long ISI (750 ms). Analyses including all 64-channels indicated that the theoretical distinction between homonymy and polysemy was reflected in the N400 component of the event-related potentials (ERPs). For homonymous (both balanced and unbalanced) words, no effects survived at this long ISI.

On the other hand, for polysemous (both metaphorical and metonymic) words, activation was still observed for both dominant and subordinate senses even at this very long delay. These findings are consistent with previous studies that indicate processing differences between homonymy and polysemy, and point toward differential mental representations depending on the type of lexical ambiguity. The collaborative nature of polysemous senses seems to strengthen the representation and facilitate maintenance even at very long ISIs, while the competitive nature of homonymous meanings leads to decay.

Poster Session 2

Poster 01: Time-course of meaning activation during pun processing: An EEG investigation

Kremena Koleva [1], Holly Ashton [1,2] & Ekaterini Klepousniotou [1]

1. Institute of Psychological Sciences, University of Leeds
2. Maastricht University, Netherlands

We investigated the processing costs associated with pun comprehension. Modular approaches to non-literal language processing suggest that literal meanings are activated obligatorily before intended non-literal meanings are subsequently accessed. Interactive approaches, however, claim that non-literal meanings are accessed directly thus avoiding the processing of irrelevant literal meanings. Does pun processing require more cognitive resources to simultaneously access two intended meanings or is it possible to access two meanings in an efficient manner? We investigated the time-course of meaning activation during pun processing using a 64-channel EEG system. We used puns which relied on the successful literal re-interpretation of idioms (e.g., Old cleaners never die, they just bite the dust.) relative to idiomatic sentences (e.g., Like it or not – we all bite the dust). These two types of sentences were presented as primes in an across-modal semantic priming delayed lexical decision task employing a short ISI (0ms). Targets were related to: (i) the literal meaning of an idiom's content word; (ii) the idiomatic meaning; (iii) were unrelated. Filler sentences and pseudo-word targets were used as foils. ERPs formed relative to the target onset indicated that literal and idiomatic targets were primed only after pun processing (reflected in less negative N400 amplitudes compared to unrelated targets). Conversely, after idioms, all targets showed similar amplitudes. N400 effects for puns were distributed across the scalp in frontal, medial and posterior regions. The observed differences between puns and idioms indicate that accessing the two meanings of punning sentences requires additional cognitive resources at short ISIs

Poster 02: Influence of colour and luminance on visual working memory: A study using EEG

M. Kosilo [1], J. Martinovic [2] & C. Haenschel [1]

1. Cognitive Neuroscience Research Unit, School of Psychology, City University London
2. School of Psychology, University of Aberdeen

Early encoding processes in working memory have been shown to have a significant impact on performance [3]. Although current reports point to the interplay between perception and working memory [4], the role of perceptual factors in working memory is not clear. To address this, the current study investigates whether manipulating low – level attributes of visual stimulus can affect working memory performance. Participants performed a delayed discrimination task in which they had to remember up to 3 abstract shapes. The stimuli were defined along different directions in cardinal colour space [2]. The aim was to create stimuli that would isolate the luminance mechanism (L+M), or two different chromatic mechanisms: S-cone-isolating (S) or L-M mechanism. The stimuli were equated in terms of salience through an initial psychophysical same/different threshold task. In line with accounts of everyday vision benefitting from fast luminance projections transmitted through magnocellular pathway [1] we expected that luminance will benefit performance on working memory task. The results point to the differential contribution of different cone signals to working memory performance, with luminance – defined stimuli leading to higher accuracy and faster reaction times. Different classes of stimuli differentially modulated the P1 and N2 components in the EEG signal. Amplitude and latency differences will be discussed. We conclude that perceptual factors at the early encoding stages of working memory contribute to working memory performance and that EEG provides an insight into neural processes involved in encoding.

- [1] Bar, M. (2003) A cortical mechanism for triggering top-down facilitation in visual object recognition. *Journal of Cognitive Neuroscience, 15(4),* pp.600-609.
- [2] Derrington, A. M., Krauskopf, J., & Lennie, P. (1984) Chromatic mechanisms in lateral geniculate nucleus of macaque. *The Journal of Physiology, 357,* pp.241-265.
- [3] Haenschel, C., Bittner, R. a, Haertling, F., Rotarska-Jagiela, A., Maurer, K., Singer, W., & Linden, D. E. J. (2007) Contribution of impaired early-stage visual processing to working memory dysfunction in adolescents with schizophrenia: a study with event-related potentials and functional magnetic resonance imaging. *Archives of general psychiatry, 64(11),* pp.1229-40.
- [4] Pasternak, T., & Greenlee, M. W. (2005) Working memory in primate sensory systems. *Nature Reviews Neuroscience, 6(2),* pp.97-107.

Poster 03: The impact of attention and mindfulness meditation on sensory information processing: A startle modification analysis

Veena Kumari [1], Aseel Hamid [1], Andrew Brand [1] & Elena Antonova [1]

1. Department of Psychology, Institute of Psychiatry, King's College London

The magnitude of the human eye blink reflex to a strong startle-eliciting sensory stimulus, the pulse, is reduced if this is preceded shortly by a weak prestimulus, the

prepulse. This effect is known as prepulse inhibition (PPI) and considered to index sensorimotor gating function. PPI is stronger with monaural, than binaural, acoustic prestimuli in healthy people (1, 2) as well in schizophrenia (2) and related populations (3). It is presently unknown why monaural prepulses produce more PPI than binaural prepulses. Our aim was to investigate the possibility that monaural prepulses are experienced as more salient or attention-capturing (unambiguous to locate and hence engage bottom-up orienting attention network) than binaural prepulses and, if so, this would be expected to result in stronger PPI. The effect of verbal and visuospatial attention manipulations on monaural and binaural PPI was tested in 30 healthy people from the general population, as well as 30 experienced mindfulness meditation practitioners. Attention manipulation similarly reduced PPI in both groups, and this was most strongly evident for PPI with right ear prepulses under visuospatial attention manipulation. Mediators detected more targets than mediation-naïve individuals during attention tasks. Spatial attention processes contribute to greater monaural PPI, particularly with right ear prepulses. Similar attentional modulation of PPI despite better performance in meditators, relative to meditation-naïve individuals, suggests that they may have a stronger information processing capacity.

- [1] Marsh et al (1976) *Science*.
- [2] Kumari et al (2007) *Psychophysiology*.
- [3] Kumari et al (2005) *Psychophysiology*.

Poster 04: Neural correlates of number-induced spatial orienting are partially separate from those of endogenous spatial orienting

Chia-Yuan Lin [1], Marieke Jepma [2] & Silke M. Göbel [1]

1. Department of Psychology, University of York, England
2. Department of Psychology and Neuroscience, University of Colorado Boulder, USA

Single digit numbers have been shown to shift attention: small numbers induce a shift to the left side while large numbers induce a shift to the right side. However, the underlying neural mechanisms of this number-induces spatial orienting remain largely unknown. In the current fMRI study, we examined the brain activation during number-induced spatial orienting, and compared it to classical endogenous spatial orienting. Twenty-one volunteers (13 women; mean age: 24 years) were asked to detect laterally presented targets shown after central presentation of single digits (number cueing) or leftward/rightward arrows (endogenous cueing). Reaction times were significantly faster for validly cued targets (e.g., a small number or a leftward arrow followed by a left target) than invalidly cued targets (e.g., a small number or a leftward arrow followed by a right target). A whole brain analysis showed that number-cued orienting activated left inferior parietal lobule while endogenous orienting activated bilateral inferior parietal lobule. ROI analyses revealed that the brain activation in bilateral angular gyrus was negatively correlated with the behavioural number-cueing effect, but not significantly correlated with the behavioural endogenous cueing effect. Activation of the left IPS, however, was positively correlated with the endogenous cueing effect, but not with the number-cueing effect. Our findings illustrate the neural correlates of number-induced attention shifting. Moreover, our results suggest that the number-induced spatial

orienting network is at least partially separate from the classical endogenous attention orientation network.

Poster 05: An EEG investigation of age-related changes in the hemispheric contributions to cognitively demanding working memory tasks

Christopher MacCarthy [1] & Caroline Brown [1]

[1.] University of the West of England

Understanding age-related neuro-functional changes and how they are characterised is continuing to increase in importance due to an ageing population. This study seeks to explore the proposed differences in hemispheric contributions as we age through an electroencephalogram (EEG) framework. It was hypothesised that older participants would elicit a more global or bi-lateral pattern of working memory processes than a younger cohort. Participants viewed 100 trials of a set of four letters and were asked to memorise them. Then a single letter appeared and both groups of participants were required to answer whether the single letter was present or absent from the original set. Behavioural measures were also taken in the form of reaction time and overall accuracy scores. Contrary to the hypothesis, the older cohort elicited a markedly lateralised pattern of activation in contrast to a bilateral and more general pattern in younger counterparts. The results suggest a re-evaluation of the proposed hemispheric asymmetry previously posed by other research and suggest a potential increase in efficiency of the employment of cognitive resources rather than a compensatory mechanism as we age. Further study is required to unpick such a complex picture, especially given the present study's findings.

Poster 06: Effects of anodal transcranial Direct Current Stimulation on visuo-motor learning

Tamas Minarik [1], Paul Sauseng [1] & Annette Sterr [1]

[1.] Brain and Behaviour Research Group, School of Psychology, University of Surrey

Anodal transcranial Direct Current Stimulation (anodal-tDCS) has been shown to be an effective non-invasive brain stimulation method for improving cognitive and motor functioning in patients with neurological deficits. Anodal-tDCS over motor cortex, for instance, facilitates motor learning in stroke patients. However, findings on the effects of motor cortex anodal-tDCS on motor learning in healthy participants are inconclusive. Furthermore, its effect on visuo-motor integration is not well understood. In the present study we examined whether anodal-tDCS over the motor cortex enhances visuo-motor learning in a power-grip task in a healthy population. Participants completed a 2-session protocol with 40 minutes power-grip task in each session. This task required the control of a visual signal by modulating the strength of the power-grip for 6 seconds per trial and was carried out under anodal-tDCS and sham condition for each participant. The neurostimulation protocol comprised a standard montage with the active electrode over the contralateral motor cortex and 20 minutes of 1mA stimulation or sham stimulation (counterbalanced), with a week apart. Performance measures derived from time-on-target and target-deviation showed significant improvement over time for both

stimulation conditions; during and after anodal-tDCS. Importantly, however, the results suggest that the applied neurostimulation did not influence visuo-motor learning. Specifically, anodal-tDCS had an impact neither within session nor between sessions (consolidation) on these performance measures. These findings in combination with previous studies indicate that anodal-tDCS improvements might be limited to cases where the motor system is challenged, i.e. patients with motor deficits or situations of very high task demand.

Poster 07: Hormones and behaviour: The importance of the derivative

K. Moakes [1], A. Mcnamara [1], P. Aston [2], C. Gavin [2] & A. Sterr [1]

1. Department of Psychology, Faculty of Arts and Human Sciences, University of Surrey
2. Department of Mathematics, Faculty of Engineering and Physical Sciences, University of Surrey

To investigate dynamic changes in cognition across the female menstrual cycle, twenty, healthy, naturally-cycling women undertook a lateralized figural comparison task on twelve occasions at approximately 3-4 day intervals. Each session was conducted in laboratory conditions with response times, accuracy rates, eye movements, salivary hormone concentrations and mood data collected. Data was analysed categorically by comparing peak progesterone (luteal phase) to low progesterone (follicular phase) to emulate two-session repeated measures typical studies. Neither a significant difference in reaction times or accuracy rates was found. Moreover no significant effect of lateral presentation was observed upon reaction times or accuracy rates although inter and intra individual variance was sizeable. We demonstrate that hormone concentrations alone cannot be used to predict the response times or accuracy rates. In contrast, we constructed a standard linear model using salivary oestrogen, salivary progesterone and their respective derivative values and found these inputs to be very accurate for predicting variance observed in the reaction times for all stimuli and accuracy rates for right visual field stimuli but not left visual field stimuli. The identification of sex-hormone derivatives as predictors of cognitive behaviours is of importance. The finding suggests that there is a fundamental difference between the up-surge and decline of hormonal concentrations where previous studies typically assume all points near the peak of a hormonal surge are the same. How contradictory findings in sex-hormone research may have come about are discussed.

Poster 08: Flexible orienting of attention within working memory (WM) in ageing: A magnetoencephalography study

Robert M. Mok [1,2], Nicholas E. Myers [1,2], George Wallis [1,2] & Anna C. Nobre [1,2]

1. Department of Experimental Psychology, University of Oxford
2. Oxford Centre for Human Brain Activity, Department of Psychiatry, University of Oxford

The ability to manipulate information flexibly according to task rules declines as we age. Top-down attention can be used to improve WM performance in younger adults. However, it is not known whether older adults can orient attention within WM to

improve task performance and whether the neural signatures underlying these abilities correspond to younger populations'. To study the neural mechanisms of orienting attention in WM in ageing, 61 older adults (60 years+) performed a precision visual WM task with or without an attention-guiding cue whilst undergoing a magnetoencephalography (MEG) scan. Retro-cues conferred a significant advantage for WM performance, suggesting preserved attentional mechanisms in older adults. Oscillations in the alpha band (8-12Hz) during the delay period after a retro-cue indexed attentional orienting to the cued item location in a similar way to younger adults. We employed a decoding approach in order to investigate the frequency and temporal pattern of the brain signals that carried the most information underlying spatial attention to the cued item. As expected, information about the location of the cued item was encoded in alpha-band oscillations, but also extended to the beta band (15-25hz). Importantly, these neural signals were transient, such that the strongest lateralization occurred immediately after the cue and slowly returned to baseline during the memory delay. These data suggest that intact WM control mechanisms in ageing may correspond to similar attentional mechanisms in younger adults.

Poster 09: EEG indices relate to fear and anxiety self-report

Roger Moore [1] & Philip Corr [2]

1. Dept. of Psychology, University of Portsmouth
2. School of Arts and Social Sciences, City University

The objective was to identify functional links between frequency specific EEG coherence and power on one hand, and self report measures of neuroticism, fear and trait anxiety on the other. Sixty-three participants completed three tasks; two were designed to induce internal rumination (nominal rumination, i.e. ruminating about a prescribed problem; and personal rumination, i.e. ruminating about a personally meaningful problem) and one was a baseline counting task. EEG was recorded from 12 regions of interest and considered across a range of wavebands. Participants also completed questionnaires including the Eysenck Personality Questionnaire-Revised (EPQ-R) [1], the Fear Survey Schedule (FSS) [2], and the State Trait Anxiety Inventory (STAI) [3]. Factor analyses (for coherence and power separately) was used to create a series of virtual variables, each representing composite waveband specific EEG coherence or power activity for each of the task conditions. These were regressed with scores for neuroticism (EPQ-R), total fear (FSS) and trait anxiety (STAI) revealing important differences between power and coherence data across frequencies. The clearest findings were linked to EEG coherence. Across most frequencies, total fear and trait anxiety relate to coherence; specifically, fear is related to nominal rumination and anxiety to personal rumination, the sign of which indicate that coherence is reduced in high fear and anxiety participants respectively. These findings point to important functions of fear and anxiety, the latter being a form of personal 'fear', whereas fear can be impersonal and not related directly to personal factors.

- [1] Eysenck, H.J., Eysenck, S.B.G. (1991). *Eysenck Personality Scales (EPS Adult).* Hodder & Stoughton: London.
- [2] Wolpe, J., Lang, P.J. (1977). *Manual for the Fear Survey Schedule.* San Diego, CA: Educational and Industrial Testing Service.

- [3] Spielberger, C. D. (1983). *Manual for the State-Trait Anxiety Inventory (STAI).* PaloAlto, CA: Consulting Psychologists Press.

Poster 10: A kinematic and neural exploration of action selection processing

Faisal Mushtaq [1], Richard McGilchrist Wilkie [1],
Mark Arwyn Mon-Williams [1] & Alexandre Schaefer [2]

[1.] Institute of Psychological Sciences, University of Leeds
[2.] School of Business, Monash University, Malaysia

In decision-making, negative outcomes bias choice selection- an integral part of learning. But how does the brain process these outcomes when they have no bearing on future behaviour? We report two studies exploring the role of negative outcomes on decision-making behaviour and their neural correlates. Experiment 1 recorded movements in a two-choice gambling task. Participants chose to move to either a 'safe' (relatively small wins/losses) or 'risky' target with equal (randomised) probability of winning/losing. Participants rapidly learned the probability distribution and thereafter responses were driven by random selection and hysteresis. Importantly, participants were faster to respond after a negative outcome independent of the subsequently chosen target. Experiment 2 recorded event- related potentials (ERPs) during an equivalent stimulus-response task. The same behavioural pattern was found. Response-locked ERPs clearly indicated when the previous trial was a loss outcome. These data indicate motor and cognitive processes are biased by negative outcomes as indexed by more rapid action selection and a distinct electrophysiological signature following a negative outcome.

Poster 11: The different cognitive processing in Korean prefixed word as Inverse Efficiency: fMRI study

Sooleen Nam [1] & Kichun Nam [1]

[1.] Department of Psychology, Korea University, South Korea

The Current study was carried out in order to define the different neural cognitive processing in Korean prefixed nouns as Inverse Efficiency, as well as compare and contrast the activation patters of morphological, orthographic, and semantic information using fMRI (functional Magnetic Resonance Imaging). A masked priming lexical decision task was used in 2 experiments. Experiment 1 (behaviour study) consisted of the 3 conditions: (1) morphologically related, (2) orthographically related, (3) semantically related and (4) unrelated condition. The participants were identified two distinct groups (high IES group and low IES group) by IES (Inverse Efficiency Score) in Experiment 1. Experiment 2 (fMRI study) added neural scanning to the same paradigm. Both experiments had stimulus onset asynchronies (SOA) of 300 msec. In the behaviour experiment, the results shown the all morphological, semantic and orthographic priming effects were significantly higher in low IES group than high IES group. Comparing the brain activity the higher IES group versus the lower IES group reveals the two groups were able to use different brain region and brain activities when they process the word specific information in Korean prefixed noun. Combining the results, we conclude that orthography, morphology, and semantics are all processed

independently by inverse efficiency of individual participants in terms of neural cognitive processing.

Poster 12: Sense of agency in people with subclinical checking tendencies

Joseph Nemeth [1] & Ellen Seiss [1]

[1.] Brain and Behaviour Research Group, University of Surrey

Sense of agency (SoA) refers to the subjective experience of controlling one's own actions and resultant effects. Recent research has indicated possible underlying SoA abnormalities in people with Obsessive Compulsive Disorder (OCD), although these findings are inconsistent. This study attempted to clarify the nature of SoA alterations for people with subclinical checking tendencies compared with non-checking controls. This was achieved by measuring both explicit and implicit aspects of the SoA in two separate tasks. In a 'Judgement of Agency' task, participants first engaged in a learning phase in which associations between actions (button press) and effect (tone type) were established. In the subsequent testing phase, the tone following the action was congruent or incongruent with participants' learned expectations and the participant's task was to rate their SoA. The checking group (n = 20) showed significantly higher agency judgements than the non-checking group (n = 22), indicating a greater explicit sense of agency. The second task required participants to estimate the time for their actions and resultant effects, which provided a measurement for the subjective temporal compression of the interval between an action and effect, i.e. intentional binding, which is recognised as an implicit measure of SoA. Intentional binding was stronger for checkers (n = 22) compared with non-checkers (n = 23). Together, these findings indicate that subclinical checkers experience greater explicit and implicit SoA compared with non-checkers. This could be related to their feeling of incompleteness, enhanced sense for responsibility, and it could have potential implications for clinical practice.

Poster 13: Evidence for visual feature representations in both retinocentric and headcentric, but not body or world-centric reference frames

Sandeep Parwaga [1] & Philip A. Duke [1]

[1.] School of Psychology, University of Leicester

Perception of the world is generally stable and allows us to interact successfully with the environment despite movements of the eyes, head and body. How are such perceptions formed? One possibility is that retino-centric image features are transformed into representations at higher levels, such as head-, body-, or perhaps world-centred representations. The present study investigated this hypothesis using a contingent tilt aftereffect paradigm designed to reveal adaptive representations beyond the retino-centric level. We found tilt aftereffects contingent on eye-gaze direction, but not head- or body-direction. This demonstrates that visual features are represented in a head-centric frame and suggests no higher levels of perceptual representation. Having found evidence for an adaptive head-centric representation, we examined its contribution to the classical tilt aftereffect using a method designed to isolate retino-centric and head-centric components and examine their temporal characteristics. We found evidence that

tilt representation involves 1) a retino-centric tilt encoding mechanism, which is sensitive to test stimulus duration, and 2) an eye-gaze direction encoding mechanism, which is not. Our results suggest that retino-centric visual feature orientation is jointly encoded with eye-gaze direction to produce head-centric, but not body- or world-centric representations.

Poster 14: A transcranial magnetic stimulation study on the perception of slant

Vassilis Pelekanos [1,2], Hiroshi Ban [3] & Andrew E. Welchman [2]

1. School of Psychology, University of Birmingham
2. Department of Psychology, University of Cambridge
3. Centre for Information and Neural Networks, Osaka, Japan

Our ability to estimate the slant of nearby objects (such as a table top) is critical for visually guided interactions. Estimating surface slant involves inferring information about 3D structure from 2D retinal images, and the cortical circuits that support this ability are currently unknown. Here we sought to test for the involvement of different cortical areas in slant judgments by perturbing activity using repetitive transcranial magnetic stimulation. Participants (n=8) viewed slanted surfaces defined by binocular disparity rendered in random dot stereograms. We presented two baseline slants (10 deg, 50 deg) and measured slant discrimination thresholds around these values using the method of single stimuli. Stimuli were presented for 850 msec, and 5 online rTMS pulses were synchronised with every stimulus presentation. In different testing sessions, we targeted stimulation to the posterior parietal cortex (PPC) and functionally-localised areas V3A and LO in both hemispheres. We obtained control measurements by applying rTMS to CZ. We failed to observe any significant effect of rTMS over V3A or LO on slant discrimination performance. However, we found that performance for the high and low slants became equivalent when stimulating right PPC. Finally, order analysis showed that, irrespectively of the area of stimulation, there was a considerable learning effect with participants improving across testing days. These results hint at a functional contribution of the PPC to slant estimation, however, further work is needed to fully understand the nature of its involvement.

Poster 15: Excitability of the motor cortex in Tourette syndrome in the period preceding volitional movement

Sophia Pépés [1]

1. School of Psychology, University of Nottingham, lpxsp3@nottingham.ac.uk

Tourette syndrome (TS) is a neurodevelopmental disorder characterised by frequent occurrence of motor and phonic tics. It has been suggested that the disorder has arisen from a dysfunctional cortical-striatal-thalamocortical (CSTC) pathway. This suggests that as well as dysfunction in deeper brain structures there is impaired function at the level of the cortex. Transcranial magnetic stimulation (TMS) allows us to examine corticospinal excitability (CSE) in the motor cortex and thus allows us to explore and understand dysfunction that occurs in this region in TS. Here, we explore the responsiveness of the motor cortex to TMS stimulation by using different intensities of

resting motor threshold (RMT) and measuring MEP responses to plot an input-output curve (IO curve) in a group of adolescents with TS and matched controls. Secondly, we investigate alterations in CSE during the preparation of a volitional movement by recording TMS-induced motor-evoked potentials (MEPS) at different percentages of reaction time during a simple Go/NoGo task in the same group. We look at differences in MEP amplitude and variability during different periods of movement preparation. Finally we look at diffusion tensor imaging (DTI) data collected for the TS group to determine if there is a relationship between tic severity, CSE measures and the white matter connectivity.

Poster 16: Modulation of attention bias modification (ABM) using transcranial direct current stimulation over the right inferior frontal gyrus

Sara Pretorius [1], Margot Crossman [1], Jonathan Silas [1] & Amanda Holmes [1]

[1.] University of Roehampton

Biased attention towards threatening information is implicated in the development and maintenance of anxiety. Recently, attention bias modification (ABM), a cognitive training paradigm, has been shown to reduce attention bias and anxiety. tDCS is a form of non-invasive brain stimulation which is known to bring about substantial, often lasting performance augmentations in cognitive tasks when applied during training. The present study examined whether the effects of ABM could be enhanced using transcranial direct current stimulation (tDCS). Over three consecutive days, two groups of participants were administered either sham or active anodal tDCS over the right inferior frontal gyrus whilst receiving ABM training. Threat bias and state anxiety were assessed before and after ABM on each day. ABM with concurrent tDCS, but not with sham stimulation, produced a significant monotonic reduction in anxiety over the course of the experiment. Threat bias was reduced on days 2 and 3 in the tDCS group but not the sham group. However, these reductions were observed before the ABM training and not after. The results highlight the potential for tDCS to enhance the outcomes of ABM. The absence of threat bias diminution after ABM may reflect fatigue effects. However, the finding that performance improvements did appear a day after the first ABM session in the tDCS group, suggests that there were latent facilitatory effects. This is in line with previous reports that suggest tDCS can induce long lasting changes in behaviour via the modulation of the underlying neural mechanisms.

Poster 17: Memory deficits in sub-clinical washers and checkers: A remember/know study

Brendan Richards [1], Sarah Garfinkel [2], Nicolas Rothen [2], Annette Sterr [1], Laura Simonds [1] & Ellen Seiss [1]

[1.] Brain and Behaviour Group, School of Psychology, University of Surrey
[2.] Sackler Centre for Consciousness Science, University of Sussex

Obsessive-compulsive (OC) checkers and washers commonly engage in repetitive patterns of behaviour or rituals designed to eliminate the source of their concerns. The suggestion that a global deficit in memory may underpin the need to repeatedly check or

wash has mixed support from research, though there is stronger evidence that patients have lower confidence in memory. However, some previous studies may have been hampered by the use of experimental designs lacking the required sensitivity to appropriately assess cognitive abilities with obsessive-compulsive disorder. The present study aimed to examine memory functioning in individuals with subclinical checking and washing symptoms using single-word verbal stimuli which were specifically related to their obsessive-compulsive concerns. Participants completed a two-part word recognition experiment using a Continuous Identification with Recognition Paradigm (CID-R), designed not only to assess memory accuracy, but also the impact of repetition priming, remembering versus familiarity (remember/know) and memory confidence. Preliminary findings showed no significant difference in memory accuracy between OC and non-OC individuals. However, OC participants had a greater tendency to report familiarity with stimuli, rather than firmly remembering the words ($p<0.05$), and made more false alarm responses than controls ($p<0.05$). OC participants also displayed lower confidence in memory than controls ($p<0.05$). It is possible this type of functioning could underpin the uncertainty which might lead to compulsive checking and washing.

Poster 18: Electrophysiological investigation of bidirectional motor-language effects

Simone Rossi [1] & Jeremy Goslin [1]

[1.] Department of Psychology, University of Plymouth

Theories of embodied cognition posit close integration between motor and linguistic processing. The effect that the linguistic system has on motor activation is well evidenced. Less so less so the inverse relationship, where inhibitory or excitatory effect of motor activity on the perception of related action verbs can be moderated by the temporal distance between the two events. This study seeks to clarify the bidirectional cross-talk between these processes by making a correlational study between electrophysiological activity and the temporal proximity of motor activity to the perception of related action verbs. Participants made either a foot or hand motor response to auditory cues, with visual words presented at random intervals between 0 and 500ms after the auditory cue. The words consisted of verbs that were congruent to the action (e.g. foot response – kick), incongruent (e.g. foot response – grab), or abstract (hand response – look). ERPs time locked to the onset of the words were correlated to the temporal distance between motor response and word onset for each sample, generating Event Related Correlation Coefficient (ERCC) waveforms. These ERCCs revealed that the amplitude of the N400 related to visual word recognition was reduced when the onset of congruent words and motor responses became more proximal. Conversely, when ERCCs were generated from ERPs time-locked to the motor response closer temporal proximity of congruent action verbs inhibited neural activity in motor regions. This suggests early co-activation of share motor representations can help the lexical integration of action verbs, but inhibit related motor activity.

Poster 19: Regularity effect in late Korean-English bilinguals: fMRI Study

Jaehee Ryu [1] & Kichun Nam [1]

[1.] Department of Psychology, Korea University, South Korea

Bilinguals are known as people who can speak two or more language fluently. One of the most interesting issues for bilinguals is the relationship between the native language and second language. Previous studies have attempted to find the process that shows the differences while both the English native speakers and Korean native speakers are using English through the standardized frequency effect and regularity effect. Regularity effect is defined as regular word by GPC-rule will be named more accurately and faster than irregular word. In previous domestic study confirmed that the effect. The experimental results do not show any differences between the Korean native speakers and English native speakers. This behavioural experiment was carried out using the naming task paradigm. The experimental results do not show any differences between the Korean native speakers and English native speakers. Examining the results, only a frequency effect was found, whereas a regularity effect was not. fMRI experiment was carried out using covert naming task and lexical decision task paradigm. The experimental results show any differences between regular words and irregular words processing in the Late Korean-English bilinguals.

Poster 20: I know what you will do in here. Observers implicitly integrate object and actor information to predict forthcoming actions

Kimberley Schenke [1]

[1.] School of Psychology, Plymouth University (kimberley.schenke@plymouth.ac.uk)

These studies investigated whether observers form implicit associations in the form of intentional relations between characters, situations, and their typical behavioural patterns, which drive predictions of their future actions and perceived preferences towards objects. Pairs of photographs showed characters with objects and participants reported whether the characters interacted or turned away from each object. Trials were manipulated so that one actor typically interacted with one object and turned away from the other object. For example John mostly kicks the ball and turns away from the computer whilst Claire does the reverse. Results demonstrated both faster reaction times for expected than unexpected actions towards the objects and increased liking for 'preferred' objects. That is, there were faster reaction times when actors interacted with the object they usually interact with. We also found these characters were perceived to have increased liking for acted on objects than for objects they tended to turn away from. This suggests that participants learned to associate the characters with the object they tended to interact with, and used these associations in future encounters and for making judgments on character attitudes towards the objects. Crucially, these participants were not aware of these associations even when they were asked to search for the pattern within the stimuli, pointing to a highly implicit mechanism. These studies provide the working paradigm for research investigating whether this knowledge for preference of actions and objects becomes embodied.

Poster 21: Explaining the Self away: Electrophysiological correlates of self-specific prediction errors in the human brain

Alejandra Sel [1] & Manos Tsakiris [1]

1. Department of Psychology, Royal Holloway University London

Predictive coding has emerged as a prominent unifying theory of cortical function to characterise all forms of information processing in the brain. Despite its scope and novelty, a predictive coding account of self-processing has not been empirically investigated. We here controlled the level of prediction error associated with the face of the self or that of an unfamiliar or familiar other, and measured the resulting visual mismatch negativity (vMMN) an event related potential evoked by violations of regularity. Participants were presented with alternating sequences of self- or other-face stimuli in an identity-irrelevant task. These sequences were violated with deviant images containing 33%, 66% or 100% of the self-face, when others' face was expected, or vice versa, controlling, thus, for the prediction error associated with self or other's face. The self-related deviant condition elicited a vMMN response whose amplitude was linearly proportional to the deviant magnitude (i.e. % of self). This effect was source localized within the middle and superior frontal gyri, regions previously associated with the updating of probabilistic mental models. Deviant others' faces did not evoke vMMN. These findings show how self-specific "surprising" stimuli lead to prediction errors that are in turn putatively minimised through the updating of predictions processed in frontal areas. This self-specific cortical pattern supports a predictive coding account of the self, whereby self-related information takes the form of bottom-up error signals from unimodal sensory systems that are explained away by top-down processes that minimise the level of surprise across the brain.

Poster 22: Cortical Hyperexcitability is associated with the out-of-body experiences in non-clinical hallucinators: Evidence from a tDCS study

Chie Takahashi [1] & Jason J. Braithwaite [1]

1. Selective Attention & Awareness Laboratory, Behavioural Brain Sciences Centre, School of Psychology, University of Birmingham

Repetitive striped patterns, or gratings, with a certain spatial frequency (3 cycle-per-degree of visual angle) can provoke visual discomfort and induce phantom visual distortions / somatic sensations in susceptible individuals, known as 'pattern-glare'. The pattern-glare tasks are effective to measure underlying cortical factors implicated in somatic distortions and body-based hallucinations (Braithwaite et al., 2013a, 2013b). The aim of present study was to examine these signs of cortical hyperexcitability in non-clinical populations predisposed to out-of-body experiences (OBEs) by manipulating neuronal excitability of the visual cortex via transcranial direct current stimulation (tDCS). Participants completed questionnaires to evaluate their predispositions to specific anomalous perceptions and the existence of OBEs. They also took part in a computer-based pattern-glare task across three separate tDCS sessions, (sham / anodal / cathodal) applied over the visual cortex. The task was designed to measure degrees of cortical hyperexcitability via reporting their experiences of phantom visual and somatic distortions experienced during the viewing of the irritable gratings. Those prone to

anomalous perceptions (including OBEers) showed elevated latent (sham) hyperexcitability. The number of phantom visual/somatic distortions were significantly higher (relative to controls) but only when viewing gratings known to be irritable to visual cortex. In addition, the visual cortex of hallucinatory-prone individuals showed; (i) stronger effects of excitatory tDCS, and (ii) weaker effects of inhibitory tDCS. Both results are indicative of increased cortical hyperexcitability. Taken together, these findings show that OBEs reflect underlying neuronal anomalies even in non-clinical samples.

- Braithwaite, J.J., Broglia, E., Bgashaw, A.P., Wilkins, A.J. (2013a). Evidence of elevated cortical hyperexcitability and its association with out-of-body experiences in the non-clinical population. New findings from a Pattern-Glare Task. *Cortex, 49 (3),* 793-805. doi: 10.1016/j.cortex.2011.11.013
- Braithwaite, J.J., Broglia, E., Brincat, O., Stapley, L., Wilkins, A.J., & Takahashi, C. (2013b). Signs of elevated cortical hyperexcitability associated with spontaneous anomalous body experiences in the non-clinical population. *Cognitive Neuropsychiatry, 18 (6),* 549-73. doi: 10.1080/13546805.2013.768176

Poster 23: Mood and stress can affect working memory capacity in naturalistic settings

Julia C. Teale [1] & Malcolm D. MacLeod [1]

[1.] University of St Andrews

Recent research has indicated that when mood is experimentally manipulated in young adults, low mood participants' performance is subsequently impaired on a test of memory inhibition (Retrieval Practice Paradigm; RPP). Other research has found that performance on the RPP is also related to an individual's working memory capacity (WMC). No studies, however, have tested whether individual differences in mood across time affects performance on WMC measures. The present study used a within-subjects design to measure individuals at times of low mood/ high stress, and at times of high mood/ low stress. To do this, teachers (working full-time, at least 6 days a week) were recruited as participants. Participants were tested during the busiest point in term-time, and during the school holidays (order was counterbalanced). Our study indicated that teachers performed better on the WMC task during times of better mood and better stress.

Poster 24: Imagine that: Motor imagery has an immediate effect on reaction time in a modified motor preparation task

Ben Toovey [1], Ellen Seiss [1] & Annette Sterr [1]

[1.] University of Surrey

Neural simulation theory suggests that motor imagery (MI) is linked to motor execution (ME). While evidence for equivalence is strong, much research is focused on upper limb movements. Furthermore it is unclear how MI can affect ME in motor cognitive tasks. This work sought to demonstrate that MI has an immediate effect on ME in a lower limb

movement preparation task. The first task employed a traditional motor preparation paradigm. The second task required participants to imagine foot dorsiflexions relevant to the cued laterality, and then to respond to a go stimulus. Both tasks had an SOA of 3 seconds. Volunteers completed a single session consisting of these two tasks, using foot pedals to respond. In both tasks participants saw a correct, incorrect or ambiguous prime stimulus in preparation for the upcoming cue stimulus. Preliminary analyses have shown no differences in RT between congruent and incongruent trials during the motor preparation task, however congruent RT was faster than incongruent RT in the imagery task was able to induce the otherwise absent congruency effect. This finding suggests that MI of the lower limb can have a differential effect on actual reaction time as congruency effects were found after imagery but not no-imagery tasks. Greater RT costs for incongruent MI tasks might reflect increased effort in initiating a preprogrammed movement while actively inhibiting M1 neurons to prevent execution of the incorrect imagined act. Steps are being taken to investigate this interference property of MI and will employ electroencephalographic (EEG) methods.

Poster 25: Modulation of individual oscillatory frequency-peak by off-peak entrainment

Nina Wolinski [1], Nick Cooper [1] & Vincenzo Romei [1]

[1.] Centre for Brain Science, Department of Psychology, University of Essex

The interest in human brain oscillations and their functional relevance has recently seen a resurgence. In particular, the development of recent methodologies in neurostimulation has provided a novel causal approach to the study of human brain oscillations. Rhythmic transcranial magnetic stimulation1 (rhythmic TMS) and transcranial alternating current stimulation2 (tACS) can entrain natural brain oscillations. They do so by enhancing oscillatory amplitude at the stimulation frequency and phase-aligning on-going oscillations to the imposed rhythm when the external rhythm coincides with the natural frequency of the targeted brain area. Whether an externally imposed rhythm can also modulate other oscillatory parameters, e.g. individual frequency peak, has not yet been assessed. To directly test this hypothesis we first measured 5 minutes of resting EEG activity and calculated the individual alpha frequency peak (IAF) in 10 participants. We then delivered parietal tACS (Cz-P4) for 20 minutes at 2Hz above or below IAF or in sham mode during separate sessions (within-subjects design). Following the tACS sessions, 5 further minutes of resting EEG were measured and IAF was again extracted. Preliminary findings indicate that this entrainment protocol systematically shifted IAF towards the externally imposed frequency. No significant shift was observed for sham stimulation. This suggests that off-peak entrainment can shift individual oscillatory peaks in desired directions. This has important implications for the causal assessment of the meanings of frequency peaks, for example, how they relate to individual differences in cognitive functions.

- (1) Thut, G., Veniero, D., Romei, V., Miniussi, C., Schyns, P., & Gross, J. (2011). Rhythmic TMS causes local entrainment of natural oscillatory signatures. *Current Biology, 21,* 1176-1185.

- (2) Helfrich,R.F., Schneider, T.R., Rach, S., Trautmann-Lengsfeld, S.A., Engel, A.K., & Herrmann, C.S. (2014). Entrainment of Brain Oscillations by Transcranial Alternating Current Stimulation. *Current Biology, 24,* 333-339.

Poster 26: Identification of deceptive moves and direction of play in football

Michael Wright [1]

[1.] Brunel University

The purpose of the experiments was to analyze the effect of deceptive football moves (step-overs) on direction prediction. Higher-skilled (HS) and lower-skilled (LS) football players viewed 2s point-light video clips, from a defender's perspective, of a player approaching and turning with the ball. The observer's task was to predict whether the player would turn the ball right or left (direction identification). In a second block of trials with identical stimuli (order counterbalanced) the task was to say whether the move was normal or deceptive (deception identification). Direction was systematically misperceived on deceptive moves (mean d' < 0), but HS were relatively more accurate than LS. For deception identification, HS were also more accurate (mean d' > 0). For normal moves, regression analysis found no significant predictors of direction identification (d'). Nor, on deceptive moves, was deception identification (d') a significant predictor. Expertise, however, was a significant predictor (20% of total variance on early-occluded, 23.4% on late-occluded deceptive moves). Additionally, for HS footballers indicated a bias towards identifying late-occluded moves as deceptive, and beta (β) for deception identification was a significant predictor of direction identification (d') on late-occluded deceptive moves (10%). Perhaps this tendency to regard all moves suspiciously can inhibit premature responding to early body kinematics, which would indeed be deceptive in the case of a step-over, allowing weight to be given to the later "honest" kinematic cues.

Poster 27: Ventral and dorsal stream contributions to the visuomotor effects of action relations: An rTMS study

Shan Xu [1], Dietmar Heinke [1] & Glyn Humphreys [2]

[1.] School of Psychology, University of Birmingham
[2.] Department of Experimental Psychology, Oxford University

In a previous study (Xu, Heinke, and Humphreys, VSS2014) we presented images of pairs of functionally related objects, and required speeded left-right choice responses to an imperative target at the centre of the screen. We demonstrated an inhibitory effect of implied actions on responses aligned with passive objects (e.g. a bowl) and a response advantage associated with the active objects (e.g. a spoon). In the present study, we investigated the neurocognitive mechanism behind these effects by examining the contributions from the ventral and the dorsal visual streams separately. According to Goodale and Milner's (1992) theory of the two visual streams, the dorsal (action) stream mediates the visual control of actions directed at objects, whereas the ventral (perception) stream processes objects for identification. To tease apart the contributions of the two streams to the visuo-motor effects of implied actions, we

delivered online transcranial magnetic stimulation (TMS) to the left anterior intraparietal sulcus (aIPS) and to the left lateral occipital areas (LO). We showed that rTMS to the left aIPS reduced both the inhibitory effect on responses aligned with passive objects and the advantage of those aligned with the active objects. These reductions only occurred when the active objects were contralateral to the stimulation. Stimulation of the left LO did not produce any distinctive effect. The results suggest the importance of the dorsal visual stream in generating the effects of implied actions, and that the effects are driven by the affordances of objects that would be active in action.

- Xu S, Heinke D, and Humphreys GW (2014) Action relations affect affordance selection: Evidence from visuomotor responses to paired objects. Poster at the 14th *Annual Vision Sciences Society Meeting*, St. Pete Beach, Florida, USA.
- Goodale, M. A., & Milner, A. D. (1992). Separate visual pathways for perception and action. *Trends in neurosciences*, *15*, 20-25.

Poster 28: **Improving older people's emotion perception using brain stimulation**

Tao Yang [1] & Michael Banissy [1,2]

1. Department of Psychology, Goldsmiths, University of London
2. Institute of Cognitive Neuroscience, University College London

Extensive behavioural evidence have shown older people have declined ability in facial emotion recognition. Evidence from neuroimaging suggests that the inferior frontal gyri (IFG) degrades rapidly with aging, and plays a role in facial expression perception. The aim is to investigate whether high frequency transcranial random noise stimulation (high-frequency tRNS) applied to the IFG would improve emotion perception in older adults. Healthy older participants (60+ years) were recruited for this study. Fifteen participants was assigned to receive high-frequency tRNS and sixteen participants were assigned for sham condition. Age, gender, handedness were matched between two groups. Stimulation group received 20-minutes high tRNS (1mA, 15s fade in/out) over the stimulated regions F7 and F8. The results showed that there was a significant improvement for 'anger' perception following high-frequency tRNS. In contrast, the same tRNS stimulation did not significantly change the performance on other two face perception tasks. This finding is in line with previous findings from affective studies showing inferior frontal gyrus is more involved in processing negative emotions (anger) rather than positive (happiness) emotions. The findings also highlight tRNS as a potential tool to aid facial emotion perception in typical aging.

Poster 29: **Ayahuasca beverage induces changes on the locomotor and exploratory activities and on the expression of glutamate transporter (EAAC1) in the prefrontal cortex and hippocampus of rats**

Luana Zamarrenho [1], Melina Iyomasa [2], Jaime Hallak [3] & Maria Luiza Rosa [4,5]

1. School of Phylosophy, Science and Letters of Ribeirao Preto-USP
2. School of Medicine of Catanduva-FIPA
3. School of Medicine of Ribeirao Preto-USP
4. Barretos School of Health Sciences, Dr. Paulo Prata-FACISB
5. Institute of Neuroscience and Behavior-INeC, Brazil

This work aimed at investigating whether rats treated with Ayahuasca show behavioural alterations in the open field and elevated plus maze; and on the expression of glutamate transporter (EAAC1) in the prefrontal cortex (PFC) and hippocampus. Twelve groups of male Wistar rats (230-250g, n=10/each) were used. They received 0.2 or 0.4ml/g of Ayauhasca beverage or water: only once (acute), 3 times/day for 3 days (sub-chronic) or once/day for 15 days (chronic). Thirty minutes after the last ingestion the animals were submitted to behavioural tests. At the end they were anaesthetized, perfused and their brains used for immunohistochemistry for EAAC1. Comparisons used "t" test or one-way ANOVA/Duncan ($p \leq 0.05$). Acute or sub-chronic ingestion of Ayahuasca induced a decrease in both locomotor (27%) and exploratory (20-24%) activities, while chronic ingestion induced an increase (15-34%). Ayahuasca induced non-significant increase in both number of entries and time spent in the open arms. Sub-chronic and chronic treatments with Ayahuasca induced significant increase in EAAC1 expression in hippocampus (20-67%). In contrast, the expression of EAAC1 in the PFC was significantly decreased in rats treated with 0.2 or 0.4ml/g sub-chronically or 0.4ml/g chronically (17-25%). Acute ingestion of 0.2ml/g induced smaller increase in EAAC1 expression (16%). These results suggest that i) Ayahuasca changes the locomotor and exploratory activities in a way depending the dose and frequency of ingestion; ii) Ayahuasca has no effect on the level of anxiety; iii) Acute, sub-chronic or chronic ingestion of Ayahuasca trigger distinct mechanisms in the PFC and hippocampus involving the modulation of the glutamatergic neurotransmission.

Notes