2017 BACN
Annual Scientific Meeting
Sponsored by
MEETING PROGRAMME
Thursday 7th September

(Conference registration from 8:30)

9:00 Welcome address and conference introduction in the main auditorium.

Early Career Prize Lecture
9:30 Duncan Astle (MRC Cognition and Brain Sciences Unit, Cambridge), Using systems neuroscience to understand typical and atypical cognitive development.

10:30 Tea and coffee break, with sponsor exhibits

Open session
10:50 Helge Gillmeister (University of Essex), How do bodies become special? Electrophysiological evidence for the emergence of body-related cortical processing in the first 14 months of life.
11:15 Beatriz Calvo-Merino (City University of London), The sensory homunculus feels beyond our body: From emotion to aesthetics.
11:40 Berenice Valdés-Conroy (Universidad Complutense de Madrid, Spain), Processing threat in individual and social space: An ERP study.
12:05 Beverley J. Brown (University of Nottingham), A neural basis for contagious yawning: Investigating automatic imitative behaviour.

12:30 Lunch break, with sponsor exhibits
13:00 Poster session (day 1)

Symposium: Cognitive neuroscience of object affordance and it’s clinical implications.
14:00 Patric Bach (Plymouth University), Attributing goals to others induces predictive biases in action observation: Differences in autistic and typically developing individuals.
14:25 Magdalena Ietswaart (University of Stirling), Affordance and imitation in left hemisphere stroke and in autism.
14:50 Sanjay Kumar (Oxford Brookes University), The role of hand action on objects in attentional selection and inhibition.
15:15 Pia Rotshtein (University of Birmingham), Interaction of semantic and procedural knowledge in paired object affordance.
15:40 Ellen Poliakoff (University of Manchester), Observing affordances and transitive actions in Parkinson’s disease.

16:05 Tea and coffee break, with sponsor exhibits

Invited keynote speaker, sponsored by Rogue Resolutions
16:30 Steven Tipper (University of York), Automatic action simulation: Boundary conditions and challenges.

17:30 Day end followed by Conference Dinner and Ceilidh, from 19:00 at the Duke of Cornwall Hotel, Plymouth.
MEETING PROGRAMME
Friday 8th September

(Conference registration from 8:30)

**Symposium sponsored by Plymouth University Cognition Institute:**  
*New analysis methods of EEG in cognitive neuroscience.*

9:00 Giorgio Ganis (Plymouth University), *Brain decoding with multivariate pattern analyses of event-related potentials.*

9:25 Bruno Rossion (University of Louvain, Belgium), *Understanding brain function with fast periodic visual stimulation in EEG.*

9:50 Marios Philiastides (University of Glasgow), *Machine learning for fusing EEG with fMRI and enabling network reconstruction during human decision making*

10:15 Laura Astolfi (Sapienza University of Rome, Italy), *A new perspective in social cognitive neuroscience: EEG hyperscanning and multiple-subject modelling*

10:40 Tea and coffee break, with sponsor exhibits

**Open session.**

11:00 Alejandro Galvez-Pol (City University of London), *Revealing mnemonic representations of the body in the brain.*


11:50 Thomas D. Sambrook (University of East Anglia), *Model-free and model-based prediction errors revealed by single-trial EEG analysis.*

12:15 Jan Kuipers (University of Stirling), *Electrophysiological brain responses of isolated words reflect semantic word knowledge during learning.*

12:40 Lunch break, with sponsor exhibits

13:00 Poster session (day 2)

14:00 BACN Annual General Meeting

**Mid-Career Prize Lecture**

14:30 Matt Lambon Ralph (University of Manchester), *Semantic cognition and its disorders.*

15:30 Tea and coffee break, with sponsor exhibits

**Symposium: Neurofeedback for the 21st Century**

15:50 John Gruzelier (Goldsmiths, University of London), *Historical perspective, contemporary validation of EEG-neurofeedback applications.*

16:15 Eddy Davelaar (Birkbeck College, University of London), *A cognitive science approach to neurofeedback.*

16:40 Tibor Auer (Royal Holloway, University of London), *Mind and machine in neurofeedback using real-time functional MRI: Theoretical and practical considerations.*

17:05 Katya Rubia (Kings College, University of London), *fMRI Neurofeedback in ADHD adolescents.*

17:30 Conference End
Automatic action simulation:
Boundary conditions and challenges
Steven Tipper (1)

(1) University of York, UK

When observing another person’s actions there is evidence for activation of the motor system in the observer. It has been proposed that such an action simulation process evolved primarily to facilitate the understanding of another person’s behaviour. Furthermore, evidence suggests that such processes are automatic, where action simulation is evoked when the other individual’s behaviour is incidental to the participant’s task. However, in studies examining attention, peripersonal vs extrapersonal space, and first-person vs third-person perspective, boundary conditions are observed. These results might question the level of automaticity of such action simulation processes, and whether they initially evolved for understanding others.
Difficulties with executive functions like attentional control and working memory are key features of numerous neurodevelopmental disorders, and of children with no diagnosis but who struggle with learning. The approach hitherto taken to understanding these difficulties is to use case-control designs, with neuroimaging techniques reliant on voxel-by-voxel comparisons. We believe that this approach can overstate the relative purity of these disorders and their diagnostic labels, and these imaging methods are heavily biased towards finding small peaks of neural difference between children.

This talk features an alternative transdiagnostic approach to exploring the neural basis of cognitive difficulties in childhood. We use machine learning to identify groups of children with common cognitive profiles and network science to identify differences in brain organisation (e.g. [1]). The talk also features some of the group’s work using MEG to identify dynamic transient networks that are associated cognitive abilities (e.g. [2]), and are altered according to regional profiles of gene expression in children (e.g. [3]). Finally, I will cover some of our work using systems neuroscience to explore changes in these brain systems following intensive cognitive training (e.g. [4 and 5]), and using machine learning to identify individual differences in patterns of improvement following training.

Semantic cognition and its disorders
Matt Lambon Ralph (1)

(1) Neuroscience and Aphasia Research Unit, School of Biological Sciences, Faculty of Biology, Medicine and Health, University of Manchester, UK

Semantic cognition reflects the controlled use and representation of semantic knowledge – our database of meaning for words, objects, people, emotions, etc. In this talk I will focus on the representational component of semantic cognition. I will discuss our evolving understanding of the neural basis of semantic memory and its contrastive disorders after different kinds of neurological damage. This includes the convergent use of multiple clinical, computational and cognitive neuroscience methods not only to map the key neural regions and their connectivity but to understand how this network functions to generate semantic representations and, when damaged, gives rise to different semantic disorders.


Attributing goals to others induces predictive biases in action observation: Differences in autistic and typically developing individuals.

Patric Bach (1), Matthew Hudson (2), Toby Nicholson (3), Rebecca McKenzie (1)

(1) School of Psychology, Plymouth University, UK
(2) Aalto University, Finland
(3) University of Kent, UK

While social perception is often conceptualized as a bottom-up activation of motor knowledge, recent predictive processing models argue instead for an inferential process, where sensory input is evaluated relative to top-down information about others’ goals. Here, we tested whether this integration occurs differently in autistic and typically developing individuals. Participants observed actors reach for or withdraw from objects. At some point of their course, the hands suddenly disappeared, and participants reported the vanishing point on a touch screen. Prior to action onset, we manipulated the observer’s knowledge about the actor’s intention, such that they either expected a reach or a withdrawal. The results indeed revealed predictive biases on action observation, with perceived disappearance points being displaced in the direction of (1) motion and (2) inferred goals, such that hands appeared to move closer to objects when expecting a reach and further away when expecting a withdrawal. Importantly, the two sources were differently weighted in autistic and typically developing individuals, with the latter integrating both prior motion direction and top-down goal information, and the former relying exclusively on goal information, disregarding motion. These top-down influences on perceptual action judgments are in line with predictive coding models of social perception and provide new insights into the social deficits into autism spectrum condition, suggesting an over-weighting of explicit goal information over lower-level biological motion input.

The role of hand action on objects in attentional selection and inhibition

Sanjay Kumar (1)

(1) Department of Psychology, Oxford Brookes University, UK

Research has shown that manipulable objects activate motor related areas of the brain. It is also known that hand related action on object is coded preattentively and that hand action on perception and responding are difficult to prevent. The hand action also provides contextual enhancement of object affordances. It would be interesting to question to what extent such preattentive coding and enhanced affordances from hand action are useful to guide our attention and inhibit inappropriate action. My earlier work using EEG and ERP investigations using object verification task have shown that hand actions are coded early in the visual processing stage and modulate early attentional orientation. Furthermore, my
work has also shown that selection of a target becomes easier if the hand action is congruent to the action typically performed by a target object in presence of incongruent hand action on a distractor object through reduced interference from the distractor. Conversely, the target selection becomes difficult if hand action is incongruent to the action typically performed by the target object in presence of congruent hand action on a distractor object through enhanced interference from the distractor. Intriguingly, enhanced affordance from hand action on objects also overcomes fundamental early motor inhibition typically observed in the “negative compatibility effect” paradigm. In this talk I will also present data from my recent work on the role of hand action on attentional inhibition using “inhibition of return paradigm” where I have found that hand action plays crucial role in inhibiting attentional deployment to a pre-cued location.

Affordance and imitation in left hemisphere stroke and in autism.
Magdalena Ietswaart (1)

(1) University of Stirling, UK

The processes involved in imitation, motor imagery, and action observation of object use may best be understood when not separated but instead as each relying on action simulation. Apraxia is fairly common following left hemisphere stroke. Apraxic patients struggle to imitate object interaction. It is unclear to what extent this is due to impaired motor imagery. This was investigated through a perceptual task of object use. Patients with apraxia were found to be selectively impaired on perceptual decisions reliant on motor imagery to select the appropriate grasp for object-use. This deficit increased with apraxia severity. These selective effects were replicated in healthy volunteers during inhibitory brain stimulation over the left parietal cortex using tDCS. This suggests that action simulation plays a role in imitation. This notion of action simulation was further investigated in automatic imitation in autism. Previous research has found diminished propensity to imitate others' actions in autism. It is unclear to what extend this, and behavioural problems in autism in general, are related to atypical processes of action simulation due to reduced function of the mirror neuron system. If action simulation is not normal, automatic imitation would be reduced in autism. This was investigated in an action observation paradigm recording automatic imitation of exaggerated high reaching of objects. Automatic imitation of the exaggerated reaches was found in individuals with autism, suggesting intact action simulation. This finding was confirmed investigating anticipatory eye-movements in action observation which were found to be normal in autism. Together these findings suggest that disruption of the left parietal lobe gives rise to compromised affordance of object-related action evident in impaired imitation. More social manifestations of diminished imitation, common in autism, are unlikely to have their source in reduced action simulation or compromised affordance of object-related action.
Symposium 1: Cognitive neuroscience of object affordance and its clinical implications

Observing affordances and transitive actions in Parkinson’s disease
Ellen Poliakoff (1)

(1) Division of Neuroscience and Experimental Psychology, University of Manchester, UK

People with Parkinson’s disease (PD) are slower to initiate movements and often produce movements of reduced amplitude. Their movements can be improved by simple visual or auditory cues. In healthy people, the motor system can be activated by observing objects related to actions and object-directed actions. Therefore, on the one hand given the strong effects of basic cues on their movement, people with PD may show a stronger effect than healthy controls in response to observing affordances. On the other hand, their motor impairments might reduce affordance-related effects. My earlier work using a visuomotor priming reaction time task suggested that people with PD are affected both by basic spatial stimuli and affordance stimuli [2] and interestingly differed from controls in over-responding to the basic spatial stimuli [1]. I will present a follow-up experiment where we have investigated the effects of observing affordances on reaching movements. In addition, I will present ongoing work investigating whether combined observation and imagery of functional transitive actions can facilitate movements in PD, which has implications for the design of therapeutic interventions.


Interaction of semantic and procedural knowledge in paired object affordance.
Pia Rotshtein (1)

(1) University of Birmingham, UK

Two models have been proposed to account for the retrieval of action knowledge. One model suggests that objects must be recognized before any knowledge regarding their potential usage can be retrieved. A second model, argues that an additional direct route from perception-to-action enables retrieval of action knowledge even in the absence of object recognition. In a set of behavioral studies with healthy participants across the life span and neurological patients we tested the ability to retrieve action knowledge: can two object interact together. Retrieval of action knowledge was performed in the context of distracters that could be semantically related or unrelated to the interacting objects. We measured the use of hands, while selecting the objects as an indication of the involvement of motor procedural processing. We showed that retrieval of action knowledge depends on both sensory-motor procedural processing (assumed to reflect the he direct route form perception-to-action) and semantic processing. We further showed that impairment to select objects for action emerge following lesion to the left parietal or anterior temporal cortices.
Brain decoding with multivariate pattern analyses of event-related potentials
Giorgio Ganis (1)

(1) Plymouth University, UK

This talk will provide an introduction to brain decoding methods using event-related potentials (ERPs) and will present recent results from perceptual and memory decoding paradigms, comparing them with those of traditional univariate analyses. Results reveal the time course of perceptual and memory processes and the effect of experimental parameters on classification accuracy.

Understanding brain function with fast periodic visual stimulation in EEG
Bruno Rossion (1)

(1) University of Louvain, Belgium

When the human brain is stimulated at a rapid periodic frequency rate, it synchronizes its activity to this frequency, leading to periodic responses recorded in the EEG (Adrian & Matthews, 1934). In vision, periodic stimulation has been used essentially to investigate low-level processes and attentional effects in the primary visual cortex, under the term “Steady-State Visual Evoked Potentials” (ssVEPs; Regan, 1966; Norcia et al., 2015 for review). This approach has now been extended and refined to understand higher-level brain functions, in particular the categorization of complex visual forms such as human faces, objects and words. This talk will summarize studies carried out over the last few years illustrating the unique strengths of this fast periodic visual stimulation approach: (1) the objective (i.e., exactly at the experimentally-defined frequency rate) definition of neural activity related to visual recognition as well as the simplicity of data analyses and interpretation; (2) the high signal-to-noise ratio allowing to rapidly measure visual recognition processes in difficult to test populations (e.g., infants and children, patients); (3) the independence from explicit behavioural responses; and (4) the first identification of objective markers of perceptual integration (“binding”). Contrary to widespread assumptions, this approach also provides precise information in the time-domain, and can be used to fully characterize the spatio-temporal course of visual recognition in a rapidly changing natural scene.
Machine learning for fusing EEG with fMRI and enabling network reconstruction during human decision making
Marios G. Philiastides (1)

(1) University of Glasgow, UK

Recent advances in multivariate signal processing and machine learning are enabling a richer and more rigorous characterization of the neural basis of human decision making. A defining characteristic of human behaviour is that decisions are variable in their accuracy and response time, even when one chooses between the same decision alternatives on repeated occasions. Thus, to infer the neural processes that govern learning and decision making requires identifying neural correlates of such trial-to-trial behavioural variability. In this talk I will discuss recent efforts to use machine learning to enable single-trial analysis of neural signals acquired while subjects perform simple decision making tasks in order to extract decision-relevant neural components from EEG data. I will then develop a framework for exploiting the trial-to-trial variability in these signals to analyse simultaneously acquired fMRI data to offer a comprehensive spatiotemporal characterization of learning and decision making. I will also highlight how single-trial analysis can reveal aspects of the underlying decision making networks, which are unobservable using traditional trial averaging methods.

A new perspective in social cognitive neuroscience:
EEG hyperscanning and multiple-subject modelling
Laura Astolfi (1,2)

(1) Sapienza University of Rome, Italy
(2) Fondazione Santa Lucia IRCCS, Rome, Italy

Hyperscanning, or multiple-subject recording, enables the simultaneous collection of brain activity in different subjects during a social exchange. The group of interacting subjects is thus modelled as a complex system, in which the internal structure of each subject’s brain activation is studied together with the relation arising between the different parts of the system, i.e. the different subjects’ brains. The consequent multiple-subject modelling has opened a new avenue in social cognitive neuroscience, with an impact on physiological as well as on pathological conditions, raising at the same time methodological and modelling challenges which are among the most interesting opportunities in neuroscience methods development. In this paper, the theoretical framework justifying the need for simultaneous recording and multivariate modelling of multiple subjects’ data will be discussed, together with some examples of multi-subject models related to collaboration, joint action and empathic pro-social behaviour, obtained by high density EEG and source reconstruction techniques.
Historical perspective, contemporary validation of EEG-neurofeedback applications
John Gruzelier (1)

(1) Department of Psychology, Goldsmiths, University of London, UK

The reasons why EEG-neurofeedback has been rehabilitated will be reviewed and given an international perspective. Reasons include: progress in understanding the behavioural significance of EEG oscillations and with new protocols developed; controlled evidence of a plethora of performance enhancements – some surprising – and in the case of arts performance of professional significance; evidence of validation including affirmative correlations between behavioural enhancements and learning indices [1,2]. While a host of methodological issues and refinements await investigation [3], the promise that the learned self-regulation of EEG oscillations holds has spawned an active research field. The non-invasive methods are of particular clinical relevance.


A cognitive science approach to neurofeedback
Eddy J. Davelaar (1)

(1) Department of Psychological Sciences, Birkbeck, University of London, UK

Research in cognitive science and neurofeedback have a parallel history, but never influenced each other. Whereas neurofeedback research has been mainly concerned with validation and "proof of existence", cognitive science has focused on mechanisms underlying mental processes and recently explaining brain-behaviour relations. In this talk, I will demonstrate how the tools and theories developed within cognitive science can be incorporated in neurofeedback research to unravel the mechanisms underlying neurofeedback training success (and failure) and, conversely, how neurofeedback can be used as a tool to address questions of causality in brain-behaviour relationships. The marriage of the two fields broadens the horizons of both, allowing fertile ground for new discoveries, applications, and scientific progress.
Symposium 3: Neurofeedback for the 21st Century

Mind and machine in neurofeedback using real-time functional MRI: Theoretical and practical considerations
Tibor Auer (1,2)

(1) Department of Psychology, Royal Holloway University of London, UK
(2) MRC Cognition and Brain Sciences Unit, Cambridge, UK

Neurofeedback training (NFBT) allows subjects to learn self-regulation of neuronal brain activation based on information about the ongoing activation. NFBT has already been performed with electroencephalography (EEG) since the 1970s. The implementation of real-time functional magnetic resonance imaging (fMRI) for NFBT offers a higher spatial resolution and spatial specificity. More importantly, it also allows for examining the processes underlying the NFBT [1]. We can finally investigate not only the "machine" used for the training but both the "mind" in training, as well; their interaction and their role. We can better understand between-subject variability in training success and the role of instructions in refining the search space for an optimal strategy [2]. Implicit operant learning, explicit skill learning and some sort of combination of the two [3] have been proposed as model for NFBT. EEG-NFBT literature tends towards the implicit learning [4], which 'just works' free from instructions; however, fMRI-NFBT results are less consistent as summarised in [5]. After a brief recap of the proposed models behind NFBT more elaborated in other talks of the symposium, the implementation of fMRI-NFBT and the most common approaches and applications will be discussed. Special emphasis will be put on challenges and recommendations motivated by both practical considerations and scientific findings obtained from fMRI-NFBT [6]. In addition to investigating how NFBT can be optimised, it will be demonstrated how NFBT can be employed to gain more insight into brain plasticity and even inference on NFBT models [7].


fMRI Neurofeedback in ADHD adolescents
Katya Rubia (1), Analucia A. Alegria (1), Melanie Wulff (1), Helen Brinson (1), Vincent Giampietro (1), Gareth J. Barker (1), Daniel Stahl (1), Daniel Brandeis (2), Anthony David (1)

(1) Institute of Psychiatry, Psychology and Neuroscience, King’s College London, UK

Psychostimulant medication is effective in ADHD but has side effects and limited long-term efficacy. fMRI Neurofeedback (NF) is a promising novel brain modulation therapy that teaches participants to gain self-control over their brain activation. We conducted a proof of concept fMRI-NF study in ADHD adolescents, targeting the right inferior frontal cortex (rIFC) which is consistently underactivated in ADHD children during cognitive control and upregulated with psychostimulant medication [1,2]. Thirty-one ADHD boys were randomized in a single-blind RCT to fMRI-NF (11 sessions) over 2 weeks of the rIFC (active group) or the left parahippocampal gyrus (lPHG, control group). Visual feedback was presented via a video-clip of a rocket that had to be moved to space. Main outcome measures were changes in parents’ ratings of clinical ADHD symptoms which were assessed at pre, post, and on average 11 month follow-up. A computer-based test battery and a fMRI Stop task were also used to assess NF effects on cognition and IFC brain function. Both groups showed significant linear progressive activation increase with increasing NF sessions in their respective target regions relative to the other group. Both groups also showed significant reduction of ADHD symptoms after treatment and at 11 month follow-up, with no significant group differences, but substantially larger follow-up effect sizes for the active group. Only the active group, furthermore, showed a transfer effect (increasing rIFC activation without NF), improved trend-wise in sustained attention, showed increased IFC activation during the stop task and had significant correlations between brain activation and clinical changes. The proof of concept study shows that rtfMRI-NF or rIFC is a feasible neurotherapy for ADHD adolescents, that it is associated with short and longer-term improvement in ADHD symptoms, better attention skills and improved inhibitory brain activation.

How do bodies become special? Electrophysiological evidence for the emergence of body-related cortical processing in the first 14 months of life

Helge Gillmeister (1), Silvia Rigato (1)

(1) Department of Psychology and Centre for Brain Science, University of Essex, UK

There is general consensus that the representation of the human face becomes functionally specialised within the first few months of an infant’s life. The literature is divided, however, on the question whether the specialised representation of the remainder of the human body form follows a similarly rapid trajectory or emerges more slowly and in line with domain-general learning mechanisms. Our study investigates visual ERPs in adults (P1 and N170) and infants (P1, N290, P400, and Nc) of three age groups (3.5, 10, and 14 months) to compare the emergence of face- and body-structural encoding. Our findings show that visual ERPs were absent (P1, N290, P400) or smaller (Nc) for bodies than for faces at 3.5 months and peaked later (N290, P400) for bodies than for faces at older ages. Inversion effects for bodies were not reliably found until 14 months (P400 amplitudes). In contrast, inversion effects for faces were present from 3.5 months (N290 latencies). Inverted faces produced an adult-like pattern for P400 at older ages (enhanced P400 amplitudes from 10 months, longer P400 latencies from 14 months), emphasising the role of P400 as the precursor of the adult N170. Importantly, our findings argue that structural encoding of the human body form emerges later in infancy and is qualitatively different from the structural encoding for faces. This is commensurate with infant motor development and the experience of viewing complete body shapes later than faces.

The sensory homunculus feels beyond our body: from emotion to aesthetics.

Beatriz Calvo-Merino (1), Bettina Forster (1), Alexander Jones (2), Helge Gillmeister (3)

(1) City, University of London, UK
(2) Middlesex University, UK
(3) University of Essex, UK

Recent studies have provided a sensorimotor aesthetic framework that integrates multidimensional layers from neural, behavioral and physiological responses [1,2,3]. Here we present data from two related experiments investigating independently the specific neural determinants of aesthetic judgments. Compared to a control visual judgment task, subjects judged biological motion (of dance movements) and body postures (dance postures) during fMRI and EEG, respectively. Our results showed a stronger engagement of somatosensory cortex (SCx), as reflected in the fMRI activations and somatosensory evoked potentials (SEPs, EEG) for the aesthetic judgment (compared to a visual discrimination task) of biological motion and body postures, suggesting an important mechanism involving SCx and embodiment in relation to aesthetic evaluation of human movement/posture.
Additionally, the SEPs results suggest an early engagement of SCx during the aesthetic task happens in a somatotomiac manner (i.e. stronger SEPs when there is a congruency between the body part touched (tactile stimulation) and aesthetically judged). Overall, these results suggest that the role of somatosensory cortex in action/body perception goes beyond mere visual perceptual processing and is sensitive to a highly complex and uniquely human ability such as aesthetic judgement. This goes in line with previous studies providing SCx an important role of in emotional embodiment [4]. Finally, this aesthetic embodiment happens in a somatotopic manner, providing a truly relevant role of our body during aesthetic perception.


Processing Threat In Individual And Social Space: An Erp Study

(1) Departamento de Psicología Básica I, Universidad Complutense de Madrid, Spain
(2) Instituto Pluridisciplinar, Universidad Complutense de Madrid, Spain
(3) Instituto de Investigación Hospital Universitario 12 de Octubre (i+12), Spain
(4) Beckman Institute for Advanced Science and Technology, University of Illinois, USA
(5) William James Center for Research, ISPA-Instituto Universitário, Portugal

We measured the electrical brain response during the visual processing of threat in individual (Near/Far) and social (Near the other) space. Using an experimental set-up from previous studies [1,2] participants had to indicate whether the objects (threatening/non-threatening insects) were near enough to be reached. Stimuli were presented at nine different positions displayed on a 52”inch-long screen placed orthogonally to participants’ location. In one block of trials, participants performed the task alone while in the other half the experimenter sat at the opposite side of the screen. We replicated previous effects showing faster responses to objects presented in Near space than in Far-space and found a significant interaction of threat, space and social context. When performing the experiment on their own, affective modulations were observed in Near-space but not in Far-space. However, when the experimenter was sitting at opposite side of screen, the same effect of threat was observed in Far-space (Near the other). Analyses of ERPs replicated previous results of faster latencies and greater amplitudes in a N1 occipital component for objects presented in near space. Additionally, we found centro-parietal (CP) negative modulation sensitive to threat at around 500ms. As in RT measures, this modulation was only for
objects in Near-space when completing the task alone. When the experimenter was located at the opposite side of the screen, the (CP) modulations disappeared and new effects of threat were found at frontal electrode sites in a Negative component peaking around 400ms. Our results suggest the action of different brain systems involved in the processing of threat to us and threat to others. A centro-parietal system for the individual space, and a frontal system for the space of others. The slower modulation of individual space may be due to the interaction process between affective features and the spatial location when we have to react to a potential threat.


A neural basis for contagious yawning: Investigating automatic imitative behaviour

Beverley J. Brown (1), Soyoung Kim (2,3), Hannah Saunders (2), Hilmar Sigurdsson (1), Katherine Dyke (1), Danielle Ropar (1), Stephen R. Jackson (1,3), Georgina M. Jackson (2,3)

(1) University of Nottingham, UK
(2) School of Medicine, University of Nottingham, UK
(3) Institute of Mental Health, University of Nottingham, UK

Contagious yawning (CY) is a phenomenon that only occurs in humans, old world primates, and some dogs. It is a contagious action that is facilitated in response to hearing, seeing, or for humans, even thinking about yawning [1, 3]. Contagious yawning is also a common type of Echophenomena. Echophenomena is the automatic imitation of another individuals’ words (Echolalia) or actions (Echopraxia) [1]. The neural correlates of Echophenomena remain unknown, however it has been suggested that it might be associated with disinhibition of the human-mirror-neuron-system [1-4] and hyper-excitability of cortical motor areas [1]. In the current research we investigated the neural correlates of CY using multimodal brain stimulation protocols (TMS, NIBS). We used Transcranial magnetic stimulation [TMS] to quantify each participant’s measures of motor cortex excitability and physiological inhibition. We then administered, during a CY behavioural task, anodal-Transcranial-direct-current [a-tDCS] and random noise [tRNS] electrical stimulation (relative to sham) to increase cortical excitability of the supplementary-motor-area [SMA] . The SMA is a brain area previously associated with the genesis of Echophenomena [2,5]. Thirty-six healthy adults observed video clips of actors yawning and, in separate blocks, were instructed to either freely yaw or resist yawning. Participants were videoed throughout and their yawns or stifles counted. Results demonstrate that TMS measures of cortical excitability and physiological inhibition were significant predictors of CY prior to electrical stimulation, and, that a-tDCS and TRNS applied to the SMA both significantly increased the number of stifled yawns observed, but only when participants were attempting to actively suppress yawning. These results demonstrate that individual variability in the propensity for
CY is determined by cortical excitability and physiological inhibition in primary and secondary cortical motor areas.


Working memory (WM) supports temporary maintenance of task-relevant information. This process has been associated with increasing persistent activity in the sensory cortices processing the information [1,2]. Most studies examine this activity locked to that modality used to originally perceive arbitrary stimuli. For instance, in visual regions for figures and colours [3], and in somatosensory for tactile taps [4]. However, we argue here that more socially meaningful stimuli moderate this sensory-locked activity and recruit distinctive cortical regions. Specifically, perception of bodies is known to engage body-related regions (motor and somatosensory cortices) beyond visual brain areas [5]. In two different studies, by means of electroencephalography (EEG), we combined different conditions including motor, somatosensory, and visual-evoked potentials in a WM task for body and control non-body-related images. We assessed the presence of persistent activity in motor, somatosensory, and visual regions by subtracting brain activity from trials containing only visual-evoked potentials to those trials containing either a mixture of visual and somatosensory or visual and motor potentials. This design allowed us to isolate visually driven neural activity in areas other than visual. Our results showed that throughout the retention interval of the WM paradigm, only motor and somatosensory cortices exhibited persistent activity modulated by the number of body stimuli to-be-remembered, whereas visual/posterior regions’ persistent activity increased steadily when maintaining the control non-body-related stimuli. Our results bridge together the action observation and WM frameworks and support a dynamic WM process in which the nature of the information summons specific processing resources.

Interoceptive Inference: global vs. local predictions of internal states
Amanda C. Marshall (1), Antje Gentsch (1), Simone Schütz-Bosbach (1)

(1) Ludwig-Maximilians-University Munich

Interoception refers to the awareness of internal bodily states. A growing consensus views this awareness as an interaction of top-down predictions and bottom-up sensory feedback. We explore the contribution of predictive coding to interoception across two experiments. In addition, we differentiate between the ability to form predictions at a local (within a trial) and global (across trials) level. Participants completed an established repetition suppression paradigm in which they viewed angry or neutral facial expressions in a repeated or alternating fashion. Multichannel EEG was recorded to explore the amplitude of the Heart rate Evoked Potential (HEP) as a marker of internal awareness. To explore the effect of global predictions, half of the experimental blocks contained a cue which predicted a repetition of facial expression. This was made either implicit (experiment 1) or explicit (experiment 2). Results of experiment 1 found an enhancement of HEP amplitude for repeated faces, confirming the idea that local predictions shape the generation of internal awareness. In experiment 2, HEP enhancement following repeating trials was exacerbated in cued relative to uncued blocks. This indicates that explicit global cues can be used to form more accurate predictions and generate higher levels of internal awareness. Combined, results provide strong evidence for the contribution of predictive coding to interoception.

Model-free and model-based prediction errors revealed by single-trial EEG analysis
Thomas D. Sambrook (1), Andy J. Wills (2), Ben Hardwick (2), Jeremy Goslin (2)

(1) School of Psychology, University of East Anglia, UK
(2) School of Psychology, Cognition Institute, University of Plymouth, UK

A large literature exists implicating frontocentral ERPs as neural correlates of reward prediction error. Recently, interest has grown in fitting neural data to trial by trial output of computational models of reinforcement learning. However, to date this output has been largely derived from model-free reinforcement learning algorithms, relatively simple processes in which reward expectation is based retrospectively on the history of prior reinforcement. Much human learning and decision-making is, however, believed to be model-based, in which reward expectations are prospective, explicit predictions of the likelihood of reward based on a model of the behaviour of the environment. A recent fMRI study employing a two-stage decision process presented evidence that the brain computes prediction errors to such model-based reward expectations. This finding is surprising since standard formulations of model-based learning have no use for this term and so evidence for its generation informs our fundamental understanding of the reinforcement learning algorithms that shape behaviour. Nevertheless, because of the poor temporal resolution of fMRI it is possible that this finding arises from a confounding of prediction error with other computations in the reinforcement learning circuitry: the state prediction error (i.e. the
surprise associated with the outcome) and the expected value for the next stage of the task. We took EEGs from participants performing the two-stage task and then fitted their behaviour to a reinforcement learning algorithm which generated model free and model based prediction errors on a trial by trial basis. By realising ERP waveforms as betas from a regression of voltage against model-based prediction error, model-free prediction error, state prediction error and expected value for the following stage, we were able to separate out the components underlying these separate influences. The results corroborate the presence of a model-based prediction error.

**Electrophysiological brain responses of isolated words reflect semantic word knowledge during learning**

Jan Kuipers (1)

(1) University of Stirling

Learning a new concept and word typically involves repeated exposure to the word in the same or similar contexts such that a stable link is created in long term memory between a concept and the word. Although much is known about brain structures involved in learning, there is currently no known electrophysiological measure of learning that is not confounded by repetition, context, or word familiarity effects. Here we report a late frontal event-related potential (ERP) that is tied in amplitude to increases word knowledge only. We recorded ERPs from words unbeknownst to participants, followed by a definition. Participant word knowledge ratings, recorded after each of ten different definitions, showed incremental learning for those words followed by meaningful definitions only. These ratings correlated with a linear decrease in amplitude of a late frontal negativity (LFN) observed for learned items only whereas N400 and P2 effects only reflected word familiarity in this context. Furthermore, LFN amplitude during learning was predictive of the magnitude of the N400 semantic priming effect during the test phase in which participants made true/false judgements about sentences ending with the learned words. This is the first demonstration of a direct link between brain responses and how much word knowledge is being acquired.
**Poster 01**

**Motor imagery and attentional focus during blind action mirrors seen performance: Evidence from lab and real life data.**

Bassem Khalaf (1), Patric Bach (2), Mike Tucker (2), Rob Ellis (2)

(1) Faculty of Education, University of Mustansiriyah, Iraq
(2) School of Psychology, Plymouth University, UK

The current study used an experimental paradigm to investigate whether blind action guided by imagery is based on the same foci of attention as seen performance [e.g., 1]. In the first experiment, 23 participants were asked to close their eyes and draw a straight line between two landmarks on a graphics tablet. The examiner instructed them, in three conditions, to focus on either: (1) a mental imagery of the goal landmark (external focus of attention), or (2) drawing a straight line, focusing on the fingers (internal focus), or (3) without a specific focus of attention (control). In second experiment, 17 participants were put in a less artificial situation, and were asked to throw darts blindly at a dartboard. Again, participants were asked to mentally imagine either (1) the dart and the target, or (2) the technique and their fingers, or (3) without a specific focus of attention (control). Both experiments revealed advantages of the external focus of attention relative to both the control and internal focus conditions. These results reveal that mental imagery during blind action relies on the same attentional processes as seen performance, and give perceptual representations a direct role in motor control.


**Poster 02**

**Seeing is believing? Prior knowledge of others' beliefs bias perception of their actions.**

Katrina McDonough (1), Matthew Hudson (2), Patric Bach (1)

(1) School of Psychology, Plymouth University, UK
(2) Aalto University, Finland

Recent models argue that social perception – and perception in general – is an inferential process, where prior knowledge and higher-level expectations about an actor’s goals and beliefs guides our perceptual experience of their actions [1,2,3,4]. We have recently developed a novel paradigm, capturing these goal expectations, and allowing us to accurately measure their influence on action perception. In a series of experiments, we have demonstrated that expectations of rational action bias action observation. Participants watched others reach for objects with either rational trajectories (e.g. arched when reaching over an obstacle) or irrational trajectories (e.g. reaching straight despite an
obstacle). During its course, the hand disappeared, and participants made perceptual judgments about the last seen position on a touch screen. Judgments were consistently biased in line with action expectations, such that straight reaches were perceived higher when obstacle avoidance was predicted, and arched reaches were perceived lower when the actors could have reached straight. Additional experiments showed that these biases are also influenced by the beliefs attributed to the actor. When, prior to action onset, the actor expressed contradicting beliefs about the scene (e.g. stating that the path was clear despite the actual presence of an obstacle), perceptual biases followed the belief rather than visual information. This provides evidence, for the first time, for a top-down influence of prior expectation on action observation, involving sophisticated higher-order processing of theory of mind (“mentalizing”), and reveal that our perceptual experience of others’ actions is derived from an integration of bottom-up sensory information and high-level cognition.


**Poster 03**

**The role of left hemisphere integration networks in the size-weight illusion**

Anna Sedda (1), Myrto Efstathiou (1), Lucy Warriner (1), Angela A. Barrie (1), Gavin Buckingham (2)

(1) Psychology, School of Social Sciences, Heriot Watt University, UK
(2) Sport and Health Sciences, University of Exeter, UK

In the Size-Weight Illusion (SWI), small objects feel heavier than large objects of the same mass [1]. Recently, the SWI has been explained through integration of weight and size perception in ventral premotor areas [2]. The aim of our study is to test this hypothesis by actively manipulating neural activity in the putative network for size-weight integration using transcranial direct current stimulation (tDCS). 64 healthy participants were required to lift and rate the heaviness of objects which varied in mass and size (thus inducing the SWI). tDCS was delivered using two 5 x 5 cm rubber electrodes, generating an electrical current of 2mA for a stimulation time of 20 minutes. Group 1’s (n=12) montage involved the cathode being placed on the left ventral premotor area (PMv) while the anode on the left parietal lobe. This montage should affect perception of the SWI if this phenomenon relies on the integration between size and weight perception (2). In group 2 (n=10), to interfere with size perception only, we inhibited activity in the left parietal area (P3) while actively stimulating the right parietal area. In group 3 (n=10), the cathode was positioned on the right parietal area (P4) and the anode on the right shoulder, targeting a multisensory area that should not
be involved in the SWI. Finally, in the sham group (n=32), all parameters were the same, but the stimulation was turned off after 30 seconds. A mixed ANOVA on standardized perceptual ratings showed a significant interaction between Group and Size (p < .001, pes = .29) as well as Group and Weight (p < .001, pes = .32). Follow up tests showed a significant reduction in both size and weight perception in participants receiving cathodal stimulation over the left PMv cortex compared to all other groups, crucially including Group 2 (all p’s < .005). In summary, our findings support the notion that the left PMv is fundamental to the integration of size and weight, and that this process may drive the SWI.


**Poster 04**

**Searching for bodies: Electrophysiological evidence for independent somatosensory processing during attentional selection of body postures**

Irena Arslanova (1), Alejandro Galvez-Pol (2), Beatriz Calvo Merino (1), Bettina Forster (1)

(1) Department of Psychology, City, University of London, UK
(2) Sobell Department for Motor Neuroscience and Movement Disorders, Institute of Neurology, University College London, UK

Attention allows us to selectively process behaviorally relevant information by influencing neural activity within brain areas that represent that information. However, it is unclear whether attentional selection of body stimuli influences activity within visual areas that receive the visual percept, or within somatosensory areas that process functional bodily properties. Here, we recorded visual and somatosensory evoked activity during visual search task, whereby participants had to search for either visual (colour) or bodily (posture) properties that characterised target hand images. By dissociating somatosensory activity, associated with body processing, from initial visual input, we show that attentional selection of hand postures (but not hand colours) leads to modulation of independent somatosensory processing. This suggests that the effects of attention might be partially independent from input-sensory modality and instead affect activity within functionally relevant cortical areas. This provides evidence for flexible attention mechanisms that operate depending on the specific behavioral goals and the nature of attended stimuli.
Deficits in selective attention could play a significant role in the ADHD diagnosis. Previous literature suggests that disinhibition and selective attention problems may be the main symptoms to look at in cases of combined (ADHD-C), and inattentive (ADD) ADHD subtypes, respectively. In this work, the visual Garner paradigm [1] was administered to both ADHD subtypes to investigate possible difficulties in filtering out irrelevant visual information. Two different kinds of visual perceptual dimensions: "separate" dimensions (i.e. those that can be processed independently), and "integrated" dimensions (which cannot be encoded independently). Eighty subjects (21 ADHD-C, 23 ADD and 36 matched controls) participated in the study. In Experiment 1, participants had to classify visual stimuli according to their shape and ignore their colour. In Experiment 2, participants were asked to classify other visual stimuli in terms of their height while trying to ignore their width. Each experiment consisted of 2 homogeneous blocks (in which only the relevant variable varied) and 2 orthogonal blocks (where both variables varied). Each experiment included 160 trails. In Experiment 1 (separate dimensions), the ADD subgroup differed from the other two groups, showing an anomalous integration of the separated variables. In Experiment 2 (integrated dimensions), both ADHD groups showed an over-integrative pattern. Furthermore, the ADD group showed higher variability in their responses than the control group. The results of Experiment 1 may suggest that the ADD subtype of ADHD shows deficits in the selective attention mechanisms involved in filtering out irrelevant perceptual dimensions which had been related with posterior areas [2]. The results of Experiment 2 suggest that both ADHD groups present difficulties in integrating visual information which had been related with anterior areas [3].

Embodiment in Virtual Reality for object-based actions: An ERP experiment
Francois Foerster (1), Jeremy Goslin (1)

(1) School of Psychology, University of Plymouth, UK

Literature on human object manipulation proposed that stored information are recruited for object-based actions, depending on the action’s goal [1, 2]. Behavioural studies employed the move-use paradigm, where transporting and using object has been assessed [3]. These investigations concluded that different motor planning times reflected different cognitive processes, either integrating semantic for action and explaining the impairment found in patients with apraxia of tool use. However, these studies omit the possible influence of the kinematic complexity of these actions on motor planning, even if other studies have acknowledged it. We employed the move-use paradigm with the event-related potentials technique, where EEGs were recorded during the motor planning and execution of actions in Virtual Reality (VR). The visual representation of a novel tool to grasp in VR has been modified in order to afford the actions to cut and to crush a virtual cylinder. Moving, cutting and crushing actions were different in terms of their type (structural vs functional actions) and in terms of their kinematics (with vs without rotation of the forearm). Contrasting with previous studies employing the move-use paradigm, both motor planning and grasping times differed in terms of the actions’ kinematics. Similarly, occipital N1 and frontal P2 were modulated, depending on the complexity of the motor programs that was elicited. During the reach-and-grasp movement, the parieto-occipital network has been differently activated, depending on the subsequent action to perform. Our analyses support the embodied approach of cognition, as action’s intentions modulated early visuomotor processes. Finally, the results suggest that end-goals of actions are not fully pre-planned before initiating a movement, but partially planned during grasping. However, an open question is why the motor complexity of actions modulated early occipital activities at planning stage.

Beyond humans: Contagious yawning in primates elicited by a non-human agent
Ramiro M. Joly-Mascheroni (1), Bettina Forster (1), Beatriz Calvo-Merino (1)

(1) City University of London

The main function of yawning remains disputed. The contagious aspect of yawning, has been demonstrated within species, e.g. between humans [1]; chimpanzees, Pan troglodytes [2,3]; budgerigars, Melopsittacus undulatus [4]. In a previous study [5] we found that domestic dogs (Canis lupus familiaris) catch human yawns, in the first study to explore the contagiousness of yawning across species. This re-confirmed there is transference of communicative signals between species. In line with evidence that humans are more susceptible to yawn contagiously from those with whom they are familiar, chimpanzees yawn contagiously in response to videos of yawning in-group but not out-group members. Here, we explored the contagiousness of yawning between chimpanzees and an inanimate agent. We used an android. Results show that not only chimpanzees yawn contagiously, but they also lay down, and displayed a behaviour that resembled a state of drowsiness, suggesting the interpretation of a communicative signal produced by an unfamiliar model that was humanlike in appearance, but ultimately an android. Findings warrant further explorations of android action perception and interaction.

[1] Provine RR (1986) Yawning as a stereotyped action pattern and releasing stimulus. Ethology, 72, 448–455

The neuropsychology of weight perception in the context of the size-weight illusion
Gavin Buckingham (1), Robert D McIntosh (2), Jacqueline C Snow (3)

(1) Department of Sport and Health Sciences, University of Exeter, UK
(2) Department of Psychology, University of Edinburgh, UK
(3) Department of Psychology, University of Nevada, USA

Our sense of touch allows us to experience an object’s weight. Our hedonic experience of this property is readily biased by non-haptic cues, such as the object’s apparent size. This leads to small objects feeling heavier than larger objects of the same mass – a phenomenon known as the size-weight illusion. Because of this, and other similar misperceptions of object weight, the psychological and physiological underpinnings of heaviness perception
are still widely debated [1]. Recent neuroimaging work has suggested that visual regions of the brain might be involved in our experience of object weight [2]. To clarify the role of the visual brain in perceiving an object’s weight we examined the size-weight illusion in two famous neuropsychological patients with extensive lesions to their ventral visual streams: Patient DF (who suffers from visual form agnosia) and Patient MC (who suffers from cortical blindness due to extensive occipital lesions). Patient DF appears to experience no size-weight illusion when only visual cues to mass are allowed, suggesting that dorsal circuits are unlikely to drive this perceptual effect. Patient MC, by contrast, experiences a robust visual size-weight illusion, despite having almost no ventral visual stream. Together, these results call into question the causal role of the occipital cortex in experiencing an object’s weight.


Poster 09
Cortical Representations of Typical Tool Actions
Ethan Knights (1), Fraser W. Smith (1), Courtney Mansfield (1), Diana Tonin (1), Holly Weaver (1), Stephanie Rossit (1)

(1) School of Psychology, University of East Anglia, UK

Tools are manipulable objects that, unlike other objects in the world (e.g., furniture, body parts, buildings), are tightly linked to specific well-learned action procedures. In fact, tool use is thought to be a special form of action that requires interaction between the ventral and dorsal visual streams. However, given that the majority of studies have looked at viewing, imagining or pantomiming tool actions it remains unclear what exact properties are represented within tool regions during the actual grasping of tools. Here we used univariate and multivariate pattern analysis of fMRI data to investigate how the human brain codes typical actions with real tools. Twenty participants’ grasped 3D familiar tools as well as non-tool control objects (bars) carefully matched for grasping biomechanics. Importantly participants grasped the tools in either a typical (by the handle) or atypical manner (by the business end) and we varied the tool type according to whether they afforded a stirring (e.g., whisk) or cutting (e.g., knife) movement. Univariate analyses showed significantly greater activation for tool compared to non-tool grasping in left lateral occipital-temporal (LOTC) and parahippocampal cortices and posterior middle temporal gyrus. In addition, grasping tools that afforded stirring (wrist rotation) vs. cutting (arm extension) movements resulted in significantly stronger activation in the vicinity of motion area MT despite the absence of visual or physical motion differences between stimuli. Finally, even after biomechanical differences between stimuli were controlled for, typical grasping of tools evoked more activation in left LOTC, fusiform and anterior temporal lope (ATL) regions. These findings indicate that, even without the intent to use, learned semantic associations with tools (i.e., how they are typically manipulated) are automatically evoked in left LOTC and ATL regions.
Poster 10
Preparatory processes to touch are reduced in individuals reporting high somatic symptoms
Bettina Forster (1), Maayan Karlinski (1), Alexander Jones (2)

(1) City, University of London, UK
(2) Middlesex University, UK

Previous research has identified the Lateral Somatosensory Negativity (LSN) as a marker of preparatory processes to touch [1]. Furthermore, it has been shown that this lateralized ERP component with enhanced negativity contralateral to the expected touch location is modulated by task difficulty [2]. To investigate whether this component is implicated in somatoform disorder, we invited individuals to complete the Somatic Dissociation Questionnaire (SDQ). Participants who scored either high or low on the SDQ were invited to complete an exogenous attention task detecting tactile targets following a task irrelevant tactile cue while concurrent EEG was recorded. We found no difference in tactile target detection accuracy or speed between the high and low group. However, participants who scored high on the SDQ (reporting frequent somatic symptoms) showed a diminished LSN. Therefore, our data support the notion of disturbed attentional processing in somatoform disorder. In particular, our results suggest diminished ability to orient attention to body locations in preparation to perceiving touch.


Poster 11
Cortical activity underpinning natural walking is robust to effects of physical load carriage
Nicola Johnstone(1), Annette Sterr(1,2)

(1) Department of Psychology, University of Surrey, UK
(2) Department of Neurology, University of Sao Paulo, Brazil

Physical load carriage in an essential duty in many occupations, such as firefighting, law enforcement and military. It is known that physical load carriage has psychological and physiological effects, but there is minimal research available on the cortical response of the brain under physical load carriage. The purpose of this research is to investigate the effect of load carriage on the brain during walking. This study uses a relatively novel ERP component, the gait related cortical potential (GRCP), to assess the impact of physical load carriage on the cortical response. For a duration of three minutes, participants walked at their own pace both without a physical load, and carrying a load of one-third their body weight while EEG was recorded with a SMARTING device. Results found a GRCP during
natural walking and during load carriage, but there was no modulation in the GRCP across conditions. Behaviourally, walking speed was similar for walking with a load and without, but there was an effect of load carriage in self-reported measures of perceptions of effort and fatigue. It is concluded that load carriage has little additional impact on neural activity during walking over a very short duration.

**Poster 12**

**Can biological motion action cues trigger overt orienting of attention?**

Stephen Johnston (1), Pille Pedmanson (1), Ian Thornton (2)

(1) Department of Psychology, Swansea University, UK
(2) Cognitive Science, University of Malta, Malta

There is considerable interest in understanding what forms of information cue the attentional system of the human brain. Previous work has identified that one type of information that can direct attention is the direction of motion, as demonstrated using animated point light figures. In two eye tracking studies we extend this finding to show that not only the direction of motion of point light figures can cue attention, but so can the direction implied via action. Using eye tracking we investigated how observing actions performed by point light figures, toward either the screen left or right, affected the direction of first fixation as participants attempted to locate a subsequent target stimulus. In Experiment 1 participants matched the action performed by a point-light figure to one of two objects presented to either side of fixation. In Experiment 2, participants matched centrally presented action words to the same laterally presented pictures of objects as in Experiment 1, but prior to the presentation of the object pictures either a point-light action or a moving Gabor patch were shown. The results of both experiments show that both biological motion and the motion implied by moving Gabor patches, first fixations are more likely to be made to the object that is located in the direction of action/motion, regardless of whether this is toward a target or distractor. These findings will be discussed in relation to previous biological motion studies and attentional cueing.

**Poster 13**

**A direct mapping of mental number line representation in a special case of number-space synaesthete**

Kenneth Yuen (1), Isabel Arend (2), Avishai Henik (2)

(1) Neuroimaging Center (NIC), Focus Program Translational Neuroscience, Johannes Gutenberg University Medical Center, Germany
(2) Department of Psychology and Zlotowski Center for Neuroscience, Ben-Gurion University of the Negev, Beer-Sheva, Isra

The ability to represent numbers or magnitude is an important brain function that enables a complex organism to allocate resources and increase its chances of survival. In humans
number representations is assumed to follow a particular spatial arrangement, also known as the mental number line (MNL). The development of MNL is believed to be influenced by cultural and language factors [1], but how MNL representation is being shaped by idiosyncratic experience remains largely unknown. In the current study we attempted to address this question by a special case study. MkM, a young adult man presented with number-space synaesthesia, who represent his MNL in an idiosyncratic way that even numbers appeared in his left personal space whereas odd numbers appeared in his right personal space. Using fMRI and a number imagery task, we map MkM’s MNL representation using representational similarity analysis (RSA) combined with a whole brain searchlight. We observed that the middle temporal gyrus covering the extrastriate cortex (V5/MT) is a key region for MkM’s idiosyncratic MNL representation. When we performed the same analysis on a group of controls, they showed no significant representation of MkM’s idiosyncratic MNL, but the representation of a conventional left-to-right ascending MNL is mapped to the primary visual cortex (in which MkM showed similar mapping for the representation of the same conventional MNL). These results might suggest an emergence of individual’s idiosyncratic MNL representation in a higher order visual area resulting from the binding of conceptual and spatial information.


**Poster 14**

**The effects of local stimulus enhancement and object affordances on a infant imitation task: an eye tracking study**

Victoria E Lovett (1), Lauren Dillon (1), Stephen J. Johnston (1)

(1) Department of Psychology, Swansea University, UK

The current study investigated the effects of pseudo-imitative mechanisms, local stimulus enhancement and object affordance, on an infant imitation task using eye-tracking methods. A between subjects design was employed with four conditions, imitation – modelling the target action of mitten removal from a puppet, local stimulus enhancement – experimenter pointing at the mitten, object affordance – mitten removal from the puppet without experimenter interaction, and control – puppet present but no action was demonstrated. Fifty 6-month-old infants (26 males), participated in the study. Infants watched a video demonstration whilst gaze behaviour was recorded. Infants then took part in an immediate behavioural recall test using the same puppet stimulus viewed on the video. Data analyses showed infants in all experimental conditions (imitation, object affordance and local stimuli enhancement) were more likely to produce the target action of mitten removal than infants in the control condition. No significant differences in gaze behaviour were found across the three experimental conditions. Gaze Behaviour of the infants was compared with target action production. Infants that removed the mitten spent more time fixating on the experimenter’s face in video demonstrations than those that did not remove the mitten (regardless of condition). Local stimulus enhancement and object affordance demonstrations can cause infants to produce the target action on an imitation
task even when these demonstrations occur via video. Gaze behaviour was similar in all experimental conditions implying that these pseudo-imitative mechanisms direct attention in the same way as an imitation demonstration. Furthermore, this research suggests that infants as young as 6-months-old can learn from video demonstrations.

**Poster 15**

**How do we represent observed actions? Investigating the specificity of the sensorimotor encoding of human bodies using EEG**

Sonia Abad-Hernando (1), Alejandro Gálvez-Pol (2), Bettina Forster (1), Beatriz Calvo-Merino (1)

(1) Cognitive Neuroscience Research Unit, City, University of London, UK
(2) Sobell Department for Motor Neuroscience and Movement Disorders, Institute of Neurology, University College London, UK

Recent studies already suggest we hold information in memory differently when it contains body information [1, 3, 4]. It has been shown that visual encoding of body stimuli engages electrophysiological activity not only in visual cortices, but also in body-related areas [2]. The aim of this study is to clarify whether this activity is triggered by body stimuli per se, or modulated by the degree in which we embody that stimuli. In order to dissociate the perceptual-functional roles on how working memory encodes body-related information, we test if somatosensory cortex (SCx) involved in holding body information in memory is sensitive to the degree of embodiment elicited by different tasks while using the same body stimuli. Participants performed a visual working memory task in which items to-be-remembered were colored hand images in different postures. Each memory array consisted of 1 or 2 hands per hemifield. In 50% of the trials, we elicited simultaneously visual evoked potentials (VEP) and somatosensory evoked potentials (SEP) by applying task irrelevant single tactile taps to both hands. This allowed us to do a later subtraction, so we can isolate and examine the state of the somatosensory cortex (SCx) free of visual evoked activity, exposing its underlying processing during memory encoding and maintenance of the visual stimuli. We expect to find differences on SCx activity modulated by the level of embodiment. These findings support the idea of a sensorimotor activity that reflects encoding and maintenance of visually processed body stimuli in an independent storage from the one used for non-body visual stimuli. Although, this somatosensory activation during encoding triggered by the perception of body stimuli seems to be modulated by the attended features in the body. We found that paying attention to a colour feature does not evoke much somatosensory activity, but paying attention to a posture feature does evoke activity in the somatosensory cortex.

Poster 16
Exploring the impact of fear, anxiety and empathy on visual spatial abilities
Mary Jane Spiller (1), Marleon Hefer (1), Desiree Brathwaite (1)

(1) School of Psychology, University of East London, UK

Our emotions can impact our ability to perform everyday tasks. Furthermore, our ability to detect emotions has been shown to be linked to both levels of anxiety, and levels of empathy. Therefore, a question that arises is how anxiety and empathy might mediate the impact of emotions on task performance. The current studies have explored this in relation to the impact of fear on visuo-spatial abilities. Previous research has shown that fear can facilitate mental rotation ability in individuals who have high levels of anxiety [1]. As adolescence is a period marked with heightened reactivity of the amygdala [2], we tested a sample of adolescents’ ability to complete an egocentric mental rotation task after being primed with fearful or neutral face stimuli. We found that participants who have low levels of anxiety showed the fear facilitation effect, whereas those with high anxiety ratings did not. This suggests possible differences in the fear-appraisal process for this group. In a second study we looked at the mediating role of empathy with an adult sample, as empathy may have an effect according to the embodied cognition approach [3]. The results show an interesting effect of empathy, where the fear facilitation effect is more evident with participants in the high empathy group. The findings of both studies highlight the importance of considering individual differences when studying the impact of emotion on cognition, and possible explanations for these findings will be discussed.


Poster 17
Representation of visual perspective and body size in the Extrastriate Body Area
Mark Carey (1), Catherine Preston (1)

(1) Department of Psychology, University of York, UK

The Extrastriate body area (EBA) is a region of the occipital cortex found to respond selectively to human bodies [1]. However, the exact role of the EBA in representing our own and other’s bodies is as yet unclear. Evidence from anorexia nervosa patients has implicated this region in processing size information about one’s own body, such that abnormalities of the EBA relate to pathological body size distortions [2]. Research in healthy participants has independently highlighted the role of the EBA in processing body morphology (e.g. size and

shape) [3] and dissociating between egocentric (typical view of own body) and allocentric (typical view of others’ bodies) visual perspectives of the body [4]. However, the processing of body size and visual perspective in combination may be important in the assessment of higher-order, cognitive processing of bodies such as perceived attractiveness of another person [5], or one’s own body satisfaction [6]. Thus, the present study used fMRI to investigate EBA response amongst 30 healthy females, relating to the degree of non-clinical eating disorder psychopathology. Participants were presented with images slim and large female bodies, viewed from egocentric and allocentric perspectives. Results indicated a clear interaction between visual perspective and body morphology in the EBA bilaterally. Greater activation was observed from an egocentric perspective compared with allocentric in response to slim bodies. In contrast, no difference in EBA was observed between perspectives towards large bodies. Further, EBA activation was increased in response to larger bodies compared with slim bodies only when viewed from an allocentric perspective. However, activity of the EBA did not relate to eating disorder psychopathology. Such findings reveal an interaction between body size and body perspective in visual processing, which may be an important early step for evaluating body shape of our own and other bodies.


Poster 18
Increased Preceuneus deactivation as a possible mechanism for enhanced preparatory suppression in people with high expression of autistic traits
Carmel Mevorach (1), Mayra Muller Spaniol (1), Robin J Green (2), Brandon K Ashinoff (1), Anthony Fellows (1), Nicola Parker (1), Ahmad Abu-Akel (3)

(1) School of Psychology, University of Birmingham, UK
(2) School of Psychology, University of Leicester, UK
(3) Institute of Psychology, University of Lausanne, Lausanne, Switzerland

Previous evidence point to atypical attention processes in autism (and the broader autistic spectrum in neurotypical participants) particularly in conditions requiring distractor suppression. Further characterizing this atypicality, we have recently proposed [1] that Autistic traits are associated with a benefit when suppressing distractors in a preparatory
manner but impairment when distractors are inhibited reactively (when more dynamic control of attention is required). In the present study we consider the Precuneus (PrC) as a candidate brain mechanism that may mediate a preparatory bias. We focus on the PrC as its deactivation (within the default mode network) is thought to facilitate performance in a preparatory way [2] while its activation is thought to support dynamic switching between stimulus’ aspects [3]. To test whether PrC deactivation may explain preparatory biases in people with higher expression of autistic traits we assessed these traits in a total of 211 neurotypical adults who performed a blocked Global/Local task where target and distractor levels were known in advance (preparatory suppression). Next we examined the effect of PrC deactivation on task performance in a new cohort of thirteen participants using offline TMS over the PrC. We found reduced distractor interference in adults with high expression of autistic traits in the Global/Local task, irrespective of target level (global or local) or its relative salience. Importantly, a similar reduction in distractor interference was evident following TMS over the PrC, which occurred irrespective of saliency but was more pronounced for the more difficult global condition. Our findings point to the PrC as a potential brain mechanism underlying improved preparatory suppression. We speculate that high expression of autistic traits may be associated with increased deactivation of the PrC which in turn facilitates preparatory distractor suppression but is detrimental when dynamic control is needed.


Poster 19
Adult’s automatic imitation is mediated by action outcomes and requires identification with the observed actor.
Helen Sharps (1), Patric Bach (1)

(1) Plymouth University, UK

When interacting with others humans have an automatic tendency to imitate gestures, body language, accents, posture and other observable behaviour [1,2]. This copying of others’ behaviour is unintentional, often outside of awareness, and persists even when attention is directed away from the observed action and under both low and high perceptual load [3,4]. In contrast, imitation in children is seen to be evaluative and goal directed, and aimed at achieving the same outcome as the model [5]. This raises the question whether there is continuity between automatic imitation in adults and imitation proper in children. We therefore tested whether the valence of the outcome of an observed action affects automatic imitation, as it does in children’s goal directed imitation. In a card game, participants made left and right responses to evaluate the outcomes of a model player’s actions. We found that observing an action only facilitated one’s own similar response if the observed action had a positive outcome. Observing a losing action elicited
no such effect, and did, if anything, impair participants’ ability to produce an imitative action. The effect depended not on the visual perspective from which the model action was perceived, but required participants’ identification with the model. Together, the findings revealed that imitation cannot simply be attributed to a simple bottom-up matching of observed actions to one’s own action repertoires, but depends crucially on the action’s outcome. The data therefore indicate a continuity between goal-directed imitation in children and automatic imitation processes in adults, previously seen to be separate.

Poster 20

Emotional arousal affects ambiguity of motion direction
Ayse Ozsari (1), Nilgun Turkileri (1), David Field(1), Michiko Sakaki(1)

(1) School of Psychology and Clinical Language Sciences, University of Reading, UK

ABC (Arousal biased competition) theory suggests that emotional arousal enhances representations of high-salient stimuli while impairs representations of low-salient events [1]. It has been also shown that our perception can be biased by emotional arousal for selective attention in favour of stronger stimuli [2]. However it is not clear how emotion affects perception of ambiguous stimuli. In this study, two gratings, one of which has higher contrast than the other, were superimposed and moved to opposite direction to create motion ambiguity. It is known that people tend to perceive the direction of higher contrast in such situations [3]. Participants were asked to indicate motion direction of the stimuli while they were listening to an either emotional or neutral sound clip. Results indicated that participants were more likely perceived the direction of high contrast grating under emotional arousal, suggesting a reduction of ambiguity in favour of stronger, and therefore, high-salient stimuli. These results confirm and expand the ABC theories predictions, suggesting that emotional arousal also modulates how we perceive an ambiguous stimulus.


Early human deafness results in crossmodal reorganisation of the superior temporal cortex (STC), where these typically auditory regions respond to stimulation from other senses. Due to the close relationship between sensory and cognitive processing, the reorganisation of the STC in deaf individuals is also likely to impact cognitive processing. However, it is not known to what extent this occurs in deaf individuals, and whether it is linked to delayed language acquisition or the use of a visual language. To address this, we conducted a working memory (WM) fMRI experiment in groups that differ in their hearing status and sign language knowledge: deaf native signers, hearing native signers and hearing non-signers. Participants performed a 2-back task and a control task on point-light stimuli comprising signs from British Sign Language or moving nonsense objects. Stimuli were presented as point-light displays to control for differences in visual features. We found characteristic WM activations in fronto-parietal regions in all groups. However, deaf participants also recruited bilateral posterior STC during the WM task, but not during the control task, independently of the linguistic content of the stimuli. This was accompanied by a reduction in the recruitment of fronto-parietal regions typically associated with WM. Using resting state functional connectivity analysis, we found an increase in connectivity between frontal regions and STC in deaf individuals, which is not present in hearing individuals. These findings suggest a functional shift towards cognitive control in posterior STC as a consequence of crossmodal reorganisation, and also highlight that in the absence of auditory stimulation early in life, typically auditory regions are incorporated into a network for cognitive control. Overall, our findings suggest that the organisation of cortical cognitive networks is shaped by the nature of the sensory inputs available during development.
Getting to grips with action understanding: Affordance matching predictively shapes the perceptual representation of others’ actions.

Katrina McDonough (1), Patric Bach (2)

(1) School of Psychology, Plymouth University, UK

Recent models argue that action understanding is a predictive process, where social and contextual (e.g. object) information are used to infer the actor’s goal, so that predictions about their upcoming actions can be formed [1,2,3]. These models also argue that the predictions are not cognitive, but are represented perceptually. Studies from our lab have shown that prior expectations about a forthcoming action can bias the perception of this action towards this expectation [4]. In these studies, the actor’s intentions are announced and predictions are made explicitly, before the onset of the action. However, emerging evidence suggests that action goals and intentions can also be identified and updated during the ongoing action, by monitoring any match between the unfolding action kinematics and the potential target objects [5]. Here we show that perception of an upcoming action can be biased in the direction of the expectation when predictions are made implicitly, and when predictions are made on-line, once the action has already commenced. Participants watched an actor reach towards a large object and a small object forming either a whole hand power grip or a precision grip. During its course, the hand disappeared, and participants made perceptual judgments about the last seen position on a touch screen. Judgments were consistently biased in line with action expectations, such that power grips were perceived closer to large objects and precision grips were perceived closer to small objects. This provides evidence, for the first time, that people make on-line adjustments of predicted actions based on the match between hand grip and object goals, resulting in a distorted perception of this action. These results reveal that our perceptual experience of others’ actions is derived from an integration of incoming bottom-up sensory information and top-down expectations of the action.

**Poster 23**

**The affordance effect: Investigating its value in upper limb stroke rehabilitation.**

Paula Rowe (1), Nareg Khachatoorian(1), Corinna Haenschel (1), Kielan Yarrow (1).

[1] Department of Psychology, City, University of London, UK

The intrinsic properties of objects are said to automatically “afford” actions. Evidence from fMRI, EEG and TMS confirms that affordances play a part in how we prepare to handle tools and other objects [1,2]. In stroke rehabilitation, objects are often placed within reachable grasp of the patient. However, if the patient is not fully able to make such a grasp, naturally occurring affordances could possibly be utilised by re-introducing objects after short delays. If affordance onset and duration can be observed in stroke survivors, the timing of object removal and re-introduction may be better tailored for rehabilitation. 10 stroke survivors with remaining upper limb deficits and 15 age-matched control participants were recruited to view stimuli of objects and an empty desk in 3D while EEG recorded brain activity. Two body positions were adopted; Posture 1 with the right hand closer to the objects and Posture 2 with the left hand closer to the objects. There were also two timings of object presentation. A significant difference in anterior N2 ERP activity, believed to relate to affordances [3], was observed in both cohorts when participants viewed objects compared to when they viewed an empty desk. This activity occurred between 260ms and 370ms after stimulus onset. There were also larger N2 amplitudes for the 1Hz compared to the 2Hz presentation rate. Knowledge of these timings may be helpful to improve upper limb rehabilitation, particularly in conjunction with computer-based interventions.


**Poster 24**

**Neural correlates of accent stereotypes in a reinforcement learning task**

Ilaria Torre (1), Jeremy Goslin (1), Thomas D. Sambrook (1), Laurence White (1)

(1) School of Psychology, Plymouth University, UK

Humans and animals learn about what behaviour is more appropriate and convenient in each situation through a process of reinforcement learning. This alternation between positive and negative feedback has even been observed at the neural level, in an electrophysiological component called the “Feedback-Related Negativity” (FRN) [1,2], which
occurs at fronto-central locations approximately 250-350 ms after someone has received feedback on whether his/her action resulted in a reward or punishment (positive or negative Reward Prediction Error, RPE). However, as humans we also infer how to behave based on prior information, like attitudes or stereotypes, about the interaction partner. For example, indexical information such as a speaker’s accent influences implicit and explicit trait attribution [3-5], and in general explicit stereotypes based on someone’s voice take as little as 100 ms to form [6]. A yet unanswered question, then, is whether this prior, implicit knowledge will interact with RPEs at a neural level. We addressed this question in an ERP experiment where participants took part in a reinforcement learning task. Each possible action had an associated probability of resulting in a reward or punishment, and it was introduced by a voice speaking either in a Standard Southern British English (SSBE) or a Birmingham accent, two accents that typically elicit opposite trait attributions [7,8]. If implicit beliefs about the speaker had an effect on the prediction errors, there would be an interaction between the latter’s valence (positive and negative RPEs) and the speaker’s accent. However, Principal Component Analysis revealed separate effects of valence (thus confirming the presence of an FRN) and accent, but no interaction. This suggests that stereotypical information about a speaker and actual experience of that speaker influence perception at different times.


**Poster 25**

**The effect of transcranial direct current stimulation on reflective thinking.**

Daniel Robert Edgcumbe (1), Volker Thoma (1), Davide Rivolta (1), Cynthia H. Fu (1,2)

(1) School of Psychology, University of East London, UK
(2) Institute of Psychiatry, King’s College London, UK

Transcranial direct current stimulation (tDCS) was used to investigate whether modulating cortical excitability of the right dorsolateral prefrontal cortex (DLPFC) altered performance on judgment and thinking tasks. During a 20-minute stimulation period participants answered a series of puzzles and vignettes from the heuristic-and-biases literature, math...
puzzles with suggestively easy but wrong answers (Cognitive Reflection Test), and logic problems (which sometimes contained a conflict with believability and valid conclusion). There was no main effect for neuromodulation on performance on the battery of heuristics- and-biases (HB), belief bias syllogisms, and the 7-item Cognitive Reflection Test (CRT-1) [1]. Performance on the HB and CRT were moderated by religiosity: non-religious participants scored higher in the active tDCS condition than religious people for the former, whilst religious people scored higher in the active tDCS condition than non-religious participants for the latter, compared to sham. In a second study using a between-design and an enhanced 20-item CRT [1, 2] there was a main effect of the neuromodulation of the right-DLPFC but not the left-DLPFC: CRT scores were higher after neuromodulation of the right-DLPFC than sham. Performance on the enhanced 20-item CRT was moderated by religiosity: religious participants scored higher in the active tDCS group than non-religious participants, compared to sham. A further analysis found that there was a main effect of neuromodulation of the right-DLPFC on the 4-item CRT-2 [2]. CRT-2 scores were higher after stimulation of the right-DLPFC than sham. The CRT-2 helps to address the need to examine the effects of cognitive reflection while controlling effects of individual differences in numeracy [3]. These results support the theoretical approaches of the dual-processes framework of decision-making that stress the role of analytic thinking dispositions overcoming intuitive responses [4].


**Poster 26**

**The wider networks of the Behavioural Inhibition System:**

**Studying goal conflict through scalp wide EEG**

Tom Lockhart (1), Roger Moore (1), Kim Bard (1), Lorenzo Stafford (1)

(1) University of Portsmouth, UK

The Behavioural Inhibition System (BIS) is part of Gray’s Reinforcement Sensitivity Theory, a neural theory of approach and avoidance goal setting. The BIS mediates conflict between goals and is experienced subjectively as anxiety [1]. One promising goal conflict task was adapted for EEG by Neo, Thurlow and McNaughton [2]. To maximise applications for clinical anxiety, their research emphasised one area of the brain. Subsequently, studying wider areas with the task might reveal more about BIS processing given research using older tasks implicates multiple regions and networks with BIS activation [3]. EEG was recorded from 34 participants at 32 sites during a difficulty calibrated Stop Signal Task. Participants reacted quickly to visual stimuli, some of which were followed by a noise which signalled to withhold
the response thus creating goal conflict. 12 regions of interest were analysed for power and coherence spectra to identify whether there was an increase in theta activity during goal conflict. Psychometrics were also administered covering the BIS [4,5], anxiety [6] and neuroticism [7]. Right frontal theta increased as shown previously [2]. Left and mid fronto-central Theta also increased. In terms of coherence, theta increased between the left fronto-central and several frontal regions, including the right frontal region, and one posterior region. No links between psychometric and EEG measures were found. The results support previous work in linking BIS activity to increased right frontal theta. However, this activity seems to expand to wider frontal regions. It may also be part of a network originating from the left fronto-central region. This network could implicate inhibitory, muscle control, attention state and sensory processing changes with BIS activation. The focus of future work should be to clarify links between BIS activation, EEG and psychometrics. In conclusion, the findings support research linking wider regions and networks with BIS processing.


Poster 27
Mismatch Negativity before and after language training: Review about neuroplasticity.
Kristina Memetova (1), Aleksandr Aleksandrov (1), Ludmila Stankevich (1), Veronika Knyazeva (1)

(1) Department of Higher Nervous Activity and Psychophysiology, Saint-Petersburg State University, Russia

Neurophysiological correlates of language processing were measured before and after language training. The mismatch negativity (MMN) was recorded in the distracted oddball paradigm to a word and pseudowords. Critical pseudoword stimuli were meaningless, but after semantization and one week of language training the significant linguistic improvements, accompanied by enhanced MMN responses, were demonstrated. More specifically, the MMN amplitude to pseudowords increased significantly after training. The
results confirm our previous reports that the MMN demonstrates an enhanced response to meaningful words over meaningless items [1,2]. Now we demonstrate that semantization is associated with enhanced automatic brain indexes of lexical processing. We compared the MMN elicited by pseudowords before and after language training. In our study we used the multi-stimulus passive oddball paradigm. The acoustic stimuli contrasts were kept identical [3]. We conducted two experiments (before and after training) with three conditions: one standard stimulus and two deviant stimuli and the reversed design in two other conditions. Thus, the MMN responses were elicited by deviant items, but the critical variable determining the MMN response - the standard–deviant acoustic-phonetic contrast - was identical in all three conditions. Language training was provided for one week, twice per day. The participant listened to audio-recorded information about pseudowords fictitious meaning assigned to them. EEG was recorded before and after the learning interval.

Results. No significant main effects were found for the standard stimulus in both experiments. Event-related potentials were successfully calculated for the standard and deviant stimuli in all experimental conditions and for the all stimuli the mismatch negativity responses were obtained. After one week of language training the significant main effects for MMN mean amplitude and latency to pseudoword were shown. Meaningless pseudowords after semantization demonstrated significantly enhanced MMN responses.

Conclusion. The results support our hypothesis that the meaningless stimuli lead to a significantly more pronounced MMN response after language training. Furthermore, the MMN latency is shorter and the amplitude is bigger for the same pseudoword stimuli after the training of assigned meaning, suggesting that meaningless items show neuroplastic changes transforming to meaningful ones. The results confirm our previous reports that the MMN demonstrates an enhanced response to meaningful words over meaningless items [1,2], demonstrating now that semantization is associated with enhanced automatic brain indexes of lexical processing.


• Supported by the Russian Foundation of Humanity (project # 15-06-10806)
In recent decades, a large number of ERP studies have looked at the retrieval of episodic memory. These studies generally show a posterior and a frontal old-new effect associated with recollection of and the familiarity with the stimulus, respectively [1]. Most of these studies have used laboratory events such as lists of words and pictures to investigate episodic memory [2]. However, there is very little research that has investigated autobiographical memories for real-life events. The aim of the current study is to develop an ecologically valid paradigm to study the ERPs of real life episodic memory retrieval. We used a wearable camera to create memory cues of real life episode. These cameras automatically take multiple photos from the perspective of the wearer that can subsequently be used as memory cues. Twelve female participants were taken on a walking tour with predefined targets while wearing the cameras. A sequence of four photos leading to these targets were selected and together with new photos were used in a recognition task one week later. This study successfully used an ecologically valid paradigm to explore the neurophysiology of real life episodic memory retrieval. The results also showed that participants’ sensitivity ($d'$) increased with the sequence of photos. This suggests that the presentation of multiple photos leads to improved recognition memory. ERPs results showed old-new ERP modulations over visual regions, with higher amplitude for correctly identified new photos in comparison to correctly remembered tour photos. This points to the importance of visual processing not only for perception but also for the location of activated memory representations.


Reduced alpha-band suppression in dyads sharing the locus of attention? A dual EEG study
Juan Camilo Avendaño Diaz (1), Xun He (1).

Humans are constantly engaged in similar tasks in the presence of other performing individuals, often paying attention or acting upon the same location with them. It has been suggested that attending to the world with others could have a special importance for us, enhancing performance in general [1]. However, this may not be always the case. Previous evidence has suggested that when a dyad focuses attention to the same spatial location in a sustained visual attention task (dual attention), the attention effect is reduced in reaction times [2]. However, this reduction in the attention effect was not found in the early sensory-level ERP components such as P1 or N1 (unpublished data). To investigate at which stage the attention reduction in dual attention occurs in the frequency domain, the current study measured EEG from dyads (dual EEG) working together in the dual attention task, and analysed the alpha band activities. Literature to date has convergingly shown that alpha activity is reduced over the posterior region contralateral to the attended location [3]. In the current study, alpha activity was quantified as 8-14 Hz oscillations at posterior lateral electrode sites. Time-frequency representations (TFRs) of power were computed using Hanning-tapered Short-Time Fourier Transforms (STFT) with a frequency-dependant window length. Our data replicated past research by showing reduced alpha activity over the posterior region contralateral to the attended location starting around 150ms. This suppression, however, was significantly weaker around 200-350ms, when the dyads directed attention towards the same spatial location than towards different locations. These results echoed our behavioural data in suggesting a reduction mechanism in dual attention, possibly reflecting different processing modes across attention sharing conditions [4].

Poster 30
The effect of Transcranial Direct Current Stimulation (tDCS) on performance deficit associated with prolonged wakefulness
James Ebajemito (1), Annette Sterr (1,2)

(1) Brain and Behaviour Research Group, School of Psychology, University of Surrey, UK
(2) University of Freiburg Medical Center, Department of Psychiatry and Psychotherapy, Germany

The interval between learning and recall, if filled with good quality sleep is beneficial for learning compared to continuous wake. Based on our previous research [1], we hypothesised that tDCS can alleviate performance deficit associated with prolonged wakefulness. 15 good sleepers (PSQI = 3.73 ± 1.03) with intermediate chronotype (MEQ = 49.9 ± 5.81), aged 19.5 ± 1.19, 11 females, completed a paired-associate learning (PAL) task. A sham-controlled tDCS protocol of 20 min anodal stimulation over the right dorsolateral prefrontal cortex (DLPFC) with the cathode positioned on the left supraorbital region, in which participants either slept or remained awake in-between learning and test interval. There was a main effect of stimulation, indicated by better performance with tDCS (M = 54.8 ± 11.7) compared to sham stimulation (M = 49.2 ± 12.3); F(1,14) = 7.46, p = .02, ηp² = .35. Furthermore, there was similar performance in sleep condition (M = 53.5 ± 13.1) compared to wake condition (M = 50.5 ± 10.9); F(1,14) = 1.13, p = .31, ηp² = .07. However, a significant stimulation × condition interaction (F(1, 14) = 16.5, p = .001, ηp² = .54) demonstrated a greater tDCS induced change in the wake condition compared to the sleep condition. This findings show that tDCS may alleviate poor performance associated with prolonged wakefulness. Further studies are needed to fully characterise the interaction of tDCS effects and sleep.


Poster 31
Establishing the cognitive signature of human brain networks derived from structural and functional connectivity
JeYoung Jung (1), Maya Visser (1, 2), Richard J. Binney (1, 3), Matthew A. Lambon Ralph (1)

(1) Neuroscience and Aphasia Research Unit (NARU), University of Manchester, UK
(2) Grupo de Neuropsicología y NeuroLmagen functional, University Jaume I, Spain
(3) Eleanor M. Saffran Center for Cognitive Neuroscience, Temple University, Philadelphia, Pennsylvania, USA

Numerous neuroimaging studies have identified various brain networks using task-free analyses [1,2]. Whilst these networks undoubtedly support higher cognition, their precise functional characteristics are rarely probed directly. Accordingly, we established the
cognitive signature of a set of contrastive brain networks identified in two task-independent datasets (rsfMRI and DWI) on the lateral associative cortices. Using graph-theory analysis [3], we revealed multiple networks across the frontal, temporal, and parietal cortex, derived from structural and functional connectivity. The patterns of network activity were investigated using three task-active fMRI datasets in order to generate the functional profiles of the identified networks. We employed representational dissimilarity analysis (RSA) [4] on these functional data to quantify and compare representational characteristics of the networks. Our results demonstrated that the topology of the task-independent networks was strongly associated with the patterns of network activity of the task-active fMRI and that there was a significant resemblance between task-independent networks. Our findings establish a direct relationship between brain networks identified from task-free datasets and higher cognitive functions including cognitive control, language, visuospatial function, and perception. Not only does this study support the widely-held view that higher cognitive functions are supported by widespread, distributed cortical networks but it elucidates a methodological approach for formally establishing their relationship.


Poster 32

Nonlinear analysis of EEG signals during a mental fatigue visual-search attention task

Dineshen Chuckravanen (1), Barkın İlhan (1), Nizamettin Dalkılıç (1)

(1) Department of Biophysics, Necmettin Erbakan University Meram Faculty of Medicine, Turkey

Various studies showed the adverse effects of mental fatigue on sustained attention in terms of loss of efficiency. For instance, cumulative mental fatigue leads to reduced productivity in continuous medical monitoring. A nonlinear method was applied on EEG signals collected from human subjects performing mental fatiguing task to determine mental fatigue states. Fourteen participants with age ranging from 18 to 33 years old volunteered for this study. They all had enough rest during the last 24 hours, and they were not in any medication. The mental fatiguing task used in this study was based on a visual search attention task developed and customised in Octave under Linux platform. This algorithm was repeated in five blocks of 100 trials each so that the subjects could experience a long-term attentive task and also ensuring they would reach mental fatigue. Each visual search screen consist of a target T and distractors L whereby the subject had to
press as fast as possible the appropriate key on the keyboard when he or she noticed or did not notice the target T in any particular screen. The interval between each response and the next pattern stimulus was set to 500ms. Performance indices such as reaction time, accuracy responses, and EEG signals were simultaneously recorded. Then approximate entropy method in [1,2] was applied on the EEG data to try distinguishing mental states. Mental Fatigue VAS showed stages of mental fatigue. Nonlinear analysis of EEG signals at frontal (Fz) and parietal (Pz) brain lobes could differentiate the occurrence of mental fatigue. Moreover, the trend of approximate entropy showed a reduction in the complexity of mental activity based on the occurrence of fatigue. Approximate entropy is a promising tool for differentiating mental fatigue states. Ongoing works focus on related nonlinear methods to confirm the veracity of this finding.


**Poster 33**

**What is the free-energy principle and how does it keep us sane?**

Ines Hipolito (1)

(1) University of Wollongong, Australia

A variety of phenomena in human experience shows that, in the different evolution levels of living organisms, life and mind cannot be thought as two separated phenomena. Life-mind continuity thesis is the view that life and mind have a common abstract model or a set of basic organizational properties. There have been recent attempts to formalize the mind-life continuity thesis, this is known as the Free Energy Principle (FEP). A cognitivist view of the free energy principle conceives the relationship between life and mind under the predictive mind hypothesis. This is a computational model that associates minds with computational processes that require semantic (i.e. contentful) properties. Subjective phenomena, however, seems an evidence against a powerful generative brain model of semantic mental representations (cognitivist free energy principle). In this paper, I will take the concept of life, from the adaptivity viewpoint, and the mind as basic and non-semantic, to claim a non-cognitive perspective of the free energy principle, as developed by Karl Friston [1,2]. This continuity view between life and mind, I will argue, ensures the mental health of the self. Then I will conclude with practical consequences for empirical research and theoretical conception of mental illness.

Poster 34

An ERP study on suppressing recall of self-relevant words
Alfred Veldhuis (1), Michael Pilling (1), Clare Rathbone (1), Sanjay Kumar (1)


Self-related information is learned faster and recalled more accurately than information not related to the self [1]. This seems to be the result of automatically prioritising self-relevant information. Previous research has shown that actively suppressing the recall of learned words can reduce memorability of these words [2,3]. This study aimed to see if self-related words can be suppressed compared to information not related to the self. Participants studied a list with word-pairs (target plus cue) which was repeated three times. The word-pairs were either linked to the self or to a stranger by presenting the label 'stranger' or 'yourself' underneath the word-pairs. After each repetition participant were presented with only the cue words and were asked to recall the target words. During the follow-up think/no-think phase participants had to either think of the target word when the cue word was presented or suppress recall of the target word by reading the cue word backwards. After the think/no-think phase a final recall phase was presented. For the self-linked words a positive deflection was found in the ERP 200ms after stimulus onset; for the stranger-linked words a negative deflection was found in the ERP 400ms after stimulus onset. The P200 and N400 are respectively associated with attentional and semantic processing of stimuli. Thus the results may indicate an increased attention for self-related words alone and relatively greater semantic processing for words not linked to the self.


Poster 35

Group and individual analyses of pre-, peri-, and post-movement related alpha and beta oscillations during a single continuous monitoring task
Roger Moore (1), Matthew Mills (2), Paul Marshman (1), Philip Corr (3)

(1) Department of Psychology, University of Portsmouth, UK
(2) Tom Rudd Unit, Moorgreen Hospital, Southampton, UK
(3) Department of Psychology, City University of London, UK

Alpha and beta EEG have traditionally been linked to preparation for, execution/ inhibition of, and recovery from motor response. However, the degree to which response related trends in these wavebands are the same across participants has been questioned [1,2]. Here, we examined group EEG response during all stages of motor response (i.e. pre, post, during and inhibition) and also considered the data on an individual level. Alpha and beta
power were examined during anticipation, response execution (RE), response inhibition (RI) and post response recovery (PRR). Data from 34 participants were considered. The participant’s objective was to press a response key immediately following 4 non-repeating, single integer odd digits. These were presented amongst a continuous stream of digits and Xs. EEG were recorded from 32 electrodes (pooled to 12 regions). Group: Participant EEG response was compared to baseline revealing that high alpha desynchronised during anticipation, RE and RI; low beta during anticipation and RE; and high beta just RE. High alpha and low/high beta synchronised during PRR. Low alpha fluctuations correlated negatively with RT. Individual: A ‘typical’ RE trend was displayed individually by the largest proportion of participants (88.24%) in high alpha recorded left fronto-centrally; a ‘typical’ PRR trend was displayed individually by the largest proportion (85.29%) in low beta recorded mid centro-parietally. High alpha desynchronisation during rapid, unplanned RI is novel - we speculate this is contingent on conditions surrounding response inhibition. Regarding synchronisation during PRR, we speculate this indexes brief cortical deactivation for high alpha; for beta generally we propose this indexes response set maintenance. Correlations between low alpha and RT index neural efficiency. The clinical relevance of the variability of ‘typical’ movement related EEG trends in individuals is also discussed.


Poster 36

ERP responses associated with lightness contrast and assimilation
Stephanie L Acaster (1), Naira A Taroyan (1), Alessandro Soranzo (1), John G Reidy (1)

(1) Sheffield Hallam University, UK

Lightness contrast and lightness assimilation are examples of the perception of a surface being influenced by surrounding areas. In lightness contrast, the target surface is perceived lighter when neighbouring a dark surface, and darker when neighbouring a light surface. The reverse is true for lightness assimilation. The neurophysiological mechanisms underlying these phenomena is not clear, though it has been suggested that contrast and assimilation can each be attributed to different processes, such that contrast is explained by higher-level anchoring and gestalt-based grouping factors but assimilation is explained by low-level physiological factors [1]. Previous ERP research has reported differences in responses to illusory lightness effects such as variants of White’s effect [2] and the Craik-O’Brien illusion [3], suggesting early ERP differences associated with illusory lightness differences.

In this study, participants viewed stimuli consisting of a grey target with inducers, manipulated in terms of both the colour of inducers (black vs white) and whether the stimulus was designed to elicit contrast vs assimilation. Participants indicated whether the grey target was darker or lighter than a comparison patch with equal luminance. Response time data suggest that contrast responses are quicker for stimuli with white inducers,
whereas assimilation responses are quicker for stimuli with black inducers. Preliminary ERP results suggests differences in early components (P1 and N1), for example, contrast responses with black inducers produce significantly greater P1 mean amplitude than contrast responses with white inducers. These differences are found particularly in right occipital-parietal electrode sites.


**Poster 37**

**A rational analysis of motivated memory**

Deborah Talmi (1), Nathaniel Daw (2)

(1) University of Manchester, UK
(2) Princeton University, USA

A rational analysis of memory suggests that in order to maximize evolutionary fitness, organisms should have excellent episodic memory for stimuli that have a high utility or disutility, namely those that predict positive or negative consequences. In order to achieve this goal, we evolved to allocate preferential attention to high-utility stimuli, either by automatically attending those with high cached value, or by allocating attention top-down to those that we believe have high value, based on our model of the environment. Here we examined the memory consequences of competition between habitual and model-based attention allocation. We hypothesised that the presence of stimuli with cached value will attenuate the memory benefits normally observed for novel high-value stimuli. Hungry participants were presented with pictures of food and pictures of neutral objects. Half of the pictures of each type were framed; recalling the framed pictures earned participants 1 pound. As expected, high value increased memory and low value decreased memory compared to baseline. Surprisingly, this effect was not modulated by cached value and cached value did not enhance memory. Instead, while memory for stimuli with high cached value was preserved, memory for stimuli with low cached value suffered, resulting in an overall decrease in memory performance whenever lists included high cached value stimuli. The results favour retrieved context models and go against the predictions of Arousal-Biased Competition Theory proposed by Mather and colleagues. Taken together, this pattern progresses our understanding of the systems that control the competition for internal encoding and retrieval resources.
Entrainment refers to the process by which neural oscillations become synchronised with each other. Two methods of stimulation have been applied in the entrainment literature; either using standard intensity stimuli for all participants [1,2,3], or individualised thresholds of intensity such that stimuli are only just detectable [4,5]. In addition, different methods of time/frequency decomposition (TFD) are also employed; short time Fourier transform (STFT) [3] or Morlet Wavelet’s (MW) [4]. Twenty-four students from the University of Southampton took part in two entrainment tasks, a passive single modality task (SMT) and a dual modality selective attention task (DMT). Stimuli were presented at the same intensity for all participants to minimise the burden on participants. To assess entrainment, TFD was conducted using both STFT and MW. A true entrained response would be evidenced by increased phase coherence at the stimulation frequency around stimulus onset, and greater for attended than non-attended stimuli. Neither method of analysis found evidence of an entrained neural response to the stimuli. Instead, an evoked phase coherence starting at approximately 100ms post-stimulus was found. ERP plots confirm the presence of an N1 component (150ms) in each condition in response to the stimuli, which could contribute to the increased coherence during the same time frame. In addition, in the DMT a P1 (100ms) peak was also present in both the attended and non-attended conditions, and a P2 (200ms) was present in the non-attended condition. If we are to assume that entrainment did occur, an alternative method of analysis would need to be employed to detect these effects. If, however, entrainment did not occur, then an alternative approach to stimulation would need to be sought, perhaps using individualised thresholds of stimulus intensity.


**Poster 39**

Does meditation change how we process feedback?

Paul Knytl (1), Bertram Opitz (1)

(1) Department of Psychology, University of Surrey, UK

Focused attention meditation (FAM) practices are cognitive control exercises where meditators learn to maintain focus and attention in the face of distracting stimuli. Previous studies have shown that FAM is both activating and causing plastic changes to the mesolimbic dopamine system and some of its target structures, particularly the anterior cingulate cortex (ACC) and striatum. Feedback based learning also depends on these systems and is known to be modulated by tonic dopamine levels. Capitalizing on previous findings that FAM practices causes dopamine release, the present study shows that FAM practitioners display a more positive feedback learning bias (FLB) than matched controls on a probabilistic learning task. Furthermore, they have smaller feedback related negativity (FRN) than controls. Crucially, these effects scale with FAM experience for FRN. A possible explanation for this effect is that FAM practice causes persistent increases in tonic dopamine levels over time which results in the observed changes in feedback processing.

**Poster 40**

A systematic investigation into the timings of anodal tDCS administration and their effect on episodic memory

Angela Medvedeva (1), Giulia Galli (1)

(1) Kingston University, UK

Several studies have investigated the possibility of enhancing episodic memory through anodal transcranial direct-current stimulation (atDCS). However, the results in the literature are mixed and atDCS administration has not always resulted in cognitive enhancements. This may partially be due to differences across studies in the timings of atDCS administration with respect to the memory task. We conducted 2 experiments (N=108) to examine the effects of the time of atDCS administration on episodic memory performance. Both experiments involved ten minutes of atDCS delivered over the left ventrolateral prefrontal cortex and used a sham-controlled, between-subjects design. In Experiment 1, atDCS was delivered either in the ten minutes before the encoding task (offline), or during the encoding task (online). In Experiment 2, atDCS was delivered either in the ten minutes before the retrieval task (offline), or during the retrieval task (online). Memory was tested with a recognition memory test in both experiments. atDCS administered online, but not offline, during the encoding task increased memory performance. This effect specifically consisted of an improvement in discrimination ability. There was no effect of atDCS when the stimulation was administered during the retrieval task, either offline or online. The findings suggest that atDCS is more effective when delivered during, rather than before, the encoding of new information into memory. These findings shed light into the specific timings in which atDCS administration is successful in improving episodic memory functions.
and suggest that when used under the right circumstances, atDCS may be a valuable tool for memory rehabilitation.

**Poster 41**

**The efficacy of dopaminergic medications in the consolidation of a motor sequence task, in healthy older adults**

James McErlane (1), Hanna K Isotalus (1,2), James Selwood (1), John Grogan (1), Michael Knight (2,3), Claire Durant (2,4), Risto Kauppinen (2,4), Matt Jones (2), Elizabeth Coulthard (1,2,5)

(1) School of Clinical Sciences Bristol University, UK
(2) Clinical Research and Imaging Centre Bristol, UK
(3) School of Experimental Psychology Bristol University, UK
(4) School of Social and Community Medicine Bristol University, UK
(5) North Bristol NHS Trust, UK

Dopaminergic medication can improve motor consolidation in healthy older adults, Parkinson’s disease patients, and stroke patients. We wished to examine the effects of the non-selective D1/D2 type receptor agonist levodopa (in the form of co-beneldopa), and the selective D2 type receptor agonist ropinirole, with regards motor consolidation in healthy older adults. We hypothesise that 12 hours after a single dose of levodopa or ropinirole, older adults will show improved performance in a motor sequence task, compared to placebo. We assessed the ability of these dopaminergic medications to facilitate the consolidation of motor memory specifically, with the learning period of the motor sequence tasks occurring before administration of the medication. Studies in stroke patients have shown that levodopa has a superior efficacy compared to ropinirole with regards motor consolidation, therefore we hypothesise that levodopa will show superior efficacy compared to ropinirole with regards motor consolidation in healthy older adults. In a double-blind randomised crossover trial six healthy older participants (65-78 years old) completed three study visits. On each visit, volunteers learnt a finger tapping task by typing a 5 digit numerical sequence on a keyboard as many times as possible in 30 seconds using their non-dominant hand. This was repeated 12 times with a 30 second rest period in between learning trials. 15 minutes after learning, the volunteers received either a single dose of co-beneldopa 50/200mg, ropinirole 8mg, or a placebo. Consolidation of the motor sequence learning was tested 12 hours later, following a period of overnight sleep. To our knowledge, this is the first time a comparison has been made between the efficacy of D1/D2 type receptor non-selective agonists and D2 type receptor selective agonists with regards to motor consolidation.
Poster 42

Directional effects in dynamic emotional expressions: a behavioural and ERP analysis.

Michael J Wright (1), Justin O'Brien (1)

(1) Centre for Cognitive Neuroscience, Department of Life Sciences, Brunel University, UK

Transitions between an emotional and a neutral facial expression are asymmetric with respect to direction: ERPs to neutral-emotional transitions are larger than to emotional-neutral transitions, and there are corresponding differences in rated intensity and valence [1]. Possible explanations to be tested were: an asymmetric dynamic response, a reduced response to a neutral face, or masking of earlier by later expressions. 20 participants identified the emotion (angry, fearful or happy) in facial expressions of changing intensity [2] while EEG was recorded. Direction of change and mean intensity were varied independently in the stimulus set. ERPs to expression change were obtained together with accuracy measures. Distinct ERPs to the onset of the first facial expression and to the intensity shift were obtained. ERPs to intensity increases showed a positive shift relative to intensity decreases, which was statistically significant from around 200 ms onwards on lateral parietal and occipital electrodes. Behavioural results (accuracy) showed a significant main effect of direction of change (increase vs decrease), a significant main effect of mean intensity of expression (3 levels), and a significant direction x intensity interaction. No other effects were significant, including effects of different target emotions, or the presence versus absence of a random pixel mask after the final facial expression. The general shape of ERPs to transitions showed only minor differences for different emotions, in line with previous results [1]. The localization of these ERP responses would be consistent with a source in STS [3]. It is concluded that the brain is sensitive to dynamic changes in emotional expressions over a range of mean intensities of expression. Increases in intensity, relative to decreases, lead to ERP positive shift and greater accuracy of identification of the target emotion.

The relationship between verbal recognition memory performance and hippocampal MRI subfield volumes in healthy older adults

James Selwood (1), Hanna K Isotalus (1,2), James McErlane (1), John P Grogan (1), Michael Knight (2,3), Claire Durant (2,4), Risto Kauppinen (2,3), Matt Jones (2), Elizabeth Coulthard (2,5,6)

(1) School of Clinical Sciences, University of Bristol, UK
(2) Clinical Research and Imaging Centre, University of Bristol, UK
(3) School of Experimental Psychology, University of Bristol, UK
(4) School of Social and Community Medicine, University of Bristol, UK

The hippocampus (HC) plays a critical role in declarative memory. The HC formation includes the four Cornu Ammonis regions (CA1-4), the dentate gyrus and the subiculum. CA1 is directly connected to the subiculum and focal lesions in these regions may impair recognition memory. Previous work by our group has linked HC subfield volumes with 24 hour delayed memory performance. Both the HC volume and recognition memory performance decline with age. HC volume reduction is accepted as a correlate of atrophy. Our aim is to investigate how subfield volumes determine recognition memory performance. We hypothesised that smaller subfields, as measured by Magnetic Resonance Imaging (MRI), will be associated with poorer performance in the Remember-Know task (RKNt) at 12 hours, 3 days and 5 days after learning. Six healthy older adults (65-78 years) learnt a 100-item word list. Their recognition memory was then tested 1 hour and 12 hours after learning and then 3 days and 5 days later over the phone. At each test, volunteers were shown 20 words from the original list and 20 distractor words. A different set of words was presented for each test. T1-weighted MP-RAGE and T2-weighted TSE MRI images were acquired on a 3T Siemens Magnetom Skyra scanner. HC subfields were segmented using the Automatic Segmentation of Hippocampal Subfields (ASHS) procedure, which labels the main HC subfields and temporal lobe sub-regions. HC volumetric data will be analysed against RKNt performance. To our knowledge, no previous studies have specifically explored the impact of HC subfield size on verbal recognition memory up to 5 days after learning. We believe our study will demonstrate how neuroimaging can be used to predict performance in recognition memory tasks. Detailed neuroimaging analyses will allow sophisticated predictions to be made about cognitive performance. This may have implications for future clinical practice where such predictions might help direct more detailed cognitive assessments.
Poster 44
Decoding the EEG oscillatory activity of visual mental imagery
Claire Braboszcz (1), Giorgio Ganis (1)

(1) School of Psychology, University of Plymouth, UK

Brain mechanisms of visual mental imagery are still not well understood. Most of the current knowledge mainly relies on fMRI and EEG evoked related potential studies [1], which per nature do not convey information about the oscillatory dynamic of the brain activity during mental imagery [2]. Our study investigates the EEG oscillatory activity underlying visual mental images. Brain activity is recorded using a 64 channels EEG system while participants are creating mental images based on previously seen visual stimuli of different categories (e.g., faces versus houses). Data analysis is performed using event-related time-frequency decomposition as well as time-frequency based decoding procedures. Visual mental imagery is thus compared to visual perception, and different categories of visual mental images are compared against each others. This study thus provides new advances on the understanding of the EEG oscillatory activity during visual mental imagery.


Poster 45
Un-mixing components of a hierarchical auditory paradigm from EEG source reconstruction
Adrien Witon (1), Amirali Shirazi-Beheshtl (1,2), Howard Bowman(1,3), Ling Li (1)

(1) School of Computing, University of Kent, UK
(2) East Kent Hospitals University NHS Foundation Trust, Kent & Canterbury Hospital, UK
(3) School of Psychology, University of Birmingham, UK

The processing of information from the sensory (eg. eye) up to the brain (primary area) is well established now. However, the relationship from the primary level in the brain to the more higher functions, which give access to conscious perception still needs to be explored. To study this relationship, we used a Local-Global paradigm [1]. The local effect (LE) is related to the mismatch negativity (MMN), while the global effect (GE) reveals the P300. In this experiment, we are interested in the neuronal relationship between the local and global effect, ie. the local by global (LxG) interaction. To study these effects, an EEG source reconstruction was performed using SPM12, with a Multiple Sparse Priors inverse model. A baseline (400 - 600ms) was applied before the onset of the stimulus. The source inversion
ran from 400ms to the end of the epoch. We analyzed the sources for these effects in three
different windows: MMN (700 750 ms) [2], P3a (850 950ms) and P3b (1000 1200ms) [3]. An
ANOVA was used to find the significant clusters: cluster forming threshold is set at 0.001,
and Family-Wise Error (FWE) rate correction at 0.05. We also illustrated how the amplitude
at the sources evolves by plotting the time series generated at the source level.
The MMN window shows an LE in the temporal lobe source. The P3 effect shows a strong
GE covering frontal, temporal and parietal areas. The P3a window presents an LE in
temporal, and a GE in temporal and frontal. In the P3a window, we found a LxG interaction
in the temporal area. The sources related to the MMN and the P300 are consistent with the
literature. The interaction in the P3a window, significant in the temporal area, reveals an
interaction between the MMN and P300 effects. This suggests a more complex hierarchy of
processing than previously reported, which will be discussed with regard to the global
workspace theory of conscious experience [4].

of the conscious processing of auditory regularities. Proceedings of the National Academy of Science, 106(5), 1672-1677.;
research of central auditory processing: a review. Clinical neurophysiology, 118(12), 2544-2590.
2128-2148.
and objective physiological data during conscious perception. Proceedings of the National Academy of
Sciences, 100(14), 8520-8525.

Poster 46
A hippocampal-frontal circuit in macaques holds memories of
currently unavailable choice values to guide future behavior
Fouragnan Elsa (1), Chau Bolton (1,2), Kolling Nils (1), Papageorgiou Georgios
(1,3),
Sallet Jerome (1), Rushworh Matthew (1)

(1) Experimental psychology, University of Oxford, UK
(2) Laboratory of Neuropsychology, University of Hong Kong, China
(3) McGovern institute for brain research, Massachusetts Institute of Technology, USA

Adaptive decisions require an agent to learn the value of choice options in the environment
through experience over time [1,2]. However, not all choices are available all of the time.
For learning to be worthwhile it is crucial to maintain information about choices even during
periods when they are not immediately available if they are likely to become available again
in the future [3]. To investigate the encoding, maintenance and retrieval of currently
unavailable choices, we designed, in macaques, an fMRI experiment in which animals
learned varying reward probabilities associated with several options [4]. Crucially, on each
trial, only two options out of three were presented. This allowed us to examine signals
related not only to the currently available options but also to the unavailable one which
could only be represented in memory [5]. Animals learned the options’ values and maintained them in memory without forgetting even when options were not available on a given trial. Hippocampal activity was predictive of accurate future decisions involving a currently unavailable option. It was particularly important for maintenance of an option’s value in memory when it could not be chosen. Conversely, regardless of current availability for choice, the anterior cingulate (ACC), the anterior prefrontal cortex and the ventromedial prefrontal cortex (vmPFC) rank alternative options according to their overall expected value. Within this value network the activity in ACC uniquely predicted future switching behaviors to take those alternatives. On the other hand, vmPFC value signals were modulated by the degree to which the context affected each animal’s accuracy on the current trial. Overall, this study reveals a function of the hippocampal-prefrontal circuit in maintaining option specific value, while also dissociating the roles of ACC and vmPFC in forecasting alternative decisions and encoding contextual value signals respectively.


**Poster 47**

The effects of observer age on the discrimination of facial expressions.

Thomas Murray (1), Justin O’Brien (1), Noam Sagiv (1)

(1) College of Health and Life Sciences, Brunel University London, UK

Previous research has demonstrated age-related impairments in the recognition of emotions in facial expressions [1], however little is known about the misperception of emotions, i.e. the mistakes an observer may make when identifying emotions. This project measures emotion discrimination – the ability to distinguish two emotional expressions, and how this changes with observer age. Using image morphing to warp pairs of facial expressions on a single continuous dimension, we can vary the similarity of the emotions presented to participants. Applying an adaptive psychophysical paradigm, we can measure the ability of different age groups to discriminate between emotional faces with varying similarities. We predict that older adults will have higher discrimination thresholds than younger adults, and that these thresholds may vary as a function of the emotions presented to participants. Additionally, we will employ attentional, cognitive, perceptual, and face-processing control tasks to examine whether any deficits observed in older adults can be explained by factors other than a specific decline in emotional face processing. When we establish these thresholds of emotion discrimination with behavioural methods, we will use fMRI to establish how this discrimination is represented in the brain. Using Multivariate
Pattern Analysis, we expect to see differential patterns of activation for each facial expression in the Occipital Face Area and Superior Temporal Sulcus [2]. Furthermore, we expect to see a relationship between the performance of the classifier and the behavioural discrimination thresholds, such that the ability to classify the patterns of activation will be reduced for facial expressions that the participant finds difficult to discriminate. This will provide insight into the processes and brain activation related to confusion or misperception of emotional expressions, and how this varies as a function of age.


Poster 48

The N170 is amplified for eye-sensitive emotions when the eyes are occluded from view

Kerri Bailey (1), Vicky Adams (1), Louis Renoult (1), Fraser W. Smith (1)

(1) School of Psychology, University of East Anglia, UK

Recognition of emotional expressions remains surprisingly accurate under conditions of partial occlusion; for example, when sunglasses occlude the eye region from view. Despite the fact that such conditions are often encountered in our visual experience, current models of object recognition do not deal well with occlusion (e.g. [1]). Our previous work suggests that higher levels of the visual system can feedback information about the occluded region of a scene or face [2-3]. In the present work, we used electroencephalography (EEG) to investigate the event-related potentials (ERP)'s elicited in the celebrated face selective neural component (N170) when participants viewed partially occluded emotional faces. We presented participants with four partial face samples (minus eye region, minus mouth region, eye region only, mouth region only) and whole faces as a control, of three important basic facial expressions (happiness, fear, and disgust). Fourteen participants performed either expression or gender recognition tasks on the same stimuli. We report that the right N170 ERP increased in amplitude when the eye region was occluded, particularly if it was predominantly important for recognising the emotion (e.g. fear; [4]). Previous studies have, in contrast, reported a weaker N170 when responding to a face with removed eye regions [5]. We suggest that different task requirements may underlie the contrasting patterns of findings: in [5] participants performed orthogonal tasks (e.g. detect changes in contrast), which can be easily done from minimal face information. On the other hand, expression or gender recognition may necessitate a more important contribution from cortical feedback to compensate for the missing information. Our results thus complement previous findings that suggest the N170 is extremely sensitive to the eye region of a face by demonstrating that, under certain conditions, it can also be extremely sensitive to the absence of the same features.
Acoustic pitch can be perceptually linked to visuospatial elevation. In fact, this crossmodal correspondence has been extensively described in the literature through numerous behavioural studies [1,2]. However, some questions remain to be answered: is this correspondence automatic? That is, can these two features be associated in the absence of attention? And more importantly, how early does the representation of pitch and spatial elevation converge? An audiovisual oddball paradigm, including standard and deviant stimuli, was used to answer these questions. Participants were presented with a visual (a coloured circle) and an auditory stimulus (a tone of a certain pitch) and were told to press a button every time they detected a change in the colour of a central fixation cross. In the 'standard' trials, the visual stimulus appeared at the centre of the screen (next to the fixation point) together with a 261.6-Hz auditory stimulus. The deviant trials consisted of a visual stimulus that could appear above or below the central position of the standard stimulus together with an auditory stimulus that was either higher (329.6Hz) or lower (185Hz) in pitch with respect to the standard auditory stimulus. In this way, the deviant trials could be either crossmodally congruent (high and low pitch combined with the circle...
appearing on the upper and lower spatial positions, respectively) or incongruent (high and low pitch in combination with the circle appearing below and above fixation point, respectively). Electrophysiological recordings (EEG) were obtained from participants. Preliminary analyses of the event-related potentials (ERP) revealed significant differences in amplitude between the congruent and the incongruent deviant trials in early latencies (e.g., after only 50ms after the stimuli onset). These results suggest that the possible crossmodal overlap between pitch and spatial elevation may take place in early stages of processing, perhaps before attention is allocated.


**Poster 50**

**The neurochemistry of altruism: A cognitive neuroscience perspective on the interpersonal dimension of psilocybin**

Christopher Germann (1)

(1) University of Plymouth, UK

Psilocybin (O-phosphoryl-4-hydroxy-N,N-dimethyltryptamine) is an indole alkaloid which is present in more than 150 fungi species, some of which are endemic to the UK. Its molecular structure closely resembles serotonin (5-hydroxytryptamine). A landmark study [6] experimentally demonstrated that a single dose of psilocybin can induce permanent personality changes in the personality dimension domain “Openness to Experience”. This finding is intriguing because there is broad scientific consensus that personality traits are stable over time (i.e., a genetic basis is assumed; [2]) and can only be altered by major life events (e.g., [7]). Hence, it has been experimentally demonstrated that psilocybin can have profound influences on peoples deeply engrained thinking patterns, emotions, and behaviours. Interestingly, the neuronal signature associated with psilocybin shows remarkable overlap with the neuronal activity overserved during mediation ([3]; cf. [4]). Based on the pertinent literature, we argue that psilocybin has the potential to increase empathy and altruistic propensities longitudinally. We conjecture that the postulated perceptual and attitudinal changes are mediated by the non-dual experience of egodissolution and the feeling of interconnectedness with others, both of which can be reliably occasioned by psilocybin [1]. Furthermore, we propose that specific activity patterns of the anterior insular and posterior cingulate cortices play a pivotal role in this scenario. In addition, we hypothesise that psilocybin has lasting effects on the modular rich-club architecture of the brain.


List of presenters

Adrien Witon               aw448@kent.ac.uk
Alejandro Galvez-Pol       a.pol@ucl.ac.uk
Alfred Veldhuis            14029565@brookes.ac.uk
Amanda Marshall            Amanda.Marshall@psy.lmu.de
Amy Sophia Boyson          asb1e14@soton.ac.uk
Angela Medvedeva           a.medvedeva@kingston.ac.uk
Anna Sedda                 a.sedda@hw.ac.uk
Ayse Ozsari                ayseozsari@gmail.com
Bassem Khalaf              bassem.khalaf@plymouth.ac.uk
Beatriz Calvo-Merino       b.callvo@city.ac.uk
Berenice Valdés-Conroy     bvaldes@ucm.es
Bettina Forster            b.forster@city.ac.uk
Beverley J Brown           lpxbjbr@nottingham.ac.uk
Bruno Rossion              Bruno.Rossion@uclouvain.be
Carmel Mevorach            c.mevorach@bham.ac.uk
Claire Braboszcz           claire.braboszcz@plymouth.ac.uk
Claudia Caprile            caprileclaudia@gmail.com
Daniel Edgcumbe            d.edgcumbe@uel.ac.uk
Deborah Talmi              deborah.talmi@manchester.ac.uk
Dineshen Chuckravanen      dineshen2013@gmail.com
Duncan Astle               Duncan.Astle@mrc-cbu.cam.ac.uk
Eddy J. Davelaar           e.davelaar@bbk.ac.uk
Ellen Poliakoff            Ellen.Poliakoff@manchester.ac.uk
Elsa Florence Fouragnan    elsa.fouragnan@psy.ox.ac.uk
Ethan Knights              ethan.knights@uea.ac.uk
Francois Foerster          francois.foerster@plymouth.ac.uk
Gavin Buckingham           g.buckingham@exeter.ac.uk
Giorgio Ganis              giorgio.ganis@plymouth.ac.uk
Helen Sharps               helen.sharps@plymouth.ac.uk
Helge Gillmeister          helge@essex.ac.uk
Ilaria Torre               ilaria.torre@plymouth.ac.uk
Ines Hipolito              hipolito.ines@gmail.com
Irena Arslanova            Irena.Arslanova@city.ac.uk
James K. Ebajemito         j.ebajemito@surrey.ac.uk
James McErlane             jm16695@my.bristol.ac.uk
James Selwood              js16657@my.bristol.ac.uk
Jan Kuipers                jk28@stir.ac.uk
JeYoung Jung               jeyoung.jung@manchester.ac.uk
List of presenters

John Gruzelier  j.gruzelier@gold.ac.uk
Juan Camilo Avendaño Diaz  javendanodiaz@bournemouth.ac.uk
Katrina McDonough  katrina.mcdonough@plymouth.ac.uk
Katya Rubia  katuaya.rubia@kcl.ac.uk
Kenneth Yuen  k.yuen@uni-mainz.de
Kerri Bailey  kerri.bailey@uea.ac.uk
Kristina Memetova  kmetka85@gmail.com
Laura Astolfi  astolfi@dis.uniroma1.it
Laura Puigcerver  l.puigcerver@gmail.com
Magdalena Ietswaart  magdalena.ietswaart@stir.ac.uk
Marios Philiastides  Marios.Philiastides@glasgow.ac.uk
Mark Carey  mac541@york.ac.uk
Mary Jane Spiller  m.j.spiller@uel.ac.uk
Matt Lambon Ralph  matt.lambon-ralph@manchester.ac.uk
Michael Wright  michael.wright@brunel.ac.uk
nareg khachatoorian  nareg.khachatoorian.1@city.ac.uk
Nicola Johnstone  n.johnstone@surrey.ac.uk
Patric Bach  patric.bach@plymouth.ac.uk
Paul Knytl  p.knytl@surrey.ac.uk
Paula Rowe  paula.rowe.1@city.ac.uk
Pia Rotshtein  p.rotshtein@bham.ac.uk
Ramiro Joly-Mascheroni  rjoly@city.ac.uk
Roger Moore  roger.s.moore@port.ac.uk
Sanjay Kumar  skumar@brookes.ac.uk
Sonia Abad Hernando  Sonia.Abad-Hernando.2@city.ac.uk
Steph Acaster  s.acaster@shu.ac.uk
Stephen Johnston  sjayejohnston@gmail.com
Steven Tipper  steven.tipper@york.ac.uk
Thomas D. Sambrook  tom.sambrook@plymouth.ac.uk
Thomas Murray  tommurray1412@gmail.com
Tibor Auer  tibor.auer@rhul.ac.uk
Tom Lockhart  tom.lockhart@port.ac.uk
Velia Cardin  v.cardin@uea.ac.uk
Victoria Lovett  v.e.lovett@swansea.ac.uk