The UEA Perception and Action Workshop Programme

Hosted by the School of Psychology
Monday 9 June, 2014

Organizing committee:

Dr. Irene Sperandio, Dr. Stephanie Rossit, Dr. Fraser W. Smith
Index

Workshop Schedule..................................................................................................................3
Speaker profiles......................................................................................................................4
  Keynote speaker..................................................................................................................4
  Invited speakers..................................................................................................................5
Poster presentations...............................................................................................................9
Travel awards.........................................................................................................................11
Poster abstracts.....................................................................................................................12
Venue Map.............................................................................................................................31
# Workshop Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tr>
<td>9.30</td>
<td><strong>Registration and Coffee</strong> Julian Study Centre, Foyer</td>
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<td>Move to Julian Study Centre, Room 1.02.</td>
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<td>10.00</td>
<td><strong>Keynote</strong> DF's Brain in Action: Vision as a Sensorimotor System</td>
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<td><strong>Melvyn A. Goodale</strong>, The Brain and Mind Institute,</td>
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<td><em>The University of Western Ontario (Canada)</em></td>
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<td>11.00</td>
<td><strong>What is optic ataxia?</strong></td>
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<td><strong>Robert D McIntosh</strong>, School of Philosophy, Psychology &amp; Language Sciences,</td>
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<td><em>The University of Edinburgh (UK)</em></td>
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<td>11.45</td>
<td>Coffee &amp; Move to the Thomas Paine Study Centre Foyer</td>
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<td>12.00</td>
<td><strong>Poster Session &amp; Sponsors Showcase</strong></td>
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<td>12.45</td>
<td>Lunch (Poster Session continued)</td>
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<td>14.00</td>
<td><strong>Return to Julian Study Centre, Room 1.02</strong></td>
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<td>14.15</td>
<td><strong>Vision for action in the monkey medial posterior parietal cortex</strong></td>
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<td><strong>Patrizia Fattori</strong>, Department of Pharmacy and Biotechnology</td>
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<td><em>University of Bologna (Italy)</em></td>
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<td>15.00</td>
<td><strong>The modulation of the visual perception of contrast, time and size by action</strong></td>
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<td><strong>Maria Concetta Morrone</strong>, Department of Translational Research on New Technologies in Medicine and Surgery,</td>
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<td><em>University of Pisa (Italy)</em></td>
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<td>16.00</td>
<td><strong>Tea</strong></td>
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<td>16.15</td>
<td><strong>What makes our subjective experience of the world unique?</strong></td>
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<td><strong>Sam Schwarzkopf</strong>, Institute of Cognitive Neuroscience,</td>
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<td><em>University College London (UK)</em></td>
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<td>17.00</td>
<td><strong>Poster Prize Announcement</strong></td>
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<td>17.05</td>
<td><strong>Round table with speakers (debate open to audience)</strong></td>
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<td>17.30</td>
<td><strong>Finish – Drinks</strong></td>
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Keynote speaker

MELVYN A. GOODALE, PhD, FRSC, FRS
Distinguished University Professor
Canada Research Chair in Visual Neuroscience
Director, The Brain and Mind Institute
The University of Western Ontario
London, Ontario, Canada

Prof. Goodale is a Distinguished University Professor and Director of the Brain and Mind Institute at the University of Western Ontario where he holds the Canada Research Chair in Visual Neuroscience. He was a pioneer in the study of the neural substrates of visuomotor control, first in animals and later in humans. His early work in the 1980s, in which he demonstrated that the visual control of action is functionally independent of visual perception, laid the foundation for the ‘duplex’ account of high-level vision which he developed later, together with his long-time colleague, Professor David Milner (now at Durham University). This account provides a convincing resolution to conflicting accounts of visual function that has characterized much of the work in the field for the last one hundred years. Over the last decade, Professor Goodale has led much of neuroimaging and psychophysical research that has refined and extended the two-visual-systems proposal. These ideas have had an enormous influence in the life sciences and medicine. The two-visual-systems proposal is now part of almost every textbook in vision, cognitive neuroscience, and psychology. He is a Fellow of the Royal Society of Canada and the Royal Society (UK).
Invited speaker

ROBERT D. MCINTOSH, PhD

Head of Psychology
Senior Lecturer in Human Cognitive Neuroscience Director of the Visuomotor Lab within the Cognitive Neuroscience Suite
School of Philosophy, Psychology & Language Sciences, The University of Edinburgh, UK

Dr. McIntosh works on perception and action in the healthy and damaged brain. Following his PhD, on the visual and manual symptoms of Unilateral Neglect, he joined Prof. David Milner's research group at the University of St. Andrews, studying perception and action in neglect, visual agnosia and optic ataxia. He held a five-year Addison-Wheeler Fellowship at the University of Durham, eighteen months of which were spent at the Perception & Motor Systems Laboratory at the University of Queensland, working with Prof. James Tresilian. His recent research has focused on attention and distraction in saccadic and manual behaviour in normal children and adults, and in adults with focal brain damage or dementia. He was awarded the Elizabeth Warrington Prize of the British Neuropsychological Society for his early career research, and is currently Director of the Visuomotor Laboratory, and Head of Psychology at the University of Edinburgh.
Invited speaker

PATRIZIA FATTORI, PhD
Associate Professor of Physiology
Department of Pharmacy and Biotechnology
University of Bologna, Italy

Prof. Fattori works on the neurophysiology of visuomotor processes involved in eye-hand actions. In her PhD, in the lab of Prof. Claudio Galletti, she studied the mechanisms of visual space perception by finding visual cells in the parietal cortex whose receptive field is not anchored to the retina, but to stable positions in space (real position cells). Later on she has been involved in elucidating the neuronal mechanisms leading from capturing a target with the eyes till elaborating and executing reaching and grasping actions to acquire it. Since 2001, she is Associate Professor in Physiology at the University of Bologna. She is now studying the frame of reference for reaching movements in the monkey medial posterior parietal cortex when arm actions are performed in different directions and depths in the peripersonal space.
Invited speaker

MARIA CONCETTA MORRONE, PhD

Professor of Physiology
Department of Translational Research on New Technologies in Medicine and Surgery
University of Pisa, Italy

Prof. Morrone graduated in Physics from the University of Pisa, trained in Biophysics at the elite Scuola Normale Superiore and she is now a Professor of Physiology at University of Pisa, Medical School. Over the years her research has spanned most active areas of vision research, including spatial vision, development, plasticity, attention, color, motion, robotics, vision during eye movements and more recently multisensory perception and action. Prof. Morrone has published some 160 publications in excellent international peer-review journals, including Nature and her sister journals, Neuron, Current Biology and Trends in Neuroscience and Trend in Cognitive Neuroscience. She has been editor of several major specialized journals and was one of the founding editors of the Journal of Vision, and currently she is Chief Editor and founder of the journal “Multisensory Research” (the continuation of “Spatial Vision”).
Invited speaker

SAM SCHWARZKOPF, PhD
Research Associate
Department of Cognitive Perceptual & Brain Sciences (CPB)
University College London, UK
Birkbeck-UCL Centre for Neuroimaging (BUCNI)

Dr. Schwarzkopf’s research investigates how subjective perceptual experience arises in the human brain. He did his PhD in neurophysiology in the lab of Prof. Frank Sengpiel at Cardiff University studying the early development of the visual cortex. Subsequently, he moved into human cognitive neuroscience and, after a brief postdoc at the University of Birmingham, in 2008 he joined the lab of Prof. Geraint Rees at the Wellcome Trust Centre for Neuroimaging (the “FIL”) and the Institute of Cognitive Neuroscience in University College London (UCL). In 2012, he was awarded a five-year ERC Starting Grant to support his research on perceptual heterogeneity. He moved to the UCL department of Experimental Psychology and the Birkbeck-UCL Centre for Neuroimaging to set up an independent lab there.
Poster presentations

POSTER NUMBERS CORRESPONDED TO POSTER BOARDS

1. Metric vs categorical processing in antipointing
   Alessio Toraldo - Department of Brain and Behavioural Sciences, University of Pavia, Italy

2. Hierarchies of attentional allocation: The role of task difficulty in the allocation of attention in a manual pointing task
   Sebastian Sandoval Similä - Human Cognitive Neuroscience, University of Edinburgh, UK

3. Manipulating attention during visuomotor priming using dual-tasks
   Ellen Poliakoff - Body Eyes and Movement Laboratory (BEAM), Psychological Sciences, University of Manchester, UK

4. Movement goals are encoded in the human parietal reach region even when the movement goal is ambiguous
   Hanna Gertz - Experimental Psychology, Justus-Liebig University, Germany

5. Pictorial depth cues always influence reach amplitude
   Robert D. McIntosh - Human Cognitive Neuroscience, University of Edinburgh, UK

6. Drawing on the right side of the brain: A voxel-based morphometry analysis of observational drawing
   Rebecca Chamberlain - Laboratory of Experimental Psychology, University of Leuven, Belgium

7. Visual object recognition and visual motor control in preschool children with autism spectrum disorder
   Daria S. Pereverzeva - Moscow State University of Psychology and Education, Russia

   Katie Greenfield - School of Psychology, University of Nottingham, UK

9. Weight illusions in special populations
   Gavin Buckingham - Department of Psychology, Heriot-Watt University, UK

10. Multi-sensory integration and body representation: investigating anomalous symptoms in healthy participants
    Kristy Themelis - School of Psychology, University of Nottingham, UK

11. Ebbinghaus Illusion in Touch
    Mounia Ziat - Department of Psychology, Northern Michigan University, US

12. Attention and Action Perception in a Movement-Congruency Effect
    Silviya P. Doneva - Department of Psychology, University of Essex, UK
13. **Motion perception learning is not specific to trained colour or hemifield**  
   Stephanie Larcombe - Nuffield Department of Clinical Neurosciences, University of Oxford, UK

14. **Investigating the links between perception and action: the effects of effortful actions on vicarious agency**  
   Emma Howard - School of Psychology, University of East Anglia, UK

15. **Mapping number to space engages adaptive encoding mechanisms**  
   David C. Burr - Department of Neuroscience, Psychology, Pharmacology and Child Health, University of Florence, Italy

16. **Isolated disruption of perceptual object manipulation knowledge: evidence from patient work and neuromodulation**  
   Carys Evans - Department of Psychology, Faculty of Health and Life Sciences, Northumbria University, UK

17. **Implicit memory in acute stroke**  
   Ioanna Markostamou – School of Psychology, University of East Anglia, UK

18. **Manual asymmetries: attentional and intentional biases in dextrals**  
   Leah T. Johnstone - School of Psychology, Bangor University, UK

19. **Hotspots in the workspace: Investigating the Relation between Non-target Object Location and Avoidance Responses**  
   Rudmer Menger - Experimental Psychology, Helmholtz Institute, Utrecht University, Netherlands

20. **Manual tapping enhances visual short-term memory performance where visual and motor coordinates correspond**  
   Raju P. Sapkota - Vision & Eye Research Unit (VERU), Postgraduate Medical Institute, Anglia Ruskin University, UK

21. **A task comparison of saccade programming in scene viewing and non-scene viewing tasks**  
   R. Calen Walshe – School of Philosophy, Psychology and Language Sciences, University of Edinburgh, UK

22. **Attentional Biases in Social Anxiety are Related to Facilitated Processing of Positive Social Information**  
   Cesco Willemse – School of Psychology, University of East Anglia, UK

23. **The effect of gaze leading on attention during joint attention**  
   Gareth Edwards – School of Psychology, University of East Anglia, UK
Travel awardees

Miss Carys Evans, Department of Psychology, Faculty of Health and Life Sciences, Northumbria University, UK

Ms Leah T. Johnstone, School of Psychology, Bangor University, UK

Mr R. Calen Walshe, School of Philosophy, Psychology and Language Sciences, University of Edinburgh, UK

Dr. Raju Sapkota, Vision & Eye Research Unit (VERU), Postgraduate Medical Institute, Anglia Ruskin University, UK

Dr. Rebecca Chamberlain, Laboratory of Experimental Psychology, University of Leuven, Belgium

Mr Sebastian Sandoval Similä, Human Cognitive Neuroscience, University of Edinburgh, UK

Miss Silviya Doneva, Department of Psychology, University of Essex, UK

Miss Stephanie Larcombe, Nuffield Department of Clinical Neurosciences, University of Oxford, UK

Sponsors for travel awards & best poster prize:

![Sponsors Logos]
1) Metric vs categorical processing in antipointing

Toraldo A.¹, Manfredi V.¹, Rivolta D.¹, Mora G.², Zaliani A.²

¹Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy
²Fondazione Salvatore Maugeri, Pavia, Italy

Introduction. “Antipointing” – reaching out towards the mirror image of a stimulus with respect to a central landmark – involves encoding of (at least) two types of spatial information, categorical (e.g. left-right) and metric. We report here the case of a patient who, after right hemisphere damage, produced a clear-cut dissociation between the two types of processing.

Methods. In the context of a larger study, we tested patient DAR (75y, right-handed, temporo-occipital stroke, dense hemianopia, moderate neglect), and ten control subjects. Three experimental conditions were used. (i) Open-loop Motor AntiPointing (MAP), with subjects pointing to the symmetrical position of a target with respect to a central cross (target position was varied); (ii) Perceptual AntiPointing (PAP). Target and cross were the same; a third stimulus was slowly shifted by the examiner, starting from the cross towards the side opposite to the target, and participants had to stop the examiner by verbal command when they were satisfied that a symmetrical pattern was produced. (iii) Direct Pointing (DP) – a control condition in which participants had to open-loop point directly to the target.

Results. Patient DAR showed no deficit in DP and PAP. However, he could not perform the MAP at all – he pointed to random positions – metrically almost completely unrelated to stimulus position; however, he maintained a sharp separation between “left” and “right” trials, which clearly clustered in separate regions of the response space.

General Discussion. Consistently with Kosslyn et al’s (1989) claim of separate metric and categorical spatial processing, DAR’s MAP performance suggests spared categorical processing with selective loss of metric information. Why was metrics preserved in the PAP condition? We speculate that DAR could compensate for his metric deficit by mentally overlapping the two distances, which were simultaneously present in the visual field on the PAP, and using a “pattern recognition” strategy.
2) Hierarchies of attentional allocation: The role of task difficulty in the allocation of attention in a manual pointing task

Sebastian Sandoval Similä, Robert D. McIntosh

Human Cognitive Neuroscience, University of Edinburgh, UK

Attention has been shown to be allocated to the location of an upcoming saccade (e.g. Deubel & Schneider, 1996) or manual movement (e.g. Deubel, Schneider, & Paprotta, 1998; Song & Nakayama, 2006). While the end point of a movement has been investigated in detail, a question which has been neglected is whether for manual movements the starting point is also attended. Previous studies involving manual tasks have involved constant use of the same hand, but it is possible that, if the responding hand is unpredictable, hand selection may require attention to the starting point of the movement as well. In two studies, we cued participants to respond to one or other hand, as well as to different locations, while probing attentional allocation to the starting point or the target of the movement. Our initial study suggested that the starting point is attended as well as the target location, a more challenging paradigm found perceptual enhancement only at the latter, consistent with prior literature. This highlights the importance of task difficulty in attentional paradigms, as well as revealing more about the hierarchy of attentional allocation to task-relevant objects.

3) Manipulating attention during visuomotor priming using dual-tasks

Ellen Poliakoff¹, Elizabeth Evans², Emma Gowen²

Body Eyes and Movement Laboratory (BEAM)  
¹Psychological Sciences, University of Manchester  
²Faculty of Life Sciences, University of Manchester

Introduction: Observation of human actions influences the observer’s own motor system, termed visuomotor priming, and is believed to occur automatically. However, we previously observed that priming effects disappear when simultaneously performing a demanding visual task (Gowen et al, 2010). Here, we investigated the effect of minimally demanding visual and auditory dual tasks on visuomotor priming. This allowed us to determine whether our previous observation was due to the increased cognitive load required by the dual task or competing demand on shared resources within the visual modality.

Methods: Participants observed a finger or object moving up or down and pressed/released a button when a yellow flash appeared on the screen. Priming effects were calculated by
subtracting incompatible from compatible movement trials. The baseline group performed this task only, whereas the visual dual task group also reported when they noticed the finger or object making a jump movement, and the auditory dual task group also reported when they heard a beep during the movements.

Results: Performance was high on both visual and auditory dual tasks, indicating that they were minimally demanding. Priming effects were present for the finger in the baseline group, but were absent in the visual dual task group. Importantly, priming effects were apparent for the finger in the auditory dual task group and larger than for the baseline group.

Conclusions: Priming is removed in dual task situations due to competing resources within the visual modality rather than by general cognitive load. Furthermore, the increased priming in the auditory dual task suggests that occupying attentional resources reduces inhibition of priming, which can occur in typical viewing (baseline) conditions. This indicates that priming is not an automatic process and dual tasks could both hinder and assist rehabilitation based on observation of human movement.

4) Movement goals are encoded in the human parietal reach region even when the movement goal is ambiguous

Hanna Gertz, Katja Fiehler

Experimental Psychology, Justus-Liebig University Giessen, Giessen, Germany

It is well known that a broad fronto-parietal network is involved in reach planning. However, the nature of encoding processes in the respective brain areas such as the human parietal reach region (PRR) and the dorsal premotor cortex (PMd) remains unclear. Moreover, it is not known whether movements are planned even when the movement goal is ambiguous. We applied a pro/anti reach task in the MR scanner to dissociate the position of the spatial cue from the position of the movement goal. In addition, we manipulated whether the context rule (pro- vs. anti-reach) was presented before (specified condition) or after (underspecified condition) a variable delay. For the specified pro- and anti-reach conditions, we found comparable delay-related activation in fronto-parietal regions. Both PRR and PMd showed a preference for contralateral spatial cues in the pro-reach task and for ipsilateral spatial cues in the anti-reach task, i.e., for contralateral movement goals in both conditions. For underspecified conditions, we found activation in reach-related areas in the posterior parietal cortex, while activation in the PMd was lacking. The PRR showed a preference for ipsilateral spatial cues, similar to the anti-reach task. The present results suggest that (a) PRR and PMd encode the movement goal
rather than the spatial goal, and (b) movement goals are encoded even in ambiguous situations in the PRR with a preference for anti-reaches.

5) Pictorial depth cues always influence reach amplitude

Robert D. McIntosh¹, Sebastian Sandoval Simila¹, Matthew Iveson¹, Antimo Buonocore²

¹Human Cognitive Neuroscience, University of Edinburgh, UK
²Center for Mind/Brain Sciences, University of Trento, Italy

There is a long-standing debate over whether action systems are sensitive to pictorial visual illusions. Typically, objects are presented against pictorial backgrounds inducing illusory changes of object size, and grip aperture is measured as the hand moves toward the target. It has been suggested that direct actions are unaffected by these illusions, because action programming is accomplished by the dorsal visual stream, which relies on egocentric cues to object size and distance. Pictorial cues, by contrast, are thought to be interpreted within the ventral visual stream, giving rise to the illusory percept. Notably, many of these illusions of object size are actually secondary consequences of illusions of depth (e.g. Ponzo illusion), with the associated size illusion arising via size-constancy scaling. We thus decided to ask the more direct question of whether people reach to the wrong distance for a target presented against a pictorial depth background. We presented pointing targets against normal, medium or high depth linear perspective or texture gradient backgrounds. Participants reached farther for higher-depth backgrounds, showing a small but robust influence of the pictorial cue. This was consistent across a wide variety of conditions including: monocular and binocular viewing, immediate and memory-guided reaching, reaching with left and right hand, and was unchanged after sustained practice at the task with vision of the hand available. Comparable pictorial effects were observed in a patient (DF) with bilateral ventral stream damage, suggesting that this influence of pictorial depth does not emanate from the ventral visual stream. We suggest that linear perspective and texture gradient information are automatically processed for depth information at an early visual processing stage, affecting action as well as perception.
6) Drawing on the right side of the brain: a voxel-based morphometry analysis of observational drawing

Rebecca Chamberlain¹, I. Chris McManus², Nicola Brunswick³, Qona Rankin⁴, Howard Riley⁵, Ryota Kanai⁶

¹Laboratory of Experimental Psychology, University of Leuven, Belgium.
²Research Department of Clinical, Educational and Health Psychology, Division of Psychology and Language Sciences, University College London, UK
³Department of Psychology, School of Health and Social Sciences, Middlesex University, London, UK
⁴Royal College of Art, London, UK
⁵Faculty of Art and Design, Swansea Metropolitan University of Wales Trinity Saint David
⁶School of Psychology, Sackler Centre for Consciousness Science, University of Sussex, Falmer, UK.

Introduction: The relationship between individual differences in brain structure and expert abilities has been demonstrated in a number of domains including visual perception, spatial navigation, complex motor skills and musical ability. However research into neural differences associated with skill in visual art is scarce. The aim of this study was to investigate whether there would be any differences in brain structure in relation to increasing representational drawing skill in a diverse group of training artists. The relationship between brain structure and drawing skill was then examined in relation to local perceptual processing abilities in order to explore an existing claim that local processing facilitates drawing ability (Chamberlain et al, 2013; Drake & Winner, 2011).

Method: A cohort of graduate and post-graduate art students and non-art students completed observational drawing tasks, an embedded figures task and a block design task. Scores on these tasks were then correlated with the regional grey and white matter volume in cortical and subcortical structures.

Results: An increase in grey matter density in the cerebellum was observed in relation to observational drawing ability which was independent of artistic training, suggesting an enhancement of fine motor control and procedural memory. Furthermore, overlap in medial frontal regions associated with performance on local processing tasks and drawing suggests that drawing may be facilitated by the suppression of bias toward global perceptual processing in action selection.

Conclusion: The findings corroborate small-scale fMRI studies of online drawing and provide insights into the properties of the developing artistic brain.
7) Visual object recognition and visual motor control in preschool children with autism spectrum disorder

D.S. Pereverzeva, N.L. Gorbachevskaya

Moscow State University of Psychology and Education. Moscou, Russia

Introduction. Autism is a neurodevelopmental disorder defined by impairments of social interaction, repetitive behavior and communication disabilities. Another frequently reported characteristic is unusual performance in visual perceptual tasks, disorders of visual attention and action control. The primary purpose of our study was to assess object recognition and visual action control in children with ASD, and possibly find some links between different symptoms within group.

Participants. Twenty children with ASD (3,4 - 7 yrs), (experimental group); 10 children with Down syndrome (DS) (3,6-7 yrs), and 20 typically developing children (TD) (1,4 – 4 yrs) (control groups). Methods. Object recognition test battery designed to accesses ability of matching identity of objects under different conditions. 2. Video analysis of execution of visually guided movement. 3. Psycho-educational profile. 4. Childhood autism rating scale.

Results 1. Participants from mild learning disability ASD group made significantly more recognition errors than TD matches, relying on the similar geometrical shape of objects projections, and ignoring other perceptive and semantic features (p<0,001), and were significantly better in the identification of abstract figures. There was a positive correlation between number of “shape-based” errors and the depth of autistic symptoms. The Weak central coherence, Enhanced perceptual functioning and Complex information-processing model are discussed. 2. The number of errors in the “geometrical shape matching” task in the severe learning disability ASD group depended on the size of figures and was significantly higher in the “big size” trial (angular dimension of stimuli 100°) than in the “small size” trial (10°) (p=0,005). There was no difference between results in TD and DS groups. 3. Participants with ASD showed a significantly lower level of «eye-hand» synchrony and lack of anticipation in posture and hands preparation for moving object comparing with DS and TD subjects. This group of results is discussed in the line of perception-attention-action paradigm.
8) Visual-tactile integration in children with and without Autism Spectrum Disorder (ASD)

Katie Greenfield

School of Psychology, The University of Nottingham

Atypical multisensory integration in autism spectrum disorders (ASD) has been well documented across multiple sensory modalities (Iarocci and McDonald, 2006) but the mechanisms underlying this have yet to be established. A recent study found children with ASD were less susceptible to the rubber hand illusion (RHI) than typically developing control children (Cascio et al., 2012), indicating atypical tactile-visual integration. The researchers propose two possible interpretations of the results. Either the ASD group had an enlarged temporal binding window (TBW) for sensory integration, or they were focusing predominantly on proprioceptive inputs at the expense of integrating these with other incoming sensory information. The current study tested these explanations using a RHI task conducted via a multisensory illusion system (MIRAGE, Newport et al., 2010) with 29 children with ASD and 62 control children. Preliminary findings indicate a developmental delay in illusion susceptibility in the ASD group relative to the controls. There was no evidence that this was caused by an increased reliance on proprioceptive inputs. Instead, results suggest that the narrowing of the TBW seen in typical development is delayed in ASD leading to atypical multisensory integration and reduced illusion susceptibility.

9) Weight illusions in special populations

Gavin Buckingham

Department of Psychology, Heriot-Watt University, Edinburgh, UK

Identically-weighted objects can be made to feel as if they have substantially different weights from one another when certain physical properties, unrelated to mass, are manipulated. In the size-weight illusion, for example, small objects feel substantially heavier than equally-weighted large objects. And, in the analogous material-weight illusion objects which appear to be made from a low-density material will feel heavier than objects of the same weight which look as if they are made from a higher-density material. In both of these cases, the illusory misperception of weight is thought to reflect the way lifters integrate their prior expectations into their judgements of heaviness; the light-looking object is heavier than the lifter expected, causing them to experience it as being heavier than it actually is. Here I describe how these weight illusions manifest in a variety of special populations who suffer from perceptual, sensorimotor,
or peripheral disorders. The way that these populations experience weight illusions not only give an insight into the nature of weight illusions, but also provides a unique demonstration of the perceptual effects of various clinical disorders.

10) Multi-sensory integration and body representation: investigating anomalous symptoms in healthy participants.

Kristy Themelis, Roger Newport

University of Nottingham, School of Psychology, University Park, (Nottingham UK)

Introduction: Research suggests that discordant sensory input can induce anomalous symptoms in healthy participants and pain in a number of subjects. How distorting the body image or body schema affects pain and other unpleasant sensory and emotional experiences remains unclear and requires further investigation. Prior work from our laboratory suggested that a multisensory illusion elicited by a virtual reality device could elicit anomalous symptoms such as; loss of control, feelings of peculiarity, weight and temperature changes, and discomfort.

Aim: To investigate whether a multi-sensory illusion can generate anomalous sensations or pain and alter body perception in healthy subjects.

Methods: The experimental design was a randomized within-subject 2x4x2 factorial arrangement with 16 healthy participants. A virtual reality device was used, which allows a wide range of multisensory illusions, using a combination of cameras and mirrors so that participants can view their hands in the same spatial location as their real hand. Participants underwent 8 different conditions with illusory finger stretching or finger shrinking of the index finger and with changes in sensory input. Hand drawings and questions related to body ownership and body perception were used to investigate visuotactile incongruence and body representation.

Results: Participants drew their index finger, but not their middle finger significantly longer (p=0.019) in the conditions where the finger was illusory stretched (independent of visual or tactile input). Both illusory stretching and illusory shrinking of the finger led to a variety of reported anomalous sensations and a large number of participants reported a change in body ownership of the manipulated index finger.

Conclusion: Results suggest that inducing a multisensory conflict by using a virtual reality device can alter body representation in healthy participants. This experimental design allows in particular for the investigation of multisensory processes which are critical in many disorders where body representation is disrupted.
11) Ebbinghaus Illusion in Touch

**Mounia Ziat**, Erin Smith, Candace Calvetti, Vincent Hayward  
Northern Michigan University, 2UPMC Univ. Paris 06,

This research reports the first evidence for the existence of the Ebbinghaus illusion in touch. Blindfolded participants were asked to explore bimanually two sets of Ebbinghaus circles. The results showed that participants were more likely to be deceived when an illusion-induced stimulus is present than when a control stimulus (no illusion) is present. These results contribute to the perception-action debate. The existence of the tactile equivalent of the Ebbinghaus illusion weighs in favor of the two-stream hypothesis (Goodale and Milner, 1992) that assumes the existence of separated visual pathways for action and perception.

12) Attention and Action Perception in a Movement-Congruency Effect

**Silviya P. Doneva**, Geoff G. Cole  
Department of Psychology, University of Essex, UK

The ‘movement-congruency’ paradigm requires two participants to alternate responses to one of two targets appearing either to the left or right hand-side of a shared workspace. Results indicate that reaction times are generally shorter when participants initiate an action that imitates, within an egocentric framework, their partner’s previous response. This effect is commonly explained with an action co-representation account according to which the two co-actors represent each other’s actions. However, alternatively, participants might be inhibiting the location of their partner’s previous response, i.e., the ‘social IOR’ account. We conducted three experiments to examine the contribution of both action perception and attention on the phenomenon. Experiment 1 revealed that the movement-congruency effect occurs only as a function of target location but not action. However, the findings also demonstrated that the type of performed action modulates the effect, since it was present only when the partners executed an identical response. Experiments 2 and 3 showed that the time course of the effect concurs with what is known about IOR and that it is not influenced by the valence of the relationship between the co-actors. These findings suggest that although primarily an attentional phenomenon, the movement-congruency effect is also modulated by action co-representation.
13) Motion perception learning is not specific to trained colour or hemifield

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Introduction. There is currently debate in the perceptual learning literature as to whether learning is specific to the trained task, and/or trained retinal location. We investigated the amount and specificity of improvement in motion coherence tasks, following five days of training the left or right visual hemifield, using blue moving dots on a yellow background.

Methods. Before and after training, motion coherence thresholds were assessed for both hemifields. We used moving dot stimuli with blue dots on yellow background, red dots on green background and white dots on black background. Normal Subjects determined whether the coherently moving dots, presented amongst randomly moving dots, had leftwards or rightwards motion. The stimulus area was 13.5° diameter, centred 3° from fixation. Dot coherence changed adaptively, using a two-up one-down staircase procedure. Motion perception training required participants to complete five consecutive days of training the blue-yellow stimulus in one hemifield (800 trials/day, 20 minutes total).

Results. Five days of motion perception training were sufficient to improve motion perception performance (median 27% coherence pre-training to 13% post-training). Interestingly, training effects were not specific to the trained colour (F=1.315; p=0.321) or trained hemifield (F=4.103; p=0.073). Furthermore, the amplitude of the training effect correlated with pre-training performance (r=0.793, p=0.000, two-tailed), where individuals initially less able at the task improved by a greater amount.

Conclusions. Training on a motion coherence task improved visual performance in healthy subjects. The improvement transferred to the untrained hemifield and untrained stimulus colour combinations. Transferability may be a result of the ease of the task, as the adaptive paradigm averaged to 80% correct rate, the range of different motion directions within the stimulus, and also initial exposure to all stimulus configurations. Generalisation of perceptual learning tasks may be useful for application in visual rehabilitative strategies, for individuals with damage to the primary visual cortex.

14) Investigating the links between perception and action: the effects of effortful actions on vicarious agency

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A sense of agency helps individuals to understand the relationship between actions and their consequences. Agency is measured implicitly through temporal binding paradigms whereby actions and consequences are perceived as occurring closer together in time. Still remaining to be understood is the effect of effortful actions on a sense of agency and how this modulates vicarious agency, i.e. agency for another’s actions. Therefore in attempt to understand the relationship between actions and agency, in the first experiment participants were required to estimate temporal intervals between two events, either actions and a resulting tone, or two tones. It was found that intervals between actions and consequent tones were significantly shortened when compared to intervals between two tones, suggesting a greater sense of agency for events resulting from actions. In the second experiment participants were required to estimate temporal intervals as in experiment 1 but also under either low or high effort. As in experiment 1 an enhanced sense of agency was observed for events with prior actions. Additionally, it was found that between actions and consequent events under high effort there was greater temporal shortening when compared to two non-causal events, suggesting an enhanced sense of agency for events caused by effortful actions. Further investigation will examine the effects of effortful actions on vicarious agency i.e. agency for another’s actions.

15) Mapping number to space engages adaptive encoding mechanisms

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The mapping of number onto space is fundamental to measurement and mathematics. However, number mapping of young children, unschooled adults and adults under attentional load show strong compressive non-linearities, thought to reflect intrinsic logarithmic encoding mechanisms, which are “linearized” by education. Here we advance and test an alternative explanation: that the non-linearity results from adaptive Bayesian mechanisms (akin to a Kalman filter), which take into account the statistics of recent stimuli. This theory predicts that
the response to the current trial should correlate positively with the magnitude of the previous trial: whereas a static logarithmic non-linearity predicts trial-wise independence. Consistent with predictions, we found strong and highly significant correlations between numberline mapping of the current trial and the magnitude of previous trials, in both adults and school children. The dependency is sufficient to account for the shape of the numberline (using a simple, one-parameter model), without recourse to static non-linearities such as logarithmic encoding. Simulations show that this dynamic strategy is efficient, resulting in a reduction of overall reproduction error, and may well reflect a general strategy to cope adaptively with environmental statistics.

16) Isolated disruption of perceptual object manipulation knowledge: evidence from patient work and neuromodulation.

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Appropriate object manipulation for skilled use requires the integration of visible (dorsal) and known (ventral) action properties of an object, which has been attributed to the concept of a ‘ventro-dorsal’ stream. Apraxia, a higher order motor disorder, has been proposed to result from disrupted integration of perception and action due to impaired motor representations necessary for object-use. Apraxics can name objects, identify their function, and pick them up to move, demonstrating intact ventral and dorsal streams. However, they perform poorly when manipulating an object for use, particularly when required to pantomime the action. Using a series of perceptual matching tasks we assessed semantic, functional, and manipulation knowledge in a study with apraxic patients and a neuromodulation study with healthy volunteers. A critical distinction was made between ‘action representations’ of objects, or the understanding of how an object typically interacts with another object in the absence of the actor (e.g. how a hammer hits a nail), and object manipulation knowledge of how the object is handled for use. Experiment 1 explored performance in 16 left hemisphere stroke patients and found that deficits in object manipulation knowledge correlated with severity of apraxic symptoms. In Experiment 2, transcranial direct current stimulation (tDQS) was applied to the left inferior parietal lobe (IPL) of healthy participants and confirmed that response times were modulated selectively on the object manipulation task. Such selectivity was not found for ‘action representations’ (i.e. object-object interaction understanding); performance on this contrasting task was not disturbed in apraxia or by neuromodulation over the left IPL. These
results confirm that object manipulation knowledge is perceptually independent from semantic knowledge and implicates the left IPL in internal motor representations important for integrating perception and action. It further adds to the existence of ventro-dorsal stream as a third steam in the two-visual pathway model.

17) Implicit memory in acute stroke

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Learning and memory are supported by two interrelated yet distinct systems - explicit and implicit. Explicit memory involves conscious recollection of previous experience while implicit memory involves perceptual (or sensory based) and motor processes. While memory impairment forms a well described consequence of chronic stroke, researchers have typically shied away from studying patients in the acute stroke phase. Therefore, we investigated verbal and visuo-spatial explicit memory as well as implicit memory through repetitive auditory and motor-sequence priming in 30 individuals with unilateral left (15 patients) or right hemisphere damage during the acute stage (first week) after a cerebrovascular accident. Thirty age- and education- matched individuals with free neurological and psychiatric history served as controls. Discrepancy between left and right hemisphere patients reach significant levels only in visuo-spatial working memory, with right hemisphere patients performing more poorly than left hemisphere patients. Both left and right hemisphere patients were significantly impaired on measures of explicit verbal (Short Story, BAT; Digit Span trials, WMS-III) and visuo-spatial (Visual Memory, TVPS; Spatial Span trials, WMS-III) memory but neither was impaired on measures of implicit memory (Hebb’s Recurring Digits; Block Span +1) when compared to controls. Our results provide further evidence that perceptual and motor-sequence explicit and implicit memory processes are suberved by neurally and functionally independent memory systems. Furthermore, given the necessity of beginning rehabilitation efforts early post-stroke, our findings suggest the use of interventions that utilize intact implicit memory skills regardless of side of lesion.

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Introduction: When reaching to suddenly appearing visual targets, the right-hand of the right-hander completes these movements more quickly and achieves higher peak velocities than its partnering left-hand. The non-dominant left-hand, however, tends to have shorter reaction times. It is unclear whether this is due to post-perceptual (but relatively early) processes, or pre-action (late) processes. This experiment aimed to untangle these components using a Posner cueing paradigm to direct attention during a target localisation task, which included neutral cue conditions so that the costs of invalid cueing and benefits of valid cueing can be estimated.

Methods: Right-handed participants took part in two visually guided aiming experiments: one in which cues indicated the side of space in which the target was likely to appear, and another where cues indicated which hand the participant may have to point with. These cues were valid in 80% of incidences with a 20% invalid cue rate; with a separate condition for neutral cues.

Results: So far, typical cueing effects are found for both hand and space cue experiments. These effects are equivalent in the two hands in our participants tested to date. The cueing effects are much more dramatic for the hand cue. Additionally, the hand cue effects are largely benefits for valid cueing, with small costs of invalid cueing. In space cueing, the effects are entirely driven by the costs of invalid cueing.

Conclusion: To date, these results suggest that these attentional manipulations may have limited usefulness for “unpacking” left hand RT advantages. Nevertheless, the differences between costs and benefits across the two experiments may be useful for understanding differences between attentional processes (on the input side of sensorimotor processing) and intentional processes (on the selection/output side of sensorimotor processing).
19) Hotspots in the workspace: Investigating the Relation between Non-target Object Location and Avoidance Responses

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The presence of non-target objects influences kinematic parameters of reaches toward target objects. In previous studies, several different non-target positions have been used. Taken together, these studies suggest that when the distance to non-targets is decreased, avoidance responses are more pronounced. There have also been some observations that the response to non-target objects is asymmetrical across workspace, i.e. responses to non-targets on the inside and the outside of the reaching arm are different. However, these previous studies have provided us with only a coarse overall picture of the effect of non-target location. Therefore, the aim of this experiment was to systematically map the avoidance responses across the workspace in order to determine in detail the relation between non-target position and the avoidance response. Specifically, we were interested in the relation between horizontal and vertical position of the non-target and the reaching response. Participants were asked to perform reaches towards physical targets while non-targets were present in one of 24 different positions in the workspace. Our results replicate earlier effects of horizontal and vertical position of the non-target object on reaching behavior. We also replicate findings concerning stronger avoidances for non-targets position on the outside of the reaching limb than for non-targets on the inside. Furthermore, our results provide a detailed overview of the interaction between these factors and demonstrate that there are ‘hotspots’ qua non-target positions that prompt the strongest behavioral responses. Lastly, our results provide evidence that support a fine-grained spatial resolution of non-target motor representation in the brain.
Manual tapping enhances visual short-term memory performance where visual and motor coordinates correspond

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Introduction: Visuo-manual interaction in visual short-term memory (VSTM) has been investigated little, despite its importance in everyday tasks requiring the coordination of visual perception and manual action. This study examines the influence of a manual action performed during stimulus learning on a subsequent VSTM test for object appearance.

Methods: The memory display comprised a sequence of briefly presented 1/f noise discs (i.e., possessing spectral properties akin to natural images), wherein each new stimulus was presented at a unique screen location. Participants either did (or did not) perform a concurrent manual action (spatial tapping) task requiring that a handheld stylus be moved to a position on a touch tablet that corresponded (or did not correspond) to the screen position of each new stimulus as it appeared. At test, a single stimulus was presented, either at one of the original screen positions, or at a new position. Two factors were examined: the execution (or otherwise) of spatial tapping at a corresponding or non-corresponding position, and the presentation of test stimuli either at their original spatial positions, or at new positions.

Results: We find that spatial tapping at corresponding positions elevates VSTM performance by more than 15%, but this occurs only when stimulus positions are matched from memory to test display.

Conclusion: Data show that multi-modal attentional focus during stimulus encoding (incorporating visual, spatial and manual components) leads to stronger, more robust memory representations. The findings provide empirical evidence that supports the concept of the episodic buffer, a subsystem of a dominant working memory model that is charged with integrating information from multi-modal sources.
21) A task comparison of saccade programming in scene viewing and non-scene viewing tasks.

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Introduction. Classic variations of the double-step paradigm involve presenting participants with two targets along a horizontal axis with a varying interstimulus interval separating the two targets. From such investigations it is known that saccades that are currently being prepared may be cancelled and replaced by a new saccade program. Therefore, a question of interest is at what point in time prior to the onset of a saccade does information need to be presented in order for the pending saccade to be cancelled? This point is referred to as the saccadic dead time (SDT). Recent investigations suggest that SDT is approximately 80 ms but that this duration is subject task specific variations (Ludwig, Mildinhall, & Gilchrist, 2007).

Research Question & Method. In this experiment, two primary questions are addressed. The first addresses an empirical gap in the scene viewing literature by testing whether saccade cancellation operates in an analogous manner within scene viewing as it does within classic double-step investigations. Our second question asks whether SDT values vary depending on the experimental conditions used in this experiment. In order to address these questions we compare double-step performance between a static fixation context, a dynamic gaze scene viewing context, and a dynamic gaze noise-filtered scene context.

Results. We find evidence that saccade cancellation occurs in an analogous manner in all three conditions. However, we find that SDT is shorter in the Static condition than in both dynamic gaze conditions. No difference is observed between the two dynamic conditions.

Conclusions. These results validate the assumption that saccade cancellation processes are active within naturalistic scene viewing tasks and confirm that SDT may vary depending on experimental context. These results are relevant to models of scene viewing and reading that incorporate multi-stage saccade programming architectures.
22) Attentional Biases in Social Anxiety are Related to Facilitated Processing of Positive Social Information

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Social anxiety is thought to be linked with biases in the processing of social information. Here, we aimed to gain insight into how attentional biases in social anxiety are accounted for by differential attentional prioritization for negative stimuli. Specifically, we used disgusted faces to serve as an ambiguous social stimulus conveying rejection or contempt. We investigated whether an index of temporal attention (the attentional blink, ‘AB’) varied between individuals with high and low social anxiety when target stimuli were either faces with disgusted or happy expressions, compared with neutral stimuli (photographs of animals). Distractor stimuli consisted of scrambled neutral faces. In the AB task, participants made two-alternative-forced-choices on the emotion of the face and on the animal’s orientation (facing left or right), after each trial. In Experiment 1 the first target (T1) was the face and the second target (T2) was the animal. In this experiment, social anxiety did not modulate the attentional blink. In Experiment 2, we presented animals as T1 and faces as T2. Now we found that low socially-anxious participants displayed an attenuated blink for happy – but not disgusted – faces, compared with high socially-anxious participants. These results suggest that social anxiety does not seem to be associated with attentional biases related to facilitated disengagement from threat information, but intriguingly suggest facilitated attention toward positive social information.

23) The effect of gaze leading on attention during joint attention

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If someone looks at the same location to which we are currently oriented, do we shift our attention to the individual who has established joint attention with us? To investigate this question we conducted three experiments that assessed reaction times to targets appearing on faces that had either looked at – or away from – the participant’s current fixation point. In
Experiment 1, we first employed a relatively passive task where participants viewed a scenario where incidental Joint Attention would be established by one of two faces. In this experiment, participants were faster not to respond to targets on the responding face, but rather followed the gaze of the responding face (i.e. a classic gaze cueing effect). Experiment 2 introduced a more active task in which participants made a saccade from a peripheral to central fixation cross; this action triggered the gaze-aversion of the on-screen faces. Here, we found a null effect of joint attention condition. Finally, in Experiment 3, we replaced the fixation cross with an image of a real-world object. Now, responses were significantly faster towards the ‘responding’ face, indicating attention was preferentially directed towards the face that followed the participant’s eyes. Taken together, these experiments show that the social relevance of the participant’s experience can modulate their attentional distribution in situations where their gaze has been followed. To our knowledge, this is a social attention effect that has not been reported previously and may be akin to social referencing or automatic checking-back behaviours.
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