EPS

Experimental Psychology Society

NOTTINGHAM MEETING

6-8 JULY 2011

A scientific meeting will be held in the School of Psychology, The University of Nottingham, University Park, Nottingham, NG7 2RD on 6-8 July 2011. The local organiser is Mark Haselgrove (mark.haselgrove@nottingham.ac.uk).

Eighteenth EPS Prize Lecture
Thursday 7 July 6.00pm

Licking and liking: The assessment of hedonic responses in rodents
Dominic M. Dwyer, Cardiff University

Symposium - To accompany the Prize Lecture

Thursday 7 July 2.00pm – 5.30pm

Learning about preferences and perception
Organiser: Dr Mark Haselgrove

Symposium

Wednesday 6 July 3.00pm-6.00pm

Understanding action understanding
Organiser: Dr Antonia Hamilton

Poster Session
This will be held in conjunction with the drinks reception on Wednesday evening at 6pm in Room A22, located on the Ground Floor in The School of Psychology, University of Nottingham (No. 29 on the Campus Map). Delegates may put up posters from 12noon on Wednesday 6 April and posters can remain up until the end of the conference.

Platform Presentations
Platform presentations will be held in Lecture Theatre A01 (Ground Floor) and Lecture Theatre B37 (First Floor), The School of Psychology, University of Nottingham, University Park Campus, (No. 29 on the Campus Map). Both rooms have data projectors available for Powerpoint presentations. Presenters may provide their own laptops and connector leads, or bring USB keys for the on-site computers. Any queries about facilities in the theatres should be sent to the local organiser, Mark Haselgrove (mark.haselgrove@nottingham.ac.uk)

Refreshments will be served in Room A22, located on the Ground Floor in The School of Psychology, University of Nottingham.

The conference dinner will be at The Hemsley, University of Nottingham, University Park, Nottingham, NG7 2RD (No. 8 on the Campus Map) at 8pm on Thursday 7 July 2010. A booking form/menu is enclosed. Please ensure your completed booking form and menu choice is returned to Dr Mark Haselgrove no later than Friday 17 June 2011.

START OF PARALLEL SESSIONS

Session A

Lecture Theatre A01 – Ground Floor

1.30 **Andrew Bayliss*, Ada Kritikos*, and Merryn D. Constable*** (University of East Anglia, University of Queensland) (Sponsor Steven Tipper)
Grasping the concept of personal property.

2.00 **Geoff G. Cole, Paul A. Skarrat, and Rebeccah-Claire Billing*** (University of Essex, University of Hull)
Is social inhibition of return goal-based?

2.30 **Georg F. Meyer*, Mark Greenlee*, and Sophie Wuerger** (University of Liverpool, University of Regensburg)
Evidence for common processing networks for speech and body actions.

Symposium: Understanding Action Understanding
Organiser: Dr Antonia Hamilton

3.00 **James Kilner*** (Institute of Neurology)
A Bayesian approach to action understanding.

3.30 TEA

4.00 **Moritz M. Daum*** (Max Planck Institute for Human Cognitive and Brain Sciences)
Mechanisms of action understanding in development.

4.30 **Marcel Brass*** (Ghent University)
Control of shared representations and understanding other people's minds.

5.00 **Emily S. Cross*, Antonia F. de C. Hamilton and Scott T. Grafton*** (Radboud University Nijmegen, University of Nottingham, University of California)
Learning from watching others' actions.

5.30 **Claudia Chiavarino*, Ian A. Apperly and Glyn W. Humphreys** (University of Turin, University of Birmingham)
How the frontal and parietal lobe understand intention: Evidence from neuropsychological patients.

End of Symposium

6.00-8.00 POSTERS AND DRINKS RECEPTION – Room A22, The School of Psychology

START OF PARALLEL SESSIONS

Session B

Lecture Theatre B37 – First Floor

1.30 **Jeannie Judge and Paul J. Taylor*** (University of Central Lancashire)
Sex differences on the semantic flanker task using transposed-letter target words.

2.00 **Reshanne Reeder* and Doug Barrett** (University of Leicester)
Visual field asymmetry in the attentional blink for inefficient but not efficient visual search.

2.30 **Paul A. Skarratt and Geoff G. Cole** (University of Hull, University of Essex)
The effect of attention on temporal resolution revisited: It impairs rather than improves.

3.00 **Christina J. Howard* and Glyn W. Humphreys** (University of Birmingham)
Parietal cortex and temporal precision in vision.

3.30 TEA

4.00 **Carlo De Lillo, Giovanna Spinozzi*, Milena Palumbo* and Giuseppe Giustino*** (University of Leicester, Institute of Cognitive Sciences and Technology)
Attention shift and top-down influences on global and local processing of visual patterns: A comparative study of humans and capuchin monkeys (Cebus apella).

4.30 **Snehlata Jaswal** (Indian Institute of Technology)
Effect of stimulus exposure and study-test intervals on serial position effects observed in a binding change detection paradigm.

5.00 **David A. Ellis* and Rob Jenkins** (University of Glasgow)
I keep thinking it's Thursday: Cognitive confusion over the day of the week.

5.30 **Ben Colagiuri*, Robert A. Boakes and Phyllis N. Butow*** (University of New South Wales, University of Sydney)
The placebo effect, sleep difficulty, and side effects: Implications for informed consent.

6.00-8.00 POSTERS AND DRINKS RECEPTION – Room A22, The School of Psychology

Session A

Lecture Theatre A01 – Ground Floor

9.00 **Alexis Makin* and Marco Bertamini** (University of Liverpool)
Explicit and implicit aesthetic preferences.

9.30 **David Booth** (University of Birmingham)
Sensory motivation of ingestion versus sensorimotor pleasure.

10.00 **Sarah Davies*, Wael El-Deredy*, Elizabeth H. Zandstra* and Isabelle Blanchette*** (University of Manchester, Unilever R & D Vlaardingen, Université du Québec à Trois-Rivières) (Sponsor Ellen Poliakoff)
Evidence for the role of cognitive resources in flavour-flavour evaluative conditioning.

10.30 COFFEE

11.00 **Mike Le Pelley** (Cardiff University)
Metacognitive monkeys or associative animals? An associative analysis of "uncertainty" responding under deferred feedback.

11.30 **Emma Whitt*, Mark Haselgrove and Jasper Robinson** (University of Nottingham)
Rats' object recognition is affected by associative activation of an object representation.

12.00 **Josephine E. Haddon**, **Simon Killcross and David N. George** (Cardiff University, University of New South Wales, University of Hull)
The influence of striatum and prefrontal cortex on the exploitation/exploration trade-off in rats: A novel approach.

12.30 **David J. Stillwell* and Richard J. Tunney** (University of Nottingham)
Delay discounting measurement methodology does not affect the relationship between discounting and impulsive behaviours.

1.00-2.00 LUNCH

Session B

Lecture Theatre B37 – First Floor

9.00 **Matthew Hudson* and Paul A. Skarratt** (University of Hull)
Peripheral cues and gaze direction jointly enhance facilitation but not inhibition of return.

9.30 **Richard Ramsey*, Emily Cross* and Antonia Hamilton** (University of Nottingham, Université catholique de Louvain, Radboud University Nijmegen)
Eye can see what you want: Posterior intraparietal sulcus encodes the object of an actor's gaze.

10.00 **Daniel T. Smith, Geoff G. Cole and Rebeccah-Claire Billing*** (Durham University, University of Essex)
Mental-state attribution is not necessary for social attention effects.

10.30 COFFEE

11.00 **Markus Bindemann**, **Meri Avetisyan* and Tim Rakow** (University of Kent, Canterbury Christ Church University, University of Essex)
In face identification, observers fluctuate and individuals differ!

11.30 **Ian D. Stephen*, Isabel M. L. Scott*, Vinet Coetzee*, Nicholas Pound*, David I. Perrett and Ian S. Penton-Voak*** (University of Nottingham Malaysia Campus, University of Bristol, University of Pretoria, Brunel University, University of St Andrews) (Sponsor Mark Haselgrove)
Cross-cultural effects of colour, but not morphological masculinity, on perceived attractiveness of men's faces.

12.00 **Peter J. Hills, Michael Pake* and Rachel E. Copper*** (Anglia Ruskin University, University of Essex)
Eye-tracking the own-race bias in face perception.

12.30 **Holger Wiese and Stefan R. Schweinberger** (Friedrich Schiller University of Jena)
ERP correlates of face familiarity but not facial age depend on task demands.

1.00-2.00 LUNCH

Session A

Lecture Theatre A01 – Ground Floor

Symposium: Learning about preferences and perception
Organiser: Dr Mark Haselgrove

2.00 **Ciro Civile*, Rosamund P. McLaren* and Ian P.L. McLaren** (University of Exeter)
Perceptual learning and the face inversion effect.

2.30 **Matthew Mundy*, Paul Downing*, Dominic Dwyer, Rob Honey and Kim Graham** (Monash University, Bangor University, Cardiff University)
Exploring the cognitive neuroscience of perceptual learning.

3.00 **Geoffrey Hall, David García Burgos* and Felisa González*** (University of York, University of New South Wales, University of Granada)
Latent Inhibition in flavour-preference conditioning.

3.30 TEA

4.00 **Peter Jones*, Mark Haselgrove and Dominic Dwyer** (University of Nottingham, Cardiff University)
Overshadowing and blocking of flavour-preference conditioning.

4.30 **Martin R. Yeomans*, Natalie Gould*, Lucy Chambers* and Elizabeth H. Zandstra*** (University of Sussex, Unilever R&D Vlaardingen)
Flavour-nutrient learning in humans: Identifying boundary conditions.

5.00 **Robert A. Boakes and Dorothy Kwok*** (University of Sydney)
Proactive interference with taste aversion learning over long delays.

End of Symposium

5.30 **EPS Business Meeting** – Members only (Lecture Theatre B37)

6.00 **EPS Prize Lecture – Dominic M. Dwyer** (Cardiff University)
Licking and liking: The assessment of hedonic responses in rodents. (Lecture Theatre A01).

Session B

Lecture Theatre B37 – First Floor

2.00 **Romi Zäske*, Christiane Fritz* and Stefan R. Schweinberger** (Friederich Schiller University of Jena)
Inattention abolishes voice adaptation.

2.30 **Stefan R. Schweinberger, Christian Walther*, Gyula Kovács*, Verena G. Skuk* and Romi Zäske*** (Friederich Schiller University of Jenna, University of Regensburg)
Perception of voice gender and identity: Neurophysiological correlates.

3.00 **Ellen Poliakoff, Donna Lloyd, Nelson J. Trujillo-Barreto*, Liam Mason*, Kirsten McKenzie*, Richard Brown* and Wael El-Deredy*** (University of Manchester, Cuban Neurosciences Centre, University of Nottingham Malaysia Campus)
Differential EEG generators of tactile perception and misperception.

3.30 TEA

4.00 **Laura Mirams*, Ellen Poliakoff, Richard Brown* and Donna Lloyd** (University of Manchester)
The effect of body-focused attention on somatosensory perceptual decision making.

4.30 **Roger Newport*, Helen Gilpin*, Sophie Andrews* and Catherine Preston*** (University of Nottingham, Nottingham Trent University) (Sponsor Ruth Filik)
Losing limbs in the brain with the disappearing hand trick.

5.00 **Klaus Kessler*, Sebastian Miellet* and Nienke Hoogenboom*** (University of Glasgow, University of Duesseldorf) (Sponsor Steven Tipper)
Perceiving others is not purely visual: The role of body posture in "body gestalt" completion.

5.30 **EPS Business Meeting** – Members only (Lecture Theatre B37)

6.00 **EPS Prize Lecture – Dominic M. Dwyer** (Cardiff University)
Licking and liking: The assessment of hedonic responses in rodents. (Lecture Theatre A01).

Session A

Lecture Theatre A01 – Ground Floor

9.00 **David Maidment* and William Macken** (Cardiff University)
Is reading lips like hearing voices? The role of articulatory processes in audiovisual speech perception.

9.30 **Tiina M. Eilola*, Jelena Havelka and Johanna C. Van Hooff*** (Queen Mary University of London, University of Leeds, Vrije Universiteit Amsterdam)
Emotional word recognition in bilinguals: An ERP study.

10.00 **EPS/British Science Association Prize – Adele M. Goman*** (University of York)
Perception of vocal emotion in speech: Simulations of bilateral cochlear implantation and bimodal aiding.

10.30 COFFEE

11.00 **Marie-Josee Bisson*, Walter J.B. van Heuven, Kathy Conklin* and Richard J. Tunney** (University of Nottingham)
Processing of subtitles in foreign language films: An eye-tracking study.

11.30 **Gitte Joergensen* and Gerry Altmann** (University of York)
Anticipation, event-plausibility and scene constraints.

12.00 **Shirley-Anne Paul*, Wayne S. Murray and Alan Kennedy*** **(**University of Edinburgh, University of Dundee) (Sponsor Richard Shillcock)
Is the word-predictability effect an effect of predictability?

12.30 **Jonathan Catling, Emma Preece*, Kevin Dent* and Bob A. Johnston** (University of Worcester, University of Birmingham, University of Kent)
Age of acquisition effects in naming: A laboratory analogue.

End of meeting

Session B

Lecture Theatre B37 – First Floor

9.00 **Lucy Cragg and Camilla Gilmore** (University of Nottingham)
The role of working memory in children's arithmetic performance differs by strategy.

9.30 **Alastair D. Smith and Anthony Hall*** (University of Nottingham)
Development of strategic memory for objects relevant to navigation.

10.00 **Tom Foulsham* and Alan Kingstone** (University of Essex, University of British Columbia) (Sponsor: Geoffrey Underwood)
Gaze in the natural environment: Does research into visual attention scale up?

10.30 COFFEE

11.00 **Danielle Ropar*, Elizabeth Sheppard*, Geoff Underwood and Editha van Loon*** (University of Nottingham, University of Nottingham Malaysia Campus)
Differences in attention and prediction of driving hazards by individuals with Autism Spectrum Disorder.

11.30 **Megan Freeth and Monika Bartczak*** (University of Sheffield)
Observing Interactions: Viewing Strategies and Autistic Traits.

12.00 **Letizia Palumbo* and Tjeerd Jellema*** (University of Hull) (Sponsor Mary-Ellen Large)
Beyond face value: Involuntary 'emotional anticipation' influences social perception.

12.30 **Celine Souchay*, Dominika Z. Wojcik* and Chris J.A. Moulin** (University of Leeds)
Episodic and semantic feeling of knowing in children with Autism Spectrum Disorder.

End of meeting

Reserve List

1. Jennifer Rodd, Richard Berriman*, Matt Landau*, Theresa Lee*, Carol Ho*, Gareth Gaskell and Matthew Davis (University College London, University of York, MRC Cognition and Brain Sciences Unit)
Learning new meanings for old words: Effects of semantic relatedness.

2. Catherine Preston* and Roger Newport* (Nottingham Trent University, University of Nottingham) (Sponsor Dana Samson)
Using multisesory illusions to ameliorate chronic pain.

3. Katy V. Burgess*, Dominic M. Dwyer and Robert C. Honey (University of Cardiff)
Contrasting intervention and observation in casual reasoning scenarios for rats.

4. Anthony McGregor, Matthew G. Buckley*, Shamus P. Smith (Durham University, University of Nottingham).
Sex differences in the effect of landmarks on learning based on environmental geometry.

14. **Lauren Marsh*, Anne Springer*, Moritz Daum*, Wolfgang Prinz* and Antonia Hamilton** (University of Nottingham, Max Planck Institute for Human Cognitive Brain Sciences)
Eye tracking evidence for action simulation.

15. **Jennifer McBride*, Petroc Sumner* and Masud Husain** (Institute of Neurology and Institute of Cognitive Neuroscience, Cardiff University)
Cognitive control of object affordance investigated using grip force.

16. **Anthony McGregor, Matthew G. Buckley* and Shamus P. Smith*** (Durham University, University of Nottingham)
Sex differences in the effect of landmarks on learning based on environmental geometry.

17. **Steve Page* and Nick E. Barraclough*** (University of Hull, University of York)
Adaptation to visual actions generates auditory aftereffects.

18. **Amy Pearson*, Imogen Bosmith* and Antonia Hamilton** (University of Nottingham)
Understanding of meaningful and meaningless postures in children with Autism.

19. **Catherine Preston* and Roger Newport*** (Nottingham Trent University, University of Nottingham) (Sponsor: Dana Samson)
Using multisesory illusions to ameliorate chronic pain.

20. **Jason Tipples** (University of Hull)
Guns trigger visual orienting.

21. **Gilles Vannuscorps*, Michael Andres* and Agnesa Pillon*** (Université Catholique de Louvain, University of Ghent) (Sponsor Dana Samson)
Mirror neurons are not mandatory for fast and accurate action understanding – Insight from a case of upper limb aplasia

22. **Joanna Wincenciak*, Jennifer Ingham* and Nick E. Barraclough*** (University of Hull, University of York) (Sponsor Johan Hulleman)
Visual adaptation to emotional actions.

Grasping the concept of personal property

Andrew P. Bayliss[1], Ada Kritikos[2] and Merryn D. Constable[2]
1. University of East Anglia
2. University of Queensland
apbayliss@gmail.com

The concept of property is integral to personal and societal development, yet understanding of the cognitive basis of ownership is limited. Objects are the most basic form of property, so our physical interactions with owned objects may elucidate nuanced aspects of ownership. We gave participants a coffee mug to decorate, use and keep. The experimenter also designed a mug of her own. In Experiment 1, participants performed natural lifting actions with each mug. Participants lifted the Experimenter's mug with greater care, and moved it slightly more towards the Experimenter, while they lifted their own mug more forcefully and drew it closer to their own body. In Experiment 2, participants responded to stimuli presented on the mug handles in a computer-based stimulus-response compatibility task. Overall, participants were faster to respond in trials in which the handles were facing in the same direction as the response location compared to when the handles were facing away. The compatibility effect was abolished, however, for the Experimenter's mug - as if the action system is blind to the potential for action towards another person's property. These findings demonstrate that knowledge of the ownership status of objects influences visuomotor processing in subtle and revealing ways.

Constable, M. D., Kritikos, A., & Bayliss, A. P. (in press). Grasping the concept of personal property. *Cognition*. doi: 10.1016/j.cognition.2011.02.007.

Is social inhibition of return goal-based?

Geoff G. Cole[1], Paul A. Skarratt[2] and Rebeccah-Claire Billing[1]
1. University of Essex
2. University of Hull
ggcole@essex.ac.uk

Social inhibition of return is a phenomenon in which an individual is relatively slow to initiate a reaching response to a location that has just been responded to by another individual. The present study describes four experiments that examine whether this effect is 'goal-based'. Pairs of participants sat opposite each other and took turns to reach out for a cued object presented on a table top. The crucial manipulation was that the two participants either performed the same action on the object or a different action. Although results from all four experiments showed robust social inhibition of return, the size of the effect was not dependent on whether each participant had the same goal or not. We conclude that the mechanism giving rise to social inhibition of return does not represent the goal of an action.

Evidence for common processing networks for speech and body actions

Georg F. Meyer[1], Mark Greenlee[2] and Sophie M. Wuerger[1]
1 University of Liverpool
2 University of Regensburg
georg@liv.ac.uk

Incongruencies between auditory and visual signals negatively affect human performance and cause selective activation in neuroimaging studies; therefore, they are increasingly used to probe audiovisual integration mechanisms. An open question is whether the increased BOLD response reflects computational demands in integrating mismatching low-level signals or reflects simultaneous unimodal conceptual representations of the competing signals. To address this question, we explore the effect of semantic congruency within and across three signal categories (speech, body actions, and unfamiliar patterns) for signals with matched low-level statistics. We find that incongruent combinations of two meaningful stimuli (speech and body actions) but not combinations of meaningful with meaningless stimuli lead to increased BOLD response in the posterior STS (pSTS) bilaterally, the left SMA, the inferior frontal gyrus, the inferior parietal lobule, and the anterior insula. These interactions are not seen in premotor areas. Our findings are consistent with the hypothesis that pSTS and frontal areas form a recognition network that combines sensory categorical representations (in pSTS) with action hypothesis generation in inferior frontal gyrus/premotor areas. We argue that the same neural networks process speech and body actions.

Symposium: Understanding Action Understanding
Organiser: Dr Antonia Hamilton

A Bayesian approach to action understanding

James Kilner
Institute of Neurology
j.kilner@fil.ion.ucl.ac.uk

Ever since their discovery it has been proposed that mirror neurons enable action understanding and that they therefore play an important role in social interaction. However, there is little empirical support for this proposed role of mirror neurons in action understanding. Recently it has been proposed that in action execution there is a functional dissociation between how the abstract features, such as the goal or intention, and the concrete features, such as the movement parameters, are encoded in the inferior frontal gyrus. When cortical regions active during action observation are considered within the same framework a novel role of mirror neurons in action understanding is revealed. This role is consistent with recent empirical findings on the cortical regions underlying action understanding and challenges the view that mirror neurons encode the goal or intention of an observed action.

Mechanisms of action understanding in development

Moritz M. Daum
Max Planck Institute for Human Cognitive and Brain Sciences
daum@cbs.mpg.de

In the present talk I will focus on the mechanisms of infants' understanding of other actions. In most previous studies, infants' action understanding was mostly measured post-hoc, in response to an observed action that was completed (e.g. via looking times). Eyetracking methodology allows for the additional online measurement of action comprehension, during the observation of an ongoing action, for example, via overt or covert shifts of attention. Here, I will present a set of studies in which we measured shifts of covert attention to assess young infants' online processing of goal-directed human actions such as grasping and pointing, measured vial latency of saccades from a central non-predictive cue (e.g., a grasping hand) towards a peripheral target congruent or incongruent with the direction of the cue. The results describe the specific developmental trajectories of covert attention shifts, how they are related to the onset of action production skills, and how referential verbal cues can facilitate the comprehension of others' actions.

Control of shared representations and understanding other people's minds

Marcel Brass
Ghent University
marcel.brass@ugent.be

There is converging evidence that the observation of an action activates a corresponding motor representation in the observer. It has been argued that such 'shared representations' of perception and action are crucial for action understanding and mentalizing. Research on shared representations, however, has widely neglected the fundamental role of self-other distinction when simulating motor events and mental states. I will provide brain imaging evidence demonstrating that mentalizing and self-other distinction activate common brain circuits. Furthermore, I will present recent data relating deficits in the control of shared representations to autism spectrum condition. In summary, our research suggests a strong functional link between the control of shared representations and our ability to understand other people's minds.

Learning from watching others' actions

Emily S. Cross[1], Antonia F. de C. Hamilton[2] and Scott T. Grafton[3]
1. Radboud University
2. University of Nottingham
3. University of California
e.cross@psych.ru.nl

When learning any skill, from tango dancing to rock climbing, we benefit from physical practice, but watching others perform or learn the same skill can also improve new skill acquisition (Hodges et al., 2007). Recently, neuroscientists have turned their attention to

the brain structures that support physical and observational learning, in order to better understand haw both kinds of learning impact brain and behaviour (Burke et al., 2010; Cross et al., 2009; Frey and Gerry, 2006). In one study, we demonstrated that parietal and premotor regions are modulated in a similar manner by physical and observational learning of dance sequences (Cross et al., 2009). More recently, we extended these findings by exploring how naïve subjects physically or observationally learn how to tie knots from non-expert models. In this training study, similar parietal and premotor regions as those reported previously (Cross et al., 2009) responded when viewing images of knots from the tied and observed conditions compared to knots that were untrained. These data demonstrate the emergence of action representations based on observational learning without concurrent physical practice. Moreover, learning by observing a non-expert model appears to be beneficial in a similar manner as learning from an expert model.

Burke CJ, Tobler PN, Baddeley M, & Schultz W. (2010). Neural mechanisms of observational learning. *Proc Natl Acad Sci U S A, 107*(32), 14431-14436.

Cross ES, Kraemer DJ, Hamilton AF, Kelley WM, & Grafton ST. (2009). Sensitivity of the action observation network to physical and observational learning. *Cereb Cortex, 19*(2), 315-326.

Frey SH & Gerry VE. (2006). Modulation of neural activity during observational learning of actions and their sequential orders. *J Neurosci, 26*(51),13194-13201.

Hodges NJ, Williams AM, Hayes SJ & Breslin G. (2007). What is modeled during observational learning? *J Sports Sci, 25*(5), 531-545.

How the frontal and parietal lobe understand intention: Evidence from neuropsychological patients

Claudia Chiavarino[1], Ian A. Apperly[2] and Glyn W. Humphreys[2]
1. University of Turin
2. University of Birmingham
claudia.chiavarino@unito.it

In two studies, we explored how adults' intention processing might be disrupted following frontal and parietal brain injury. In the first study, participants saw three types of video (real intentional actions, real accidental actions, pretend actions) and, in separate sessions, judged whether the actions were intentional or accidental, and whether they were real or pretend. Frontal lesions impaired the ability to differentiate intentional from accidental actions, while parietal lesions disrupted the discrimination of pretend from real actions. In the second study, using a task designed to tease apart desire and intention attribution within the same action, we showed that frontal lesions caused difficulties in the processing of desires, and that parietal lesions further impaired the processing of intentions. These findings support the notion that the same observed behaviour might be processed at different levels of complexity by distinct functional processes and differentiable neural networks within the frontal and parietal lobes.

Chiavarino, C., Apperly, I.A., & Humphreys, G.W. (2009). Frontal and parietal lobe involvement in the processing of pretence and intention. *Quarterly Journal of Experimental Psychology, 62*, 1738-1756.

Chiavarino, C., Apperly, I.A., & Humphreys, G.W. (2010). Distinguishing intentions from desires: Contributions of the frontal and parietal lobes. *Cognition, 117*, 203-216.

End of Symposium

Sex differences on the semantic flanker task using transposed-letter target words

Jeannie Judge and Paul J. Taylor
University of Central Lancashire
jjudge@uclan.ac.uk

Previous research has demonstrated that males and females differ in the extent to which they process irrelevant distractors. Specifically, females are thought to attend to irrelevant distractors more than males (Stoet, 2010). Separate lines of evidence have suggested that increasing the perceptual load of a task reduces distractor interference. We sought to examine these effects using a semantic version of the flanker task as sex differences have also been observed in semantic processing (Wirth et al., 2007). Participants made speeded responses to category words flanked by distractors that were either from the same (congruent) or different (incongruent) semantic category to the target word. Target words were either presented normally (e.g. table: low perceptual load) or with the beginning letters transposed (e.g. atble: high perceptual load). The results revealed that both groups responded significantly faster to normal than transposed target words demonstrating that transposed letters increased the perceptual load. However, while the female group showed a significant congruency effect for both types of target words, the male group, did not show congruency effects for either type of target word. These findings suggest that females attend to irrelevant distractor words to a greater extent than males and this may be underpinned by differential semantic processing skills between the sexes.

Stoet, G. (2010). Sex differences in the processing of flankers. *The Quarterly Journal of Experimental Psychology*, 63, 633-638.

Wirth, M., Horn, H., Koenig, T., Stein, M., Federspiel, A., Meier, B., Michel, C.M., & Strik, W. (2007). Sex differences in semantic processing: Event-related brain potentials distinguish between lower and higher order semantic analysis during word reading. *Cerebral Cortex*, 17, 1987-1997.

Visual field asymmetry in the attentional blink for inefficient but not efficient visual search

Reshanne Reeder and Doug Barrett
University of Leicester
rr116@leicester.ac.uk

We used a dual-task paradigm to investigate whether the attentional blink (AB) is symmetrical across the visual field for peripheral probes known to produce efficient and inefficient search. Participants identified a uniquely coloured letter (T1) in a centrally presented rapid serial presentation stream. A peripheral probe (T2) was then presented to the left (LVF) or right (RVF) visual field at lags between 0 and 800 milliseconds. T2s were presented in displays of 6 or 12 items and perceptual discriminability (d') was calculated for each type of T2 as a function of lag and display size. For T2s producing efficient search, d' increased as a function of lag. This effect was larger for displays containing 12 compared to 6 items and was symmetrical across both visual fields. For T2s producing inefficient search, d' also increased as a function of lag; however, this effect was larger for displays containing 6 rather than 12 items. The data also revealed a LVF advantage; d' was consistently lower for T2 probes presented in the RVF. These results suggest that the spatial and temporal distribution of the AB is determined partly by the efficiency with which T2 can be discriminated from other objects in the scene.

The effect of attention on temporal resolution revisited: It impairs rather than improves

Paul A. Skarratt[1] and Geoff G. Cole[2]
1. University of Hull
2. University of Essex
p.skarratt@hull.ac.uk

Several influential studies have indicated that transient focal attention has contrasting effects on spatial and temporal resolution. Attending a stimulus better enables observers to discriminate its spatial characteristics, but compromises their ability to discriminate its temporal characteristics. Recently we reported data that challenged this view: Participants were faster to make temporal order judgements (TOJs) about attended than unattended stimuli, but questions remain as to whether faster responses equate to improved resolution. The present Experiment 1 therefore examined the effect of attention on RT and accuracy measures of TOJ performance. We found that temporal judgements are particularly susceptible to a speed/accuracy trade-off (SAT), suggesting this may have confounded previous findings. Experiment 2 eliminated the influence of SAT thereby ensuring that responses represented perceptual performance. Results showed that focal attention does indeed impair temporal resolution. These findings confirm that attention degrades temporal resolution, and provide a cautionary note that judgements of temporal events can be highly vulnerable to SAT.

Parietal cortex and temporal precision in vision

Christina J. Howard and Glyn W. Humphreys
University of Birmingham
c.howard.3@bham.ac.uk

Recently, video recording equipment with high temporal precision has allowed us to see fine temporal detail in the world such as the beating of an insect's wings. Limited temporal precision in the visual system can cause our perception of changing objects to lag by up to a quarter of a second in the past (Howard & Holcombe, 2008). The neural machinery underlying temporal updating is not well understood. The parietal lobe is involved in spatial vision and in disorders such as spatial neglect. There is limited evidence for an involvement in temporal aspects of perception, such as in making

temporal order judgements. However, the role of the parietal lobe in temporal precision is still unresolved. We tested patients with damage to the parietal lobe on a continuous monitoring task. Patients attempted to keep track of the changing features (either spatial period or orientation) of a luminance grating for several seconds. After a semi-random interval, the grating disappeared and patients reported its final feature value. By comparing the reported value and the actual feature values over the last frames of the stimulus, patients' perceptual lags can be calculated. We find unusually long and erratic perceptual lags in patients with parietal damage and discuss the role of the parietal cortex in spatio-temporal processing.

Howard, C. J., & Holcombe, A. O. (2008). Tracking the changing features of multiple objects: Progressively poorer perceptual precision and progressively greater perceptual lag. *Vision Research*, 48, 1164-1180.

Attention shift and top-down influences on global and local processing of visual patterns: a comparative study of humans and capuchin monkeys (Cebus apella)

Carlo De Lillo[1], Giovanna Spinozzi[2], Milena Palumbo[1,2] and Giuseppe Giustino[2]
1. University of Leicester
2. Institute of Cognitive Sciences and Technologies, CNR
CDL2@LE.AC.UK

Capuchin monkeys, as well as several other monkey species, show a robust local advantage when processing hierarchical visual patterns. We present results showing for the first time that the local advantage in monkeys can be reversed by inducing an attention bias to global properties of the stimuli. A first experiment was carried out on monkeys kept in semi-natural settings in social colonies at the C.N.R/Rome and which spontaneously engaged in testing without being food deprived or restrained. Attention shifts to the local and global level of visual stimuli was obtained by manipulating the percentage of trials in a Matching- to-Sample Task that required subjects to attend to the local or the global level of hierarchical visual patterns, respectively. An analysis of the time course of the effects of attention indicated that they were initially evident in the local trials only but also extended to the global trials in subsequent testing sessions. In a second experiment humans were tested using a similar procedure for comparison. Humans also showed an effect of attention bias on the processing speed of the global and local level of the stimuli. The results are discussed in relation to models of visual attention

Effect of stimulus exposure and study-test intervals on serial position effects observed in a binding change detection paradigm

Snehlata Jaswal
Indian Institute of Technology
sjaswal@iitrpr.ac.in

Colour-shape binding was tested using a change-detection paradigm, presenting sequences of six stimuli in the study phase, followed by the test-display comprising all stimuli presented simultaneously. On change trials, combinations of colour and shape

were swapped between any two stimuli. Despite the fact that participants were not explicitly asked to remember sequential order, serial position effects were observed in memory for bindings, suggesting that visual memory sustains a temporal code at a very early stage. Further, the impact of different stimulus exposure durations (200, 900, and 1500 ms) and different study test intervals (0 ms and 2000 ms) on the serial position effects was tested. Shifts in recency and primacy were obtained as stimulus exposure as well as study-test intervals were changed. Results are discussed in the context of multi-store models of memory.

I keep thinking it's Thursday: Cognitive confusion over the day of the week

David A. Ellis and Rob Jenkins
University of Glasgow
d.ellis@psy.gla.ac.uk

Awareness of the current day of the week is important for keeping medical appointments, maintaining medication schedules, and for general social coordination. Yet confusions over the day of the week are surprisingly common. In an internet-based study (N>1300), we found that some weekdays are less confusable than others. In particular, Monday and Friday appear to be relatively distinct, compared with the days in between. Confusions were normally distributed around the actual day, such that the preceding day and the following day exerted the strongest influence. In subsequent studies, we investigated the mental representation of different week days. Monday and Friday gave rise to significantly more semantic associations than the other weekdays, implying richer elaboration in memory. Moreover, semantic analysis of these associations revealed that they were affectively negative for Monday, positive for Friday, and neutral for the intervening days. Consistent with differential representation strengths, RTs to name the current day in a surprise single-trial challenge were half as long for Monday and Friday as for the other days. The strength and valence of these representations predict the observed pattern of confusability. Surprisingly, they also predict real world trends in missed medical appointments and exam performance.

The placebo effect, sleep difficulty, and side effects: Implications for informed consent

Ben Colagiuri[1], Robert A Boakes[2] and Phyllis N Butow[2]
1. University of New South Wales
2. University of Sydney
b.colagiuri@unsw.edu.au

As part of informed consent, patients in clinical practice and participants in randomised controlled trials are warned about possible side effects of their treatment. Such warnings may increase side effects if they create expectancies for these effects. The current study used an experimental model to investigate this possibility. In two experiments university students reporting moderate sleep difficulty were allocated to receive placebo treatment under the guise of a medication for sleep difficulty or to a no-treatment control group. Participants received information about bogus possible side effects, which was manipulated and counterbalanced such that two groups of participants were warned about different sets of side effects. In both experiments, placebo treatment led to reports of significantly improved global sleep quality and total sleep time

compared with no treatment, indicating a placebo effect. There was no effect of the side effect warning in the first experiment, whereas in the second experiment, the warning led to a small increase in reporting of the suggested symptom, but, rather strangely, this occurred in both the placebo and no treatment groups. These results suggest that informed consent likely produces more benefit from the placebo effect than harm and that misattribution might explain some reported side effects.

Explicit and implicit aesthetic preferences

Alexis Makin and Marco Bertamini
University of Liverpool
mbrxgam4@liverpool.ac.uk

Psychophysicists have explored the relationship between stimulus properties and subjective beauty. We address one concern with the psychophysical approach: It is possible that the aesthetic preferences people report *explicitly* differ from their *implicit aesthetic preferences* (formed spontaneously, in the absence of any verbal judgment). We used the Implicit Association Test (IAT) to test the hypothesis that implicit and explicit preferences can dissociate. In Experiment 1, symmetrical or random dot-patterns were presented. In interleaved trials, positively or negatively connoted words were shown. When one button was used to report 'symmetrical pattern' or 'positive word', and the other 'random pattern' or 'negative word', responses were significantly quicker than when the reverse response mapping was used (Symmetry or Negative, Random or Positive). This suggests an implicit preference for symmetrical patterns. In this case, the results paralleled explicit reports. However, in Experiment 2, participants showed no implicit preference for vertical over horizontal patterns, despite explicitly preferring the vertical ones. Furthermore, in Experiment 3, participants implicitly preferred mirror symmetry to rotational symmetry, despite explicitly preferring rotation to mirror. We conclude that multiple aesthetic evaluation systems can operate in parallel. This is an important consideration for researchers who use explicit reports as their dependent variable.

Sensory motivation of ingestion versus sensorimotor pleasure

David A. Booth
University of Birmingham
d.a.booth@Bham.ac.uk

Public performance of preference is distinct from private experience of pleasure. The strength of a disposition to accept a food or drink, for example, can be measured as position on a line specified by two levels of liking, pleasantness, desire to consume, likelihood of choosing or other expressions of ingestive appetite (central facilitation of ingestive movements). To understand that act of choice, the degree of preference needs to be related to influences on it (the motivation). Current strength of the tendency to eat or drink an item is proportional to the discriminative closeness of the situation's features to the maximally preferred levels that the individual has acquired (Booth & Freeman, 1993). Those features can be sensory, somatic or social (cultural or interpersonal). This paper focuses on a sensed material influence on ingestion that has also been thought to evoke pleasure – a constituent that tastes like sugar. In an experiment on a top-quality apple juice presented to young adults when thirsty, rated preferences for three slightly to tolerably over-sweetened samples were sufficient to estimate an individual's ideal point for the sweetener and also the concentration above which s/he would refuse to drink the juice. The amounts of pleasure elicited at those and still higher sweetener levels were assessed by convergent emotional effects. One was generic, an improvement in good mood. The other effect was the enjoyment of sensations of movement in the mouth and face. Those movement concepts included the rolling of the tongue that guides milk from the nipple to the throat. The two measures cross-validited in this experiment, for the first

time providing a basis to the label 'hedonic' for the ingestive movements elicited by the taste of sugar. Degrees of preference were uncorrelated with amounts of pleasure under these conditions, confirming the distinctness of the two phenomena. These findings complement published evidence from the same project that, once a configurated sweetness preference has been learnt, uncontextualisable strength of sweetness is required to elicit the inborn ingestive movements (Booth, Higgs, Schneider & Klinkenberg, 2010). Furthermore, the evidence for sensual pleasure from food so far is only for this reflex to sweetness. The usual sweetness of a drink or food is merely pleasant, liked or wanted – that is, helps to motivate ingestion.

Booth, D.A., & Freeman, R.P.J. (1993). Discriminative feature integration by individuals. Acta Psychologica 84, 1-16.

Booth, D.A., Higgs, S., Schneider, J., & Klinkenberg, I. (2010). Learned liking versus inborn delight. Can sweetness give sensual pleasure or is it just motivating? Psychological Science 21, 1656-1663.

Evidence for the role of cognitive resources in flavour-flavour evaluative conditioning

Sarah Davies[1], Wael El-Deredy[1], Elizabeth H. Zandstra[2] and Isabelle Blanchette[3].
1. University of Manchester
2. Unilever R & D Vlaardingen
3. Université du Québec à Trois- Rivières
sarah.davies@postgrad.manchester.ac.uk

One way that dis/likes are formed is through Evaluative Conditioning (EC). There is much debate regarding whether EC requires implicit or explicit processing. This experiment investigated the role of cognitive resources in EC for one type of learning that should least require semantic representation: flavour-flavour conditioning. Participants (*n*=108) were assigned to a cognitive load or control condition. Both groups completed the same EC procedure in which three novel flavoured CS were consumed. One was consumed with a pleasant US (CS+ sugar), one with an aversive US (CS+ saline) and a third with water (CS-). Each CS+/- was sampled ten times. During conditioning participants in the cognitive load condition were required to remember a series of letter strings. Differential EC occurred in the control condition but not in the cognitive load condition. Participants in the control condition showed an increased liking for flavours paired with a pleasant US and a decrease in liking for flavours paired with an aversive US. This learning was eliminated when participants' cognitive resources were diverted to a secondary task. Results from this experiment are consistent with the theory that EC occurs as a result of explicit processing, even for learning that should not require semantic processing.

Metacognitive monkeys or associative animals? An associative analysis of "uncertainty" responding under deferred feedback

Mike Le Pelley
Cardiff University
lepelleyme@cf.ac.uk

Monkeys (and some other nonhuman animals) will selectively and adaptively learn to avoid the most difficult trials of a perceptual discrimination learning task; a finding that has often been taken as evidence of metacognitive abilities in these animals. Couchman, Coutinho, Beran, & Smith (2010) have recently demonstrated that this pattern of "uncertainty" responding does not depend on animals receiving trial-by-trial feedback for their responses, but is also found if experience of the most difficult trials occurs only under conditions of deferred feedback. Couchman et al. argued that this ruled out accounts of uncertainty responding based on low-level processes of associative learning, and instead required explanation in terms of higher-level, metacognitive processes of decision monitoring. Contrary to this argument, I demonstrate that a simple associative model of reinforcement learning is well-equipped to account for the key findings of Couchman et al.'s empirical study.

Couchman, J.J., Coutinho, M.V.C., Beran, M.J., & Smith, J.D. (2010). Beyond stimulus cues and reinforcement signals: A new approach to animal metacognition. *Journal of Comparative Psychology, 124*, 356-368.

Rats' object recognition is affected by associative activation of an object representation

Emma Whitt, Mark Haselgrove and Jasper Robinson
University of Nottingham
lpxejw@nottingham.ac.uk

Object recognition tasks use rats' preference for a novel stimulus over a familiar stimulus to test whether the rat recognises stimuli it has encountered before. This method was employed in the present experiment to test whether activation, or priming, of stimuli affected rats' recognition memory. Associative activation and non-associative activation are outlined in Wagner's SOP model such that a representation can be activated directly, by presenting the stimulus (self-generated), or by presenting an associated stimulus (retrieval-generated). Rats were presented with two pairs of stimuli (PX, QY), followed by P or X, and then tested with PQ. When primed with P, rats spent more time with Q in the test, suggesting that recognition occurred as a result of self-generated mechanism. When primed with X, rats again spent more time with Q, suggesting that recognition here was a result of an associative process: Presentation of X activated the representation of P, so that when P and Q were presented, Q elicited more behaviour than P. These results suggest that recognition memory may, at least in part, be due to associative processes.

The influence of striatum and prefrontal cortex on the exploitation/exploration trade-off in rats: A novel approach

Josephine E. Haddon[1], Simon Killcross[2] and David N. George[3]
1. Cardiff University
2. University of New South Wales
3. University of Hull
HaddonJE2@cardiff.ac.uk

An important aspect of decision making is choosing when to continue to pursue a current goal (exploitation) and when to switch to pursuing other goals (exploration).

Traditionnally, the trade-off between these processes is examined using simple, single-lever paradigms. Here, we present a novel procedure in rats which affords greater insight into this issue. Rats were trained in a chamber the four walls of which were computer controlled LCD screens. As such, the displays could be changed to provide the animal with information about its position (or state) within a particular behavioural chain. We examined the influence of post-training reinforcer devaluation on lever press and magazine responding during the different stages of a simple lever–magazine behavioural chain. The results suggest that the proximity between an action and reward, and between a behavioural state and reward, both influence the decision to explore or exploit different elements of a behavioural sequence. Moreover, lesion studies provide further evidence for the involvement of striatum and prefrontal cortex in the control of instrumental (lever press) performance, but also suggest these regions are important for the way in which behavioural states influence exploration (goal-directed) and exploitation (habitual) processes.

Delay discounting measurement methodology does not affect the relationship between discounting and impulsive behaviours

David J. Stillwell and Richard J. Tunney
University of Nottingham
lpxdjs1@nottingham.ac.uk

Delay discounting measures individuals' decreasing subjective utilities as the time before an outcome occurs lengthens. Individuals who steeply discount future consequences have been shown to engage more in a range of impulsive behaviours, such as smoking (Bickel, Odum, & Madden, 1999), drug-use (Kirby & Petry, 2004), and drinking (Mitchell, Fields, D'Esposito, & Boettiger, 2005). In a sample of users from Facebook (N = 7200), using the My Personality application, we measure delay discounting using three different methods of eliciting discounting preferences (increasing rewards, decreasing rewards, and randomized rewards), as well as smoking, drug-use and drinking behaviour. We find reliable differences between the method used to elicit discounting, and reliable relationships between impulsive behaviours and discounting, but no interactions. This suggests that previous findings are robust, independent of the method used to elicit preferences, and in a large sample size.

Bickel, W. K., Odum, A. L., & Madden, G. J. (1999). Impulsivity and cigarette smoking: delay discounting in current, never, and ex-smokers. *Psychopharmacology, 146*(4), 447 -454.

Kirby, K. N., & Petry, N. M. (2004). Heroin and cocaine abusers have higher discount rates for delayed rewards than alcoholics or non-drug-using controls. *Addiction, 99*(4), 461-471.

Mitchell, J. M., Fields, H. L., D'Esposito, M., & Boettiger, C. A. (2005). Impulsive responding in alcoholics. *Alcoholism-Clinical and Experimental Research, 29*(12), 2158-2169.

Peripheral cues and gaze direction jointly enhance facilitation but not inhibition of return

Matthew Hudson and Paul A. Skarratt
University of Hull
Matthew.Hudson@hull.ac.uk

Research into the attentional cueing effects of eye gaze has suggested they are restricted to early facilitation and not later inhibition of return (IOR). As IOR is observed with peripheral cues that attract attention automatically, it remains unclear whether the absence of IOR with gaze cues is due to their central presentation. We investigated this by presenting faces in the left or right peripheral hemifields, which then gazed upward or downward. A target appeared in one of four oblique locations in the display giving the cue and target horizontal or vertical congruency, both, or neither. We examined the facilitative and inhibitive effects of gaze using short (Experiment 1) or long (Experiment 2) gaze-target intervals, respectively. Results showed greater facilitation when cue and target shared horizontal and vertical congruency, suggesting that attention was oriented to the specific cued location. By contrast, inhibition was generalised to the entire hemifield occupied by the cue, but was not influenced by gaze direction. Thus IOR did not adhere to the pattern of facilitation observed in Experiment 1. These results are discussed in relation to the orienting effects of gaze, the spatial resolution of attention and IOR, and the independence of facilitation and IOR effects.

Eye can see what you want: Posterior intraparietal sulcus encodes the object of an actor's gaze

Richard Ramsey[1,2], Emily Cross[3] and Antonia Hamilton[1]
1. University of Nottingham
2. Université catholique de Louvain
3. Radboud University Nijmegen
richard.ramsey@nottingham.ac.uk

In a social setting, seeing Sally look at a clock means something different to seeing her gaze longingly at a slice of chocolate cake. In both cases, her eyes and face might be turned rightwards, but the information conveyed is markedly different depending on the object of her gaze. Numerous studies have examined brain systems underlying the perception of gaze direction, but less is known about the neural basis of perceiving gaze shifts to specific objects. During fMRI, participants observed an actor look towards one of two objects, each occupying a distinct location. Video stimuli were sequenced to obtain repetition suppression (RS) for object-identity, independent of spatial location. RS for gazed-object was found in posterior intraparietal sulcus (pIPS). This result suggests that pIPS is sensitive to the type of object that an observed actor looks at (tool vs. food), irrespective of the observed actor's gaze location (left vs. right). General attention or lower-level object-feature processing explanations were ruled out by a control condition. Therefore, our results suggest that in addition to spatial orienting of social attention, human pIPS has an important role in object-centred orienting of social attention.

Mental-state attribution is not necessary for social attention effects

Daniel T. Smith[1], Geoff G Cole[2] and Rebeccah-Claire Billing[2].
1. Durham University
2. University of Essex
daniel.smith2@durham.ac.uk

An individual is said to possess theory of mind if they impute mental states to others. A number of recent findings have suggested that such mental-state attributions play a role in some social attention findings in which observation of where an individual is looking can influence the observer's response (i.e., gaze cuing and perspective taking). These findings challenge the notion that effects such as gaze cueing are largely reflective with minimum contribution from top-down processes. We examined the mentalistic account of social attention by carrying out three gaze cuing and two perspective taking experiments. Critically, either the individual in the display (e.g., the gaze cuing face) could see the same thing as the participant (i.e., target) or had their view obstructed by a physical barrier. We found robust gaze cuing and perspective taking effects even when the observed model in the display could not see the same thing as the participant. We conclude that automatic shifts of attention induced by an individual can account for social attention findings rather than mental-state attribution.

In face identification, observers fluctuate and individuals differ!

Markus Bindemann[1], Meri Avetisyan[2] and Tim Rakow[3]
1. University of Kent
2. Canterbury Christ Church University
3. University of Essex
m.bindemann@kent.ac.uk

It can be remarkably difficult to determine if two photographs of unfamiliar faces depict the same person or two different people. This fallibility is well established in the face perception and eyewitness domain, but most of this research has focused on the "average" observer by measuring mean performance across groups of participants. In this study, we deviate from this convention to provide a detailed description of *individual differences* and *observer consistency* in unfamiliar face identification, by assessing performance across several days. Our data reveal considerable variation *between* and also *within* observers. This variation is such that the same observers frequently make different identification decisions to the same faces on different days. And when new faces are shown on each day, observers that produce perfect accuracy on one day can make many misidentifications on another. However, a few individuals also performed with consistent high accuracy in these tests. These findings have important implications for theories of face recognition. We also argue that this method may provide a potential personnel selection tool for security roles that depend on this ability, by detecting individuals who are exceptional at person identification.

Cross-cultural effects of colour, but not morphological masculinity, on perceived attractiveness of men's faces

Ian D. Stephen[1], Isabel M. L. Scott[2], Vinet Coetzee[3], Nicholas Pound[4], David I. Perrett[5] and Ian S. Penton-Voak[2]
1. University of Nottingham Malaysia Campus
2. University of Bristol
3. University of Pretoria
4. Brunel University
5. University of St Andrews
ian.stephen@nottingham.edu.my

Much attractiveness research has focused on face shape. The role of masculinity (thought to be a relatively stable shape cue to developmental testosterone levels) in male facial attractiveness has been examined, with mixed results. Recent work on the perception of skin colour (a more variable cue to current health status) indicates that increased skin redness, yellowness and lightness enhance apparent health. It has been suggested that stable cues such as masculinity may be less important to attractiveness judgements than short-term, more variable health cues. We examine associations between male facial attractiveness, masculinity and skin colour in African and Caucasian populations. Masculinity was not found to be associated with attractiveness in either ethnic group. However, skin colour was found to be an important predictor of attractiveness judgments, particularly for own-ethnicity faces. Our results suggest that more plastic health cues, such as skin colour, are more important than developmental cues such as masculinity. Further, unfamiliarity with natural skin colour variation in other ethnic groups may limit observers' ability to utilise these colour cues.

Eye-tracking the own-race bias in face perception

Peter J. Hills[1], J. Michael Pake[1] and Rachel E. Cooper[2]
1. Anglia Ruskin University
2. University of Essex
peter.hills@anglia.ac.uk

Own-race faces are recognised more accurately than faces of another race (e.g., Meissner & Brigham, 2001), potentially due to expertise with processing own-race faces or greater motivation to individuate them. Using eye-tracking, Blais, Jack, Scheepers, Fiset, and Caldara (2008) have shown that Western Caucasian participants appear to look at different facial features than East Asian participants - consistent with a perceptual expertise account of the own-race bias. Conversely, Goldinger, He, & Papesh (2009) have shown different eye-movements for viewing own- compared to other-race faces, but that eye-movements did not differ depending on race of participant - consistent with a motivational account of the own-race bias. A standard old/new face recognition paradigm with eye-tracking was employed to resolve this discrepancy in Black African and White British participants. We found that White participants fixated on the eyes more than Black participants and that Black participants focused on the nose more than White

participants. We found no evidence to suggest that participants alter their eye-movements for own- versus other-race faces. Our results are consistent with an expertise account of the own-race bias, in which humans fixate on the most diagnostically useful features to discriminate between own-race faces and this may differ cross-culturally.

Blais, C., Jack, R. E., Scheepers, C., Fiset, D., & Caldara, R. (2008). Culture shapes how We look at faces. *PlosOne,3,* e3022.

Goldinger, S. D., He, Y., & Papesh, M. H. (2009). Deficits in cross-race face learning: Insights from eye movements and pupillometry. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 35,* 1105 – 1122.

Meissner C. A., Brigham J. C. (2001) Thirty years of investigating the own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy and Law, 7,* 3–35.

ERP correlates of face familiarity but not facial age depend on task demands

Holger Wiese and Stefan R. Schweinberger
Friedrich Schiller University of Jena
holger.wiese@uni-jena.de

Models of face recognition suggest independent processing of visually derivable information, such as age, and identity-specific information. We recorded event-related potentials (ERPs) while both old (>60 years) and young (18-30 years) famous and unfamiliar faces were categorized by age or familiarity in two subsequent blocks. Faster responses to old vs. young faces were seen during age categorization, independent of familiarity, and to famous vs. unfamiliar faces during familiarity decisions, independent of age. ERPs yielded increased N250 amplitudes for famous as compared to unfamiliar faces, independent of age. However, these N250 differences were larger in the familiarity task. The left occipito-temporal P2, probably reflecting late structural encoding, exhibited main effects of task (increased amplitudes during age categorization) and of face age (larger amplitudes for young faces), but no interaction of these factors. While these results suggest independent processing of age and familiarity, behavioural and N250 familiarity effects were enhanced when identity information was task-relevant, suggesting that processes reflected in N250 are not purely automatic but exhibit a degree of task-dependence. By contrast, age effects on P2 seemed stimulus-driven and task-independent. However, the use for further processing of age information reflected in P2 may depend on top-down modulation by the task.

Symposium: Learning about preferences and perception
Organiser: Dr Mark Haselgrove

Perceptual learning and the face inversion effect.

Ciro Civile, Rosamund P. McLaren and Ian P.L. McLaren
University of Exeter
I.P.L.McLaren@exeter.ac.uk

The face inversion effect is a robust, reliable phenomenon. Old / new recognition of inverted faces is much worse than for upright faces (Yin, 1969), and this difference is larger for stimuli such as faces than it is for pictures of houses or landscape paintings. One theoretical account of this effect posits that we have expertise for upright faces due to a combination of our familiarity with this class of stimuli and the fact that they possess second-order relational structure (Diamond and Carey, 1986). We will present three experiments that confirm this hypothesis. We will show that familiarisation with a novel class of stimuli that possesses the requisite structure leads to strong inversion effects in a recognition paradigm, but that familiarisation with similar stimulus classes that do not possess second-order relational structure does not produce this phenomenon. This work builds on McLaren's (1997) paper, but moves closer to the face recognition paradigm and confirms an effect reported in that paper for the first time: that familiarity with a class of stimuli that possesses second order relational structure confers a disadvantage for the purposes of old / new recognition when exemplars of that class are inverted.

Diamond, R. & Carey, S. (1986). Why faces are and are not special: an effect of expertise. *J Exp Psychol Gen, 115(2)*,107–117.

McLaren, I.P.L. (1997). Categorization and perceptual learning: an analogue of the face inversion effect. *Q J Exp Psychol-a*, *50*(2), 257-273.

Yin, R. K. (1969). Looking at upside-down faces. *J Exp Psychol, 81*, 141-145.

Exploring the cognitive neuroscience of perceptual learning

Matthew Mundy[1,3], Paul Downing[2], Dominic Dwyer[3], Rob Honey[3] and Kim Graham[3].

1. Monash University
2. Bangor University
3. Cardiff University

Matthew.Mundy@monash.edu

In a series of event-related fMRI experiments, participants made repeated same/different judgments to familiar and novel confusable pairs of dot patterns, faces and complex scenes. Stimulus-independent activation was seen in early visual cortex; the exact visual regions involved were pinpointed using a retinotopic mapping technique. Activity in early visual cortical regions was shown to correlate with the magnitude of perceptual learning. Using a series of orthogonal, and independent, functional localisers, clusters of stimulus-selective, novelty-sensitive voxels were identified in two medial temporal regions (perirhinal cortex and posterior hippocampus), and two extrastriate regions (fusiform face area, FFA, and parahippocampal place area, PPA). We asked how activity in these regions was influenced by discrimination accuracy and by trial repetition (e.g., adaptation). In contrast to FFA and PPA, which only cared about preferred category, activity in perirhinal cortex and posterior hippocampus predicted discrimination accuracy for faces and scenes, respectively. Both MTL regions also adapted less rapidly than extrastriate areas over trial repetition, with differences emerging between extrastriate and MTL regions after 8 repetitions. These findings, supported by our recent work with MTL-lesioned patients, show that domain-specific patterns of responding in the human brain are not just restricted to extrastriate cortex, and highlight a key role for perirhinal

cortex and posterior hippocampus, but not FFA and PPA, in storing feature ambiguous representations of faces and scenes, respectively.

Latent inhibition in flavour-preference conditioning

Geoffrey Hall[1,2], David García Burgos[3] and Felisa González[3]
1. University of York
2. University of New South Wales
3. University of Granada
gh1@york.ac.uk

In three experiments we examined the effects of giving rats preexposure to a flavour that was subsequently paired with sucrose in a flavour-conditioning procedure. In the absence of preexposure the subjects reliably showed a preference for the flavour on a choice test given after conditioning. Preexposure abolished this effect (i.e., latent inhibition was observed), but only under certain motivational conditions. Specifically, latent inhibition was obtained only when the animals were hungry during the test. We consider the implications of this finding for theoretical interpretations of the latent inhibition effect; also for the proposal that flavour-preference conditioning may involve a mechanism different from that usually taken to underlie associative learning.

Overshadowing and blocking of flavour-preference conditioning

Peter Jones[1], Mark Haselgrove[1] and Dominic Dwyer[2]
1. University of Nottingham
2. Cardiff University
peter.jones@nottingham.ac.uk

Two experiments show that the preference normally established to a neutral flavor cue that is paired with maltodextrin is attenuated when that cue is conditioned in compound with another flavor— overshadowing. A further experiment shows that the preference for a neutral flavor conditioned as part of a compound is further attenuated if the other element in that compound is separately paired with the reinforcer— blocking. These results stand in contrast to a number of previous compound flavor-preference conditioning experiments, which have not revealed reliable cue-competition effects. These discrepant findings are discussed in terms of the effects of within-compound associations and a configural perspective of learning.

Flavour-nutrient learning in humans: Identifying boundary conditions

Martin R Yeomans[1], Natalie Gould[1], Lucy Chambers[1] and Elizabeth H. Zandstra[2]
1. University of Sussex
2. Unilever R&D Vlaardingen
martin@sussex.ac.uk

In flavour-nutrient learning (FNL), the flavour of ingested food is interpreted as a contingent predictor of the positive post-ingestive effects of nutrients. However,

although widely reported in non-human animals, successful studies of FNL in humans have been rare. The studies reported here examine some of the factors that make human FNL elusive. Firstly, the implied linear relationship between nutrient content and acquired liking is questioned. Two studies are reported that show that increased flavour liking is only seen with optimal levels of nutrients: nutrient intake above that level resulting in aversive over-satiation. Secondly, the relevance of the ingested nutrients to current nutritive needs are examined. FNL is reported to be more effective when participants are hungry than when sated. In contrast, nutrients are shown to be ineffective reinforcers for people who habitually control their intake by reference to external rather than internal cues. Finally, we provide evidence that explicit knowledge of actual nutrient content prevents acquisition of flavour liking through FNL, suggesting considerable top-down influence on the FNL process in humans. Together these data identify the optimal conditions for FNL development in humans and suggest that flavour-nutrient signals compete with explicit processes involving memory and expectation to determine flavour liking.

Proactive interference with taste aversion learning over long delays

Robert A. Boakes and Dorothy Kwok
University of Sydney
bob.boakes@sydney.edu.au

Proactive interference here refers to the influence of previous events on acquisition of an aversion to a taste/flavour. In a series of experiments the target taste was sucrose followed 30 or 60 min later by lithium injection. The sucrose aversion produced by this procedure was smaller if, *prior* to being given sucrose, a rat was placed in a context that had previously been paired with lithium (context blocking). When a rat was exposed to the novel taste of saline prior to being given sucrose, no effect was found on the aversion produced by a single sucrose-lithium pairing (absence of 1-trial overshadowing), but, when two such trials were given, the sucrose aversion was much reduced by proactive interference from the saline (2-trial overshadowing). The pattern of results was well predicted by the Rescorla-Wagner model – insofar as it subsumes overshadowing as a type of blocking - when two assumptions were added: 1) that associability declines with time; and 2) that associations between two taste stimuli can be rapidly acquired even when they occur sequentially.

End of Symposium

Inattention abolishes voice adaptation

Romi Zäske, Christiane Fritz and Stefan R. Schweinberger
Friederich Schiller University of Jena
romi.zaeske@uni-jena.de

While perceptual aftereffects of adaptation to faces have been described for various social signals, aftereffects in the perception of paralinguistic information in voices have only been reported recently. In face perception, attentive perception of adaptors may be a prerequisite for aftereffects to occur [1]. Here we investigated whether

selective attention to adaptor voices modulates the voice gender aftereffect [2]. Participants were simultaneously presented with a male or a female adaptor voice to one ear, and an androgynous distractor voice to the other ear. Depending on experimental condition, they selectively attended to adaptor or distractor voices by either classifying speaker gender (Exp.1) or syllable spoken (Exp.2). Gender perception in subsequent gender-morphed voices was biased away from the adapting gender only if adaptor voices had been attended. This suggests that listeners may be unable to process more than one voice at a time, reminiscent of similar claims in face perception. Moreover, this attention-dependent voice gender aftereffect was observed following both, gender and syllable classification tasks. Thus, within the attended voice, gender information may be processed preattentively [3] even if attention is focussed on linguistic properties of the speech signal.

Knösche T.R., Lattner S., Maess B., Schauer M., and Friederici A.D. (2002). Early parallel processing of auditory word and voice information**.** *Neuroimage, 17***,** 1493-1503.

Moradi F., Koch C., and Shimojo S. (2005). Face adaptation depends on seeing the face**.** *Neuron, 45***,** 169-175.

Schweinberger S.R., Casper C., Hauthal N., Kaufmann J.M., Kawahara H., Kloth N., Robertson D.M.C., Simpson A.P., and Zäske R. (2008). Auditory adaptation in voice perception**.** *Current Biology, 18***,** 684-688.

Perception of voice gender and identity: Neurophysiological correlates

Stefan R. Schweinberger, Christian Walther, Gyula Kovács, Verena G. Skuk and Romi Zäske
1. Friederich Schiller University of Jena
2. University of Regensburg
stefan.schweinberger@uni-jena.de

The perception of speaker gender and identity and its neural correlates have received relatively little scientific attention. We discuss evidence on the role of various acoustic cues in the recognition of speaker gender and identity, and report contrastive effects of adaptation in voice gender perception, as well as in personally familiar voice identification. In experiments using different whole-sentence utterances as adaptors and test stimuli, prolonged exposure to speaker 1´s voice strongly biased the perception of identity-ambiguous voice morphs between speakers 1 and 2 towards speaker 2 (and vice versa). Remarkably, a significant though smaller bias effects to voice identification was seen when adaptors were videos of familiar speakers' silently articulating faces. Moreover, event-related potentials (ERPs) were recorded to investigate the neural representation and time course of vocal identity processing, using short VCV utterances. Identity adaptation induced amplitude reductions of the frontocentral N1-P2 complex and a prominent reduction of a parietal P3 component, for test voices preceded by identity-corresponding adaptors. Importantly, only the P3 modulation remained clear for across-syllable adaptor-test combinations. Our results suggest that voice identity is contrastively processed by auditory neurons within ~250 ms after stimulus onset, and that identity processing becomes less dependent on speech content after ~300 ms.

Differential EEG generators of tactile perception and misperception

Ellen Poliakoff[1], Donna Lloyd[1], Nelson J. Trujillo-Barreto[2], Liam Mason[1], Kirsten McKenzie[1,3], Richard Brown[1] and Wael El-Deredy[1]
1. University of Manchester
2. Cuban Neurosciences Centre
3. University of Nottingham Malaysia Campus
Ellen.Poliakoff@manchester.ac.uk

When detecting the presence or absence of weak tactile events, people frequently miss targets and falsely report sensations in the absence of a stimulus (Lloyd et al., 2008). Here we recorded brain activity using electroencephalography (EEG) whilst participants performed such a tactile signal detection task, to examine how brain activity differs when participants (i) correctly report versus miss a weak touch; and (ii) falsely report versus correctly reject an absent touch. We observed greater ERP amplitudes for reported compared to unreported tactile stimuli. These differences were present from early post-stimulus, with source localisation revealing both early (120-160ms) and late (360-400ms) activity in the precuneus, as well as a wider network during the later period. Such differences may reflect fluctuations in attention to the finger during the task. Source localisation of the difference between false alarms and correct rejections revealed activity in the insula during both early and late time periods, suggesting that interoceptive noise may have contributed to the erroneous touch reports. Our results highlight the differential processes involved in the perception and misperception of tactile events.

Lloyd D, Mason L, Brown RJ, Poliakoff E. (2008). Development of a paradigm for measuring somatic disturbance in clinical populations with medically unexplained symptoms. *Journal of Psychosomatic Research, 64*, 21-24

The effect of body-focused attention on somatosensory perceptual decision making

Laura Mirams, Ellen Poliakoff, Richard Brown and Donna Lloyd
University of Manchester
laura.mirams@postgrad.manchester.ac.uk

Although clinical models of somatization suggest that 'body-focused attention' affects somatic perception and contributes to physical symptom reporting, the concept is often poorly defined and different ways of attending to the body have not been considered. The current research investigated the effects of interoceptive and exteroceptive bodily attention on somatic perception using the somatic signal detection task (SSDT). In experiment one, thirty-seven participants completed the SSDT under usual testing conditions, and after performing an interoceptive heart beat perception (HBP) task. The HBP task led to a more liberal response criterion, due to increased touch reports in the presence and absence of a target vibration. This finding is consistent with suggestions that attending internally contributes to physical symptom reporting in patients with medically unexplained symptoms. In experiment two, forty participants completed the SSDT before and after an exteroceptive grating orientation task. This task led to a more stringent response criterion, due to decreased touch reports in the presence and absence of the target, possibly via a reduction in sensory noise. This work demonstrates that internal and external body-focused attention can have opposite effects

on somatic perceptual decision-making and suggests that attention training could be useful for patients reporting excessive physical symptoms.

Losing limbs in the brain with the disappearing hand trick.

Roger Newport[1], Helen Gilpin[1], Sophie Andrews[1] and Catherine Preston[2]
1. University of Nottingham
2. Nottingham Trent University
roger.newport@nottingham.ac.uk

One of the problems with investigating body representation is that in healthy controls we usually add something that has never been part of the body, such as a fake hand, while this is not the case in the majority of pathological cases – for example, phantom limbs and unawareness of body parts in asomatognosia. In order to address this discrepancy we developed a technique for making the hand 'disappear' from vision and touch in healthy participants. Following upper limb disappearance, healthy controls answered questionnaire items (Exp 1) or were 'stabbed' by virtual weapons (Exp 2). Across both experiments, participants displayed a lack of awareness of their disappeared limb, claiming that their hand was no longer part of their body and showing an absence of skin conductance in response to threat towards the hand. These experiments show that it is possible to disrupt the permanence of the body in the healthy brain and may give insights into pathological loss of bodily awareness.

Perceiving others is not purely visual: The role of body posture in "body gestalt" completion

Klaus Kessler[1], Sebastien Miellet[1] and Nienke Hoogenboom[2]
1. University of Glasgow
2. University of Duesseldorf
k.kessler@psy.gla.ac.uk

When we perceive other people in our everyday encounters their bodies are often partially occluded. High-level visual areas are known to automatically complete partially occluded objects, as revealed by the classic "gestalt" phenomena. However, human observers might intuitively map their own body knowledge onto partially occluded others and thereby complete their "body gestalt" by means of posture and/or motor resonance. Across five behavioural experiments we confirmed this hypothesis: Responses were significantly faster when the observer's posture matched the configuration of face and hands shown on screen. Hence, humans intuitively use their own body knowledge to 'fill in the gaps' in a body stimulus. We further conclude that in our particular paradigm posture resonance was apparently more important for body gestalt completion than motor resonance - with the former being most likely mediated by proprioceptive body schema representations, while the latter by the mirror neuron system. Finally, we will also present preliminary analysis of MEG data. Our findings elucidate the mechanisms of how humans perceive others holistically and how they might implicitly align themselves in everyday social interactions to facilitate an optimal co-representation of each other.

EPS Prize Lecture

Licking and liking: The assessment of hedonic responses in rodents

Dominic M. Dwyer
Cardiff University
DwyerDM@cardiff.ac.uk

Affective processes are a key determinant of behaviour: at its simplest, liked stimuli are approached while disliked stimuli are avoided. Although assessing hedonic responses in non-verbal animals can be difficult one, relatively tractable, approach relies on detailed analyses of rodents' licking behaviour. Rodents typically produce rhythmic sets of licks that can be grouped into clusters on the basis of the intervals between licks. The mean number of licks in a cluster (cluster size) is directly related to the concentration of palatable and unpalatable solutions. These relationships suggest that lick cluster size might be a useful index of the palatability of an animal's hedonic reaction to the solution being consumed. I will begin by reviewing studies of conditioned flavour preference and aversion that support the idea that lick cluster size can provide useful information about rats' hedonic reactions. I will then describe how this methodology has been used to address previously intractable issues in the investigation of contrast effects as well as revealing an analogue of effort justification effects that, in humans, are commonly explained in terms of cognitive dissonance reduction. Finally, I will consider how lick analysis might provide information about hedonic responses in animal models of human psychiatric disorders.

Is reading lips like hearing voices? The role of articulatory processes in audiovisual speech perception

David Maidment and William Macken
Cardiff University
maidmentdw@cardiff.ac.uk

Speech processing is an inherently multimodal process, whereby auditory and visual speech inputs come to be integrated, so that they form one coherent percept. This is clearly demonstrated by the McGurk effect, such that when the consonant-vowel pairing of '*ga*' is seen, but dubbed so that '*ba*' is heard, an illusionary percept of '*da*' is reported. Nevertheless, how the various modalities come to be fused to form this single percept remains unclear, with one emerging view suggesting that articulatory networks support the integration of audiovisual speech signals. The current experiment therefore examined the role of articulation during the presentation of auditory and visual speech material, whereby participants were asked to engage in overt speech production during McGurk syllable presentation. It was found that the McGurk effect was significantly reduced under manipulations of concurrent articulation, relative to control conditions, suggesting that the degree of integration between auditory and visual speech gestures is partially mediated by articulatory processes. The implications of this finding in context of audiovisual speech perception will be discussed.

Emotional word recognition in bilinguals: An ERP study

Tiina M. Eilola[1], Jelena Havelka[2] and Johanna C. van Hooff[3]
1. Queen Mary University of London
2. University of Leeds
3. Vrije Universiteit Amsterdam
t.eilola@qmul.ac.uk

The aim of the present study was to examine whether emotional valence affects visual word recognition differently in bilinguals' first (L1) and second language (L2). A lexical decision task was combined with an ERP recording. Twenty German-English bilinguals were presented with neutral, positive and negative words in German and English. In L2, positive valence was found to facilitate word processing while negatively valenced words produced equivalent RTs to neutral words. In L1, no facilitation or interference from emotionally charged words were observed. Analysis of event-related potentials revealed a reduced N400 for emotionally charged words relative to neutral words in L2 but not in L1. This N400 result suggests that while establishing the lexicality of L2 words is more effortful and time consuming than doing the same in L1, positive valence of L2 words can facilitate this process. The present findings provide support for the view that, at least in proficient late bilinguals, emotional content of words is accessed rapidly and can influence the speed at which bilinguals respond to those words.

EPS/British Science Association Prize

Perception of vocal emotion in speech: Simulations of bilateral cochlear implantation and bimodal aiding

A.M. Goman and A.Quentin Summerfield
University of York
ag561@york.ac.uk

The perception of vocal emotion is an important aspect of communication with which users of cochlear implants have difficulty. Patients with a single cochlear implant (CI) can use either a second CI (bilateral implantation, CI-CI) or an acoustic hearing aid (bimodal aiding, CI-HA) in their other ear. It was hypothesised that bimodal aiding would permit more accurate identification of vocal emotion than bilateral implantation because the hearing aid would provide evidence of the voice pitch which is an important cue for distinguishing vocal emotions. Raters identified talkers who distinguished anger, anxiety, happiness, sadness, and neutrality unambiguously in their speech. Emotion identification by normally-hearing adults listening to stimuli processed to simulate the transfer of information achieved by CI-CI or CI-HA was measured. Accuracy of identification was higher with CI-HA than CI-CI. This suggests that low-frequency information provided by a hearing aid could improve the accuracy with which users of a single CI perceive vocal emotion. Preliminary findings from a further study, testing post-lingually deafened adults who use CI-CI or CI-HA will be reported.

Processing of subtitles in foreign language films: An eye-tracking study

Marie-Josee Bisson, Walter J.B. van Heuven, Kathy Conklin and Richard J. Tunney
University of Nottingham
lpxmb@nottingham.ac.uk

Many European countries use subtitles to broadcast foreign language films and TV programs as a cheaper alternative to dubbing. Furthermore, native language films and TV programs are often offered optionally with different language subtitles. An important question is to what extend people process the subtitles. In this study, monolingual English participants unfamiliar with Dutch watched 25 minutes of a film under normal (Dutch soundtrack and English subtitles), reversed (English soundtrack and Dutch subtitles) or intralingual (Dutch soundtrack and Dutch subtitles) subtitling conditions whilst their eye-movements were recorded. The results revealed that the participants read the subtitles irrespective of whether they were presented in English or Dutch as assessed by the duration and the number of fixations in each subtitle. However, participants exhibited more regular reading of the subtitles when the film soundtrack was in Dutch. Furthermore, there were no significant differences between the normal and intralingual conditions, even in terms of consecutive fixations on the subtitles. The implications of these results are discussed in relation to the transitory nature of the subtitles and the highly automatic reading of words.

Anticipation, event-plausibility and scene constraints

Gitte Joergensen and Gerry Altmann
University of York
g.joergensen@psych.york.ac.uk

We often use language to refer to items within our immediate proximity, with the visual context making it easier to anticipate which item will most likely be referred to next. However, we also use language to refer to past, future, or even imagined events. In such cases, anticipation is no longer restricted by the visual context and may now be influenced by experiential real-world knowledge. In a set of eye-tracking experiments we explore whether real-world knowledge is weighted differently as a function of whether a visually constraining context is present or absent. We found that when describing events in the context of a concurrent scene, the eye movement patterns during the unfolding language indicated that participants anticipated even implausible items. However, when the scene was removed prior to language onset, participants only anticipated plausible items. In both cases, regardless of whether the scene was present or absent, mentioning an implausible object did cause the eyes to move to that object. Thus, it was only during anticipation that real-world knowledge played a part, and only when the scene was absent. We propose that the knowledge deployed when scenes are present is qualitatively different to that deployed when those scenes become memories.

Is the word-predictability effect an effect of predictability?

Shirley-Anne S. Paul[1], Wayne S. Murray[2] and Alan Kennedy[2]
1. University of Edinburgh
2. University of Dundee
shirley.paul@ed.ac.uk

We address the question of whether the effect of word-predictability on eye movements reflects a facilitation of lexical access or whether it might be driven by later processes, such as semantic integration. In Experiment 1, eye-movements were recorded while participants read sentences which varied across four levels of predictability towards a particular target word (e.g. ‘ducks’). The results showed an inverse monotonic relationship between level of sentential constraint and target word inspection time; an outcome consistent with either of the aforementioned accounts. In Experiment 2, the same set of experimental sentences were employed, but with the target word replaced by a non-predictable but semantically appropriate and plausible word (e.g. ‘geese’). Using an eye-movement contingent procedure, the target-preview was also manipulated so that it was either the predictable word (e.g. ‘ducks’) or non-predictable (e.g. ‘geese’). There was no interaction with preview, and the pattern of inspection times on the target word matched that found with predictable targets. Since this target-word was always unpredictable, the effect seems more likely to be related to semantic integration than to lexical facilitation. This outcome is incompatible with models of eye-movement control which assume that predictability primarily influences the speed of lexical access.

Age of acquisition effects in naming: A laboratory analogue

Jonathan C. Catling[1], Emma Preece[1], Kevin Dent[2] and Robert A. Johnston[3]
1. University of Worcester
2. University of Birmingham
3. University of Kent
J.Catling@worc.ac.uk

Age of Acquisition (AoA) refers to the age at which one learns a word. The AoA effect is such that words that have been learnt earlier in life are significantly easier to retrieve than words that are learnt later in life. The effect of AoA has been robustly demonstrated within a plethora of different tasks including picture naming, word naming, visual lexical decisions and semantic classification. However, within these tasks there is the potential problem of accurately measuring and balancing for other psycholinguistic variables that may have an impact on performance. In an attempt to remove these possible confounding variables Stewart and Ellis (2008) demonstrated AoA effects within a novel pattern identification task. In this laboratory analogue, participants learned to categorize novel random checkerboard stimuli. Early learned stimuli were found to be classified significantly more quickly than later learned stimuli. However to date this analogue has not been extended to object naming. In the present small scale study participants were trained to name 24 novel Greeble pictures (e.g., see Gauthier and Tarr, 1997) with a nonsense triplet name. Half of the pictures entered training early and half later. After completing the training sessions, cumulative frequency was equal between the groups. Participants named early stimuli significantly faster than later acquired items, thus supporting the proposition that AoA or order of acquisition has an effect in any learning system.

Gauthier, I., & Tarr, M. J. (1997). "Becoming a "Greeble" expert: Exploring mechanisms for face recognition". Vision Research, 37(12), 1673-1682.

Stewart, N., & Ellis, A. W. (2008). Order of acquisition in learning perceptual categories: A laboratory analogue of the age of acquisition effect? Psychonomic Bulletin & Review, 15, 70-74.

The role of working memory in children's arithmetic performance differs by strategy

Lucy Cragg and Camilla Gilmore
University of Nottingham
lucy.cragg@nottingham.ac.uk

Working memory has been shown to play an important role in mathematical achievement. Previous studies have tended to rely on a correlational design in which performance on general standardised measures of mathematics is related to performance on working memory tasks. However, it is likely that subtle relationships exist between working memory and different components of mathematical cognition. For example, working memory may play a larger role in procedural competence than knowledge of number facts. Moreover, the role of working memory in mathematics is likely to change with age. We employed an experimental dual-task design in which 8-year-olds, 10-year-olds and 12-year-olds and solved arithmetic problems using direct retrieval, counting or

decomposition strategies whilst undertaking a secondary n-back task designed to load onto verbal working memory. The results demonstrated that any kind of secondary task impairs retrieval strategies, whereas counting is more reliant on verbal working memory. All three age groups showed a similar pattern, suggesting that the reliance on working memory when solving arithmetic problems does not decrease in this age range.

Development of strategic memory for objects relevant to navigation

Alastair D. Smith and Anthony Hall
University of Nottingham
alastair.smith@nottingham.ac.uk

Recent studies have shown that adults implicitly employ a memory strategy when learning novel routes, with greater recognition accuracy for objects that were located at navigational decision points (junctions), compared to those that appeared at locations where a navigational decision is unnecessary (corners). Although there is some evidence that children are more likely to name decision-point landmarks when describing a route, it has not been ascertained whether they demonstrate a similar implicit strategy, or when this behaviour might appear. Two groups of children aged 4-5 and 7-8 years observed a short route through a virtual environment, with objects placed at decision and non-decision points. They then completed an unexpected object recognition test, responding whether stimuli were present on the route. There was no difference in overall accuracy between groups. However, whereas 4-5 years olds showed no difference between target types, 7-8 year olds were significantly more accurate at recognising decision point objects. The older group were also more accurate at drawing the remembered route on a plan view of the environment and had a higher reported sense of direction. These findings suggest that children begin to employ more implicit memory strategies to aid navigation around the age of 7 years.

Gaze in the natural environment: Does research into visual attention scale up?

Tom Foulsham[1] and Alan Kingstone[2]
1. University of Essex
2. University of British Columbia
foulsham@essex.ac.uk

We report 2 experiments examining where people look as they move around their everyday environment, and we discuss the results in the context of laboratory-based approaches to visual attention. In the first experiment, we recorded the gaze position of volunteers walking around campus, and results were compared to participants watching video clips of the same activity in the lab. Results showed that navigationally and socially important features are selected with head and eye movements, particularly when encountered in the real world. In the second experiment, participants walked around looking for a room, and then had to locate and retrieve an envelope. This task enabled us to investigate aspects of visual search untouched by laboratory approaches. Surprisingly, when the target was made highly salient it was not found quicker, although it was more likely to be found on the first fixation. Together, these experiments provide powerful new data for exploring everyday attention.

Differences in attention and prediction of driving hazards by individuals with Autism Spectrum Disorder

Danielle Ropar[1], Elizabeth Sheppard[2], Geoff Underwood[1] and Editha van Loon[1]
1. University of Nottingham
2. University of Nottingham Malaysia Campus
danielle.ropar@nottingham.ac.uk

Recent findings (Sheppard, Ropar, Underwood & van Loon, 2010) have shown individuals with Autism Spectrum Disorders (ASD) were slower in predicting driving hazards in video clips in relation to comparison groups. Slower reactions times could be the result of individuals with ASD only becoming aware of a hazard developing at a relatively late stage in the clip. Alternatively, it is possible that individuals with ASD perceived the hazards as quickly as the comparison participants, but were slower due to difficulties with planning a response. A follow-up study using eye tracking was conducted to elucidate reasons for why individuals with ASD have longer reactions times when identifying hazards on the road. Results indicated that the participants with ASD were slower to first fixate the driving hazards, ($F(1,28)=8.96$, $p<.01$). This was consistent with behavioural data showing individuals with ASD also made significantly less anticipatory responses when identifying hazards than comparison participants, $U=61$, $N=31$, $p=<.05$. This suggests that the general slowness in responding of participants with ASD is likely due to difficulties in anticipating hazards and not just planning a response. Findings are discussed in relation to socio-cognitive and attentional theories of autism.

Sheppard, E., Ropar, D., Underwood, G., & van Loon, E. (2010). Driving hazard perception in autism. *Journal of Autism and Developmental Disorders*, *40*, 504-508.

Observing interactions: Viewing strategies and autistic traits

Megan Freeth and Monika Bartczak
University of Sheffield
m.freeth@sheffield.ac.uk

Autistic traits are widely prevalent in the general population. A quantitative estimation of the degree to which an individual possesses traits associated with the autistic spectrum can be assessed using the Autism-spectrum Quotient (AQ). The reported study investigated social attention in 32 adults who either scored very high or very low on the AQ. Participants viewed video clips of four social interactions while their eye movements were tracked. For one of the clips, they were simply asked to watch; for the other three clips, they were asked to make judgements: about how the people were feeling during filming; to recount the events in the clips; or to recall which objects were used in the clips. The resulting effects on participants' eye movements were assessed. Preliminary analyses indicate that the low AQ scorers had a flexible viewing strategy and visually explored the clips much more than the high AQ scorers, who tended to maintain fixation in a more restricted region. Further region of interest analyses are being conducted. This study informs of the differences in social attention strategies in typically developing adults who display many or very few autistic traits.

Beyond face value: Involuntary emotional anticipation shapes social perception

Letizia Palumbo and Tjeerd Jellema
University of Hull
L.Palumbo@2007.hull.ac.uk

Contributions of 'bottom-up' and 'top-down' influences to perceptual judgments of dynamic facial expressions were explored in adults with typical development (TD) and Asperger's Syndrome (AS). We examined the roles played by (1) basic perceptual processes, i.e. sequential contrast/context effects, adaptation and representational momentum, and by (2) '*emotional anticipation*': the involuntary anticipation of the other's emotional state of mind, based on the immediately preceding perceptual history. Short video-clips of facial expressions (100% joy or 100% anger) that gradually morphed into a (nearly) neutral expression were presented. Both TD and AS participants judged the final expression of the joy-videos as slightly angry and the final expression of the anger-videos as slightly happy ('overshoot' bias). However, when the final neutral expression was depicted by a different identity, this bias was absent in the TD group, but remained present in the AS group. Another manipulation, involving neutral-to-joy-to-neutral and neutral-to-anger-to-neutral sequences, showed that only AS participants judged the last neutral frame as neutral. These findings suggest that in TD individuals the perceptual judgments of other's facial expressions are influenced by emotional anticipation (a low-level mindreading mechanism), while AS individuals, due to a failure in the spontaneous attribution/anticipation of other's emotional-states, may have applied compensatory mechanisms.

Episodic and semantic feeling of knowing in children with Autism Spectrum Disorder

Celine Souchay, Dominika Z. Wojcik and Chris J.A. Moulin
University of Leeds
c.souchay@leeds.ac.uk

Autism is a disorder which primarily affects social and communication function. However, the neuropsychological profile of this disorder is increasingly considering other cognitive deficits such as memory. We considered memory function from a metamemory viewpoint, based on the view that the neurological profile of autism implicates regions crucial for memory function. Whilst prominent theories of autism suggest that the central deficit in the condition is metacognitive, lacking the ability to understand others' mental states, there is little research on such abilities within memory tasks. To assess metamemory functioning we administered two feeling-of-knowing (FOK) tasks, one for episodic and one for semantic materials. In these tasks participants are asked to predict the likelihood of subsequently recognizing currently unrecalled information. It was found that children with autism made inaccurate FOK predictions, but only for episodic materials. For semantic materials, the children with autism made predictions which were not significantly different from controls. Thus, a specific deficit in metacognition emerges for one only set of materials. We argue that this deficit can be conceived of as a reflecting a deficit in recollection, possibly stemming from an ability to cast the self in the past and retrieve information about the study episode.

End of meeting

Reserve List

Learning new meanings for old words: Effects of semantic relatedness

Jennifer Rodd[1], Richard Berriman[1], Matt Landau[1], Theresa Lee[1], Carol Ho[1], Gareth Gaskell[2] and Matthew Davis[3]
1. University College London
2. University of York
3. MRC Cognition and Brain Sciences Unit
j.rodd@ucl.ac.uk

Adults often need to learn new meanings for words that they already know, such as the specific meanings of the verbs "tweet" and "friend" that are used on social networking sites, or the meanings of "normal" and "significant" within statistics. In these experiments we taught participants novel meanings for relatively unambiguous words (e.g., "ant") by embedding them within paragraphs that describe their new meanings. Explicit recall of these meanings was significantly better when there was a strong semantic relationship between the novel and existing meanings. This relatedness effect emerged after relatively brief exposure to the meanings (Experiment 1), but persisted when training was extended across seven days (Experiment 2) and when semantically demanding tasks were used during this extended training (Experiment 3). A lexical decision task was used to assess the impact of learning on online recognition. The presence of a semantic relatedness effect on this task was used as an indicator that the new meanings were sufficiently well integrated into their lexicons to influence online recognition. This effect was only present in Experiment 3, which indicates that integration of new meanings into the mental lexicon requires a relatively deep level of semantic processing of the new meanings.

Using multisensory illusions to ameliorate chronic pain

Catherine Preston[1,2] and Roger Newport[2]
1. Nottingham Trent University
2. University of Nottingham
catherine.preston@ntu.ac.uk

There is increasing evidence that illusion therapies can be beneficial for the amelioration of chronic pain, particularly so for conditions in which the experience of pain is thought to be cortically driven. For example, mirror therapy and size reduction illusions can reduce the experience of pain in phantom limb pain and complex regional pain syndrome type 1, respectively. Here data is presented from an exploratory experiment looking at the effectiveness of multisensory illusions applied to the painful hands of a group of participants with chronic pain from osteoarthritis. The illusions were found to produce a mean of 50% pain reduction in 85% of those tested. Some participants also spontaneously reported greater range of movement during the illusions. In a second experiment, control participants were asked to rate feelings of ownership and make judgments concerning their movements whilst undergoing a similar illusion. The findings demonstrate that, despite being visually distorted during the illusion, participants still considered the seen hand as their actual hand. In addition, the perceptual judgments for range of movement with that hand were significantly affected as a result of the illusion.

Contrasting intervention and observation in casual reasoning scenarios for rats

Katy V. Burgess, Dominic M. Dwyer and Robert C. Honey
Cardiff University
burgessk1@cardiff.ac.uk

Rats were used to investigate predictions derived from causal model theory. In Experiment 1, rats received either a common-cause (i.e., A→B, A→food) or a causal-chain training scenario (i.e., B→A, A→food), and in both scenarios B had an alternative, observed cause (i.e., C→B). During testing, B elicited less food-well activity when its arrival was contingent on a novel intervention (lever pressing) than when it occurred unannounced; but the alternative cause (C) had little impact on responding to B; and critically, none of these results interacted with training scenario. In Experiment 2, rats again received the two training scenarios, but there was now both an alternative, observed cause for B (i.e., C→B), and a control stimulus that was not an alternative cause for B (i.e., D→Ø). During the test, C and D did not influence test performance to B in the manner anticipated by causal model theory: In rats given the common-cause scenario, but not the causal-chain scenario, the alternative cause C actually enhanced responding to B relative to the control stimulus, D. The results of the present experiments undermine the application of causal model theory to rats.

Sex differences in the effect of landmarks on learning based on environmental geometry

Anthony McGregor[1], Matthew G. Buckley[2] and Shamus P. Smith[1]
1. Durham University
2. University of Nottingham
anthony.mcgregor@durham.ac.uk

Participants were trained to locate an invisible goal within an arena, the position of which could be determined by cues provided by the arena's shape and by landmarks within the arena. Theories of associative learning predict that the presence of one cue will restrict how much is learned about another, but a number of animal studies have contradicted these predictions with results in support of a geometric module that is responsible for learning about environmental shape regardless of the presence of non-geometric cues. Compared with control groups that learned to navigate using only shape or only landmarks, landmarks restricted learning based on shape. However, it was particularly evident that women found it difficult to learn to navigate based on shape cues if landmarks moved between trials, making them irrelevant for navigating to the goal's position. This effect was not present when wall colour, rather than arena shape, could be used to find the hidden goal. The final experiment suggested the sex difference in use of shape cues could be overcome with extended training . Together the results suggest men and women rely on different cues when navigating. There was no evidence, however, that geometric cues are impervious to cue competition.

Reliability of measuring the approximate number system

Nina Attridge[1], Kirsty Lay[1], Matthew Inglis[1], Camilla Gilmore[2] and Sophie Batchelor[2]
1. Loughborough University
2. University of Nottingham
n.attridge@lboro.ac.uk

There is evidence that humans and some non-human animals have an innate Approximate Number System (ANS) that allows us to rapidly, but only approximately, represent numerosity. Children and adults appear to use these representations to compare, add and subtract non-symbolic quantities with above-chance accuracy. Furthermore, it has been suggested that the ANS may be the basis of formal mathematical ability in humans, and a relationship between individual differences in ANS acuity and mathematical ability in children has been demonstrated. However, the data we report here from three experiments suggests that the reliability of ANS measures may be vastly below satisfactory, raising doubts about whether they can accurately quantify individual differences in ANS acuity. This also calls into question the finding of a relationship between ANS acuity and mathematical ability in children, and suggests that the recent development of interventions to harness the relationship for improved mathematics learning may be premature.

Within-compound associations in a spatial task

Joe Austen, Yutaka Kosaki and Anthony McGregor
Durham University
j.m.austen@dur.ac.uk

Many failures to demonstrate cue-competition in geometry learning involve the use of landmarks (e.g., McGregor, Horne, Esber, & Pearce, 2009; Pearce, Ward-Robinson, Good, Fussell, & Aydin, 2001). Pearce, Graham, Good, Jones, and McGregor (2006) proposed that under some circumstances learning based on geometry may be facilitated by the presence of a non-geometric feature via within-compound associations. It is possible that failures of overshadowing between landmarks and geometry are also a result of within-compound associations. We demonstrate the presence of within-compound associations between geometry and landmark cues by revaluing landmark cues following initial discrimination training to the compound. At test, the animals that underwent revaluation of landmarks were unable to discriminate locations based on geometry. We also demonstrate that these within-compound associations are present only after extended training.

McGregor, A., Horne, M., Esber, G.R., & Pearce, J.M. (2009). Absence of Overshadowing Between a Landmark and Geometric Cues in a Distinctively Shaped Environment: A Test of Miller and Shettleworth (2007). *Journal of Experimental Psychology: Animal Behavior Process, 35*, 357-370.

Pearce, J.M., Graham, M., Good, M.A, Jones, P.M., and McGregor, A. (2006) Potentiation, Overshadowing, and Blocking of Spatial Learning Based on the Shape of the Environment. *Journal of Experimental Psychology: Animal Behavior Process, 32*, 201-214.

Pearce, J.M., Ward-Robinson J., Good, M.A., Fussell, C., & Aydin, A. (2001). Influence of a Beacon on Spatial Learning Based on the Shape of the Test Environment. *Journal of Experimental Psychology: Animal Behavior Process, 27*, 329-344.

An investigation into the role of Arabic numerals, number words and nonsymbolic numerosities in numerical magnitude processing

Sophie Batchelor and Camilla Gilmore
University of Nottingham
lpxsb@nottingham.ac.uk

Multiple representations of number support the processing of numerical magnitude information. Whilst it is understood that the ability to transcode between number words and Arabic numerals, and the ability to map between symbolic and nonsymbolic representations are predictors of arithmetic performance in children (Mundy & Gilmore, 2009; van Loosbroek, Dirkx, Hulstijn & Janssen, 2009), less is known about the exact role of these different representations. The experimental aim was to distinguish between two models of number processing, the *Triple Code Model* (Dehaene & Cohen, 1995) and the *Encoding Complex Model* (Campbell & Clark, 1988), which argue for and against an abstract magnitude code respectively. A numerical comparison task was used to test 7-9-year-old children's (N=21) and adults' (N=29) ability to compare numbers across different notations. Children and adults showed a significant performance cost for cross-notation comparisons compared to within-notation comparisons. There were no differences in performance between the different cross-notation conditions, indicating that the act of crossing the boundary between representations, rather than the type of representations involved, is of central importance. The findings are discussed in terms of the *Triple Code Model* and the *Encoding Complex Model*, neither of which are able to account for this pattern of results.

Campbell, J. I. D., & Clark, J. M. (1988). An encoding-complex view of cognitive number processing: Comment on McCloskey, Sokol, & Goodman (1986). *Journal of ExperimentalPsychology: General, 117,* 204-214.

Dehaene, S., & Cohen, L. (1995). Toward an anatomical and functional model of number processing. *Mathematical Cognition,* 1, 83-120.

Mundy, E., & Gilmore, C. K. (2009). Children's mapping between symbolic and nonsymbolic representations of number. *Journal of Experimental Child Psychology, 103,* 490-502.

van Loosbroek, E., Dirkx, G. S. M. A., Hulstijn, W., & Janssen, F. (2009). When the mental number line involves a delay: The writing of numbers by children with different arithmetical abilities. *Journal of Experimental Child Psychology, 102,* 26-39.

The left-right reversal of a film is hard to detect: A study of Kurosawa's films.

Carole Bode and Marco Bertamini
University of Liverpool
C.Bode@liverpool.ac.uk

The mirror reversal of an image is subtly different from the original. Often such change goes unnoticed by observers although it can affect preference (Levy, 1976). We studied the effect of mirror reversal of feature films. We invited people to watch Yojimbo or Sanjuro in a cinema. These are two classic action films by Akira Kurosawa. Participants knew that this was part of a study, but they did not know about the reversal. On one day Yojimbo was shown in its original orientation, and on another day the film was mirror reversed. Sanjuro was shown reversed on one day and non-reversed on another day. From the answers to a questionnaire we found that viewers did not notice the reversal, even when they had seen the film before and considered themselves fans of Kurosawa. However, a question about the use of space (scenography) revealed that although people who had seen the film before gave higher ratings compared to those who had not, this was only true when the film was not reversed. We interpret this in relation to the mere exposure effect.

Levy, J. (1976). Lateral dominance and aesthetic preference. Neuropsychologia, 14(4), 431-445.

Contrasting intervention and observation in casual reasoning scenarios for rats

Katy V. Burgess, Dominic M. Dwyer and Robert C. Honey
Cardiff University
burgessk1@cardiff.ac.uk

Rats were used to investigate predictions derived from causal model theory. In Experiment 1, rats received either a common-cause (i.e., A→B, A→food) or a causal-chain training scenario (i.e., B→A, A→food), and in both scenarios B had an alternative, observed cause (i.e., C→B). During testing, B elicited less food-well activity when its arrival was contingent on a novel intervention (lever pressing) than when it occurred unannounced; but the alternative cause (C) had little impact on responding to B; and critically, none of these results interacted with training scenario. In Experiment 2, rats again received the two training scenarios, but there was now both an alternative, observed cause for B (i.e., C→B), and a control stimulus that was not an alternative cause for B (i.e., D→Ø). During the test, C and D did not influence test performance to B in the manner anticipated by causal model theory: In rats given the common-cause scenario, but not the causal-chain scenario, the alternative cause C actually enhanced responding to B relative to the control stimulus, D. The results of the present experiments undermine the application of causal model theory to rats.

Rewards in memory dynamically bias action choices to capture gaze

Estela Camara, Sanjay Manohar and Masud Husain
University College London
ecamara@ub.edu

Recent studies have shown that both monkey and human observers can act optimally, directing their gaze to locations that maximize overall rewards. But might rewards also have a deleterious effect on actions? Here, we first examined whether previously rewarded locations affect gaze direction when no reward is associated with the current action choice. By tracking eye position, we show that a location associated with a

positive outcome can bias action choices towards it. Next, we investigated whether the ability of a distracting visual stimulus to capture gaze is modulated by the previous value of that location. We found that distractors draw our eyes to them significantly more if they appear at a location that had previously been associated with a reward, even when gazing towards them now leads to punishments. Our results reveal that there can be surprising short-term costs of using reward cues for optimizing goal-directed behaviour. These findings have implications for understanding how value associated with locations in the visual scene dynamically influences working memory and action choices in the healthy brain, in childhood development or in psychiatric and neurological conditions (i.e. impaired ability to update value assignments to items in the visual scene).

Eye movements reveal rapid concurrent access to factual and counterfactual interpretations of the world

Heather J. Ferguson
University of Kent
h.ferguson@kent.ac.uk

Understanding a counterfactual scenario involves an understanding of at least two possibilities: the explicit conjecture and its implied meaning. We eye-tracked 36 participants while they read short narratives in which a counterfactual context set up a realistic hypothetical situation, and a subsequent critical sentence drew reference to the consequence of this event. This event was either consistent or inconsistent with the preceding context. Thus, the current study assessed the speed with which readers can infer the actual state of affairs from a counterfactual utterance, and whether they continue to suffer interference from the alternative interpretation during integration. Passages depicting a factual scenario were included as a baseline of normal contextual integration. Results revealed processing costs for both consistent and inconsistent information within a counterfactual context. These effects were characterized by distinct behavioural responses, with counterfactual consistent continuations driving early increased reading times, but counterfactual inconsistent continuations eliciting a higher incidence of regressions from that critical word. Later reading measures provided evidence that overall, readers favoured the implied factual meaning of the discourse. Taken together, these results demonstrate that readers can rapidly make a factual inference from a preceding counterfactual context, despite maintaining access to both counterfactual and factual interpretations of events.

Inner speech during silent reading reflects the reader's regional accent

Ruth Filik and Emma Barber
University of Nottingham
ruth.filik@nottingham.ac.uk

While reading silently, we often have the subjective experience of inner speech. However, there is currently little empirical evidence as to whether this inner voice resembles our own voice whilst speaking out loud. The current study exploits prosodic differences in regional accents to investigate this issue. Specifically, we compared reading behaviour of Northern and Southern English participants who have differing pronunciations for words like 'glass', in which the vowel duration is short in a Northern

accent (rhyming with 'mass') and long in a Southern accent (rhyming with 'sparse'). Participants' eye movements were monitored while they silently read limericks in which the end words of the first two lines (e.g., glass/class) would be pronounced differently by Northern and Southern participants. The final word of the limerick (e.g., mass/sparse) then either did or did not rhyme, depending on the reader's accent. Results showed longer reading times for the final word of the limerick, and more regressions in to the end words of lines one and two, when the final word did not rhyme, based on the accent of the reader. This would suggest that inner speech during silent reading resembles the external speech of the individual reader.

The filtering of irrelevant distractors among media multitaskers

Rebecca Harris and Jeannie Judge
University of Central Lancashire
raharris@uclan.ac.uk

Heavy media multitaskers are more susceptible to interference from irrelevant distracters than light media multitaskers (Ophir, Nass & Wagner, 2009). We examined this further using a semantic flanker task. Media multitasking was assessed using the Ophir et al. scale. Heavy media multitaskers (HMM: n = 13) and light media multitaskers (LMM: n = 13) completed an experimental task in which they responded to target words that were flanked by irrelevant distractor words; distractor words were from the same (congruent) or different (incongruent) semantic category to the target word. The attentional demands of target word identification were increased by presenting the word with transposed letters on 50% of the trials. The results revealed a three-way interaction between group, congruency and target word presentation. Planned comparisons showed that the congruency effects (i.e. faster responses for congruent than incongruent trials) did not reach significance for either group; however, LMM showed congruency effects for normal (14 ms) and transposed targets (18 ms) and HMM showed congruency effects for transposed targets (25 ms) but a reversal for normal targets (i.e. faster responses for incongruent than congruent trials). These findings suggest differential processing between HMM and LMM and are discussed within an attentional framework.

Ophir, E., Nass, C. & Wagner, A. D. (2009). Cognitive control in media multi-taskers, *PNAS*, 106, 15583-15587

Anticipating others' actions from social cues in typically-developed and autistic individuals

Matthew Hudson, Hollie G. Burnett and Tjeerd Jellema
University of Hull
Matthew.Hudson@hull.ac.uk

Social cues convey information about another's goals and intentions and may enhance anticipation of other's actions. Using representational momentum paradigms, we investigated whether anticipations of the continuation of actions performed by an agent are influenced by the agent's gaze direction. We tested individuals with high-functioning autism (HFA) and matched typically-developed (TD) individuals. All participants observed a head rotate towards them, while the gaze direction was either leading, or lagging behind, head rotation. They also observed identical rotations of a cylinder

containing the geometrical equivalent of the gaze manipulation. Their estimations of how far the stimuli had rotated were measured. The TD group was influenced by the gaze manipulations for the animate, but not for the inanimate stimulus: they underestimated head rotation if gaze was lagging behind. In contrast, the HFA group did not discriminate between the stimuli, showing a small, similar, influence for the gaze manipulation in both the animate and inanimate conditions. We conclude that action anticipation is based not only on action kinematics, but also on inferences about the actor's goals and intentions. However, the anticipations of individuals with HFA are influenced by the low-level directional aspect of gaze, rather than the intentional meaning conveyed.

Attenuation of auditory attentional capture under high visual load during serial recall: Top-down blocking, not passive filtering?

Robert W. Hughes, M. J. Hurlstone and Dylan M. Jones
Cardiff University
HughesRW@cardiff.ac.uk

Visual-verbal serial recall is disrupted appreciably by an unexpected deviation within a to-be-ignored speech sequence (e.g., one token presented in a different voice from the remainder), presumably through the power of the deviant to exogenously capture attention from the focal task. However, the disruption is markedly reduced (and sometimes eliminated) if the visual encoding load in the focal task is increased by embedding the to-be-remembered items in static visual noise. The present study tested two possible accounts of this attenuation: Does the high encoding load exhaust perceptual capacity such that the deviation is not detected (passive filtering) or is the deviant detected but high load presses into action an active top-down capture-blocking mechanism? The present study yielded support for the top-down blocking account by demonstrating that a manipulation of top-down knowledge—specifically, the provision of a forewarning about the impending deviation—had the same attenuating effect on the impact of the deviation as a high encoding load. More generally, the present results bolster the view that some forms of auditory distraction are resistible.

The behavioural and electrophysiological correlates of familiarity, inversion, and the presence of the eyes in face recognition

Laura A. Jones and Peter J. Hills
Anglia Ruskin University
laura.jones3@student.anglia.ac.uk

The face-inversion effect (lower recognition accuracy for inverted faces relative to upright faces) is associated with an increase in the latency and amplitude of the event related potential N170 (Itier & Taylor, 2002). The eyes are integral for face recognition and the removal of eyes from faces disrupts the configuration and is reflected in a delay of N170 (Itier, Alain, Sedore & McIntosh, 2007). Familiarity with a face can affect N170 and mediate the effects of disruption to the configuration (Itier & Taylor, 2004). A study is presented in which recognition accuracy for famous and non-famous faces which are inverted or upright and have eyes or no eyes, using a standard old/new recognition paradigm. During the experiment participants' EEG activity was recorded from 64 electrode sites. The results demonstrate that participants were significantly less accurate

when the faces were inverted, non-famous and had the eyes removed. Additionally, there was a three way interaction in that participants were less accurate when the faces had no eyes but only for inverted faces and this was mediated by familiarity. Additionally, EEG data illustrated that the N170 amplitude was smaller for non-famous faces and faces without eyes but larger for inverted faces.

Itier, R. J., Alain, C., Sedore, K. & McIntosh, A. R. (2007). Early face processing specificity: It's in the eyes! *Journal of Cognitive Neuroscience, 19*, 1815-1826.

Itier, R. J. & Taylor, M. J. (2002). Inversion and contrast polarity reversal affect both encoding and recognition processes of unfamiliar faces: A repetition study using ERPs. *NeuroImage, 15*, 353-372.

Itier, R. J. & Taylor, M. J. (2004). Effects of repetition learning on upright, inverted and contrast-reversed face processing using ERP's. *NeuroImage, 21*, 1518-1532.

Reward and penalty rapidly and differentially gate distraction

Sanjay Manohar and Masud Husain
Institute of Cognitive Neuroscience
s.manohar@ucl.ac.uk

Emerging lines of evidence suggest that reward and penalty might be important in guiding attention. Customarily, attention filters out deleterious distracting stimuli. However, distractibility could be advantageous in the wild: distraction ought to occur, a priori, when the risk of ignoring a new event outweighs the expected utility of the current goal. In this study we measure oculomotor capture – where an involuntary eye movement is evoked to a bright distractor, instead of the desired but dim target. Do reward and penalty modulate this distraction? In experiment 1, by explicitly manipulating reward and penalty magnitude between blocks, we show that both penalties and modest rewards reduce distraction. Modest rewards simultaneously hasten responses and reduce distraction, whereas penalties make subjects more cautious. Unexpectedly we also found increased capture with very high rewards. In experiment 2, we manipulate the location of the valued and penalised items on the previous trial. We find that oculomotor capture is greatest when a reward was previously missed at the current distractor location. This cannot be explained simply by speeded reaction times, inhibition of return, or motor perseveration. Our findings argue for reward-sensitivity in the neural system mediating bottom-up spatial attention, which is dynamic, spatially selective, and rapid.

Della Libera, C. & Chelazzi, L. Visual Selective Attention and the Effects of Monetary Rewards. Psychological Science 17, 222-227 (2006).

Maunsell, J.H.R. Neuronal representations of cognitive state: reward or attention? Trends in Cognitive Sciences 8, 261-265 (2004).

Takikawa, Y., Kawagoe, R., Itoh, H., Nakahara, H. & Hikosaka, O. Modulation of saccadic eye movements by predicted reward outcome. Exp Brain Res 142, 284-291 (2002).

Theeuwes, J., Kramer, A.F., Hahn, S. & Irwin, D.E. Our Eyes do Not Always Go Where we Want Them to Go: Capture of the Eyes by New Objects. Psychological Science 9, 379 -385 (1998).

Eye tracking evidence for action simulation

Lauren Marsh[1], Anne Springer[2], Moritz Daum[2], Wolfgang Prinz[2] and Antonia Hamilton[1]
1. University of Nottingham
2. Max Planck Institute for Human Cognitive Brain Sciences
lpxlm1@nottingham.ac.uk

Action simulation is believed to be a core function of the human mirror system, allowing us to predict actions and possibly learn new actions. However, direct measures of ongoing action simulation are hard to obtain. The present study explores the role of eye movements as an implicit and online measure of action simulation. Participants viewed predictable sequences of natural, goal-directed actions which were occluded for a two second period. Following occlusion, the action sequence reappeared at three levels of temporal asynchrony. Participants were instructed to imagine the continuation of the action during the occlusion period and to make a judgement about the temporal coherence of the sequence. During natural viewing and occlusion, eye movements were recorded. Significant correlations between eye movements during natural viewing and during occlusion are reported. This suggests that eye movements continue to track an action during occlusion, indicating ongoing action simulation in this period. Moreover, initial results indicate that stronger eye movement correlations across participants predicted better behavioural performance. Further work should assess the functional role of these eye movements for accurate action prediction.

Cognitive control of object affordance investigated using grip force

Jennifer McBride[1], Petroc Sumner[2] and Masud Husain[1]
1. Institute of Neurology and Institute of Cognitive Neuroscience
2. Cardiff University
j.mcbride@ion.ucl.ac.uk

Looking at an object can prime the observer to interact with it – "object affordance". But what mechanisms underlie such priming of action? Here, we investigated whether object affordance effects could be integrated into a wider framework of overlearnt stimulus-response (S-R) associations using as our index on-line, moment-to-moment measurement of grip force. Specifically, we asked if affordance effects are subject to the same control mechanisms that exist in so-called 'conflict tasks' such as Eriksen flanker or Stroop. In two experiments, participants squeezed force transducers to make speeded responses to objects that afforded an action with either the left or right hand. Responses were faster when the object afforded an action with the same hand that was required to make the response (congruent trials) compared to the opposite hand (incongruent trials). Importantly, this effect was modulated by trial history, demonstrating that current control settings might be modulated by previous experience of conflict just as in other S-R mapping tasks (e.g. the "Gratton" effect in Eriksen flanker). Next, we combined affordance with the Eriksen flankers to directly investigate the

relationship between these effects. Results are discussed in terms of the overlap between object affordance and other stimulus-response mappings and their cognitive control.

Sex differences in the effect of landmarks on learning based on environmental geometry

Anthony McGregor[1], Matthew G. Buckley[2] and Shamus P. Smith[1]
1. Durham University
2. University of Nottingham
anthony.mcgregor@durham.ac.uk

Participants were trained to locate an invisible goal within an arena, the position of which could be determined by cues provided by the arena's shape and by landmarks within the arena. Theories of associative learning predict that the presence of one cue will restrict how much is learned about another, but a number of animal studies have contradicted these predictions with results in support of a geometric module that is responsible for learning about environmental shape regardless of the presence of non-geometric cues. Compared with control groups that learned to navigate using only shape or only landmarks, landmarks restricted learning based on shape. However, it was particularly evident that women found it difficult to learn to navigate based on shape cues if landmarks moved between trials, making them irrelevant for navigating to the goal's position. This effect was not present when wall colour, rather than arena shape, could be used to find the hidden goal. The final experiment suggested the sex difference in use of shape cues could be overcome with extended training . Together the results suggest men and women rely on different cues when navigating. There was no evidence, however, that geometric cues are impervious to cue competition.

Adaptation to visual actions generates auditory aftereffects

Steve Page[1] and Nick E. Barraclough[1,2]
1. University of Hull
2. University of York
s.a.page@2006.hull.ac.uk

Repeated exposure (adaptation) to visual actions can induce adaptation aftereffects influencing subsequent perception of visual actions (Barraclough, Keith, Xiao, Oram, & Perrett, 2009). Cross-modal aftereffects have been found with simple stimuli where adapting to motion in depth causes subsequent auditory amplitude aftereffects (e.g. Kitagawa & Ichihara, 2002). We tested whether hand action sound perception was influenced by prior adaptation to different modality stimuli (auditory, visual only, audiovisual, or orthographic representations of actions) in order to investigate if actions are coded multimodally. After adapting to auditory action sounds (hand knocking and hand slapping), subsequent test stimuli (blended 'knock' and 'slap' sounds) sounded less like the adapting stimulus. This aftereffect showed a characteristic increase with repetition of the adapting stimulus. We also observed aftereffects following audiovisual and visual only adaptation, but not following orthographic stimuli. These crossmodal adaptation aftereffects suggest multimodal coding of actions in humans, and may result from adaptation of multimodal neurons involved in action coding similar to

those observed in the Superior Temporal Sulcus of the macaque monkey (Barraclough, Xiao, Oram, & Perrett, 2005).

Barraclough, N.E., Keith, R. H., Xiao, D.-K., Oram, M.W., & Perrett, D.I. (2009). Visual adaptation to goal-directed hand actions. *Journal of Cognitive Neuroscience, 21,* 1805-1819.

Barraclough, N. E., Xiao, D.-K., Oram, M. W., & Perrett, D. I. (2005). Integration of visual and auditory information by STS neurons responsive to the sight of actions. *Journal of Cognitive Neuroscience, 17,* 377–391.

Kitagawa, N, & Ichihara, S. (2002). Hearing visual motion in depth. *Nature, 416,* 172-174.

Understanding of meaningful and meaningless postures in children with Autism

Amy Pearson, Imogen Bosmith and Antonia Hamilton
University of Nottingham
lpxap@nottingham.ac.uk

Previous research has demonstrated that high functioning adults with ASD display atypical processing/recognition of body postures, and that being able to understand and imitate body posture may aid social communication skills in ASD individuals (Reed et al. 2007). If this is true then we may expect children with autism to demonstrate similar atypical recognition skills. We examined posture recognition using a between groups design with 3 groups of children: lower functioning ASD, Mild learning difficulties and typical children (total=113). All children were between the ages of four and eleven and were matched on the basis of BPVS score. Children were shown pictures of bodies, hands and objects in various meaningful and meaningless postures and asked to match the picture that displayed the same item from a different point of view from a choice of two. Results showed no significant differences between the groups on both meaningful and meaningless postures across bodies, hands or objects, suggesting that even lower functioning children with ASD may not have difficulty recognising and matching postures and understanding that postures can be the same even if shown from a different point of view.

Reed, C. L., P. Beall, et al. (2007). Brief Report: Perception of Body Posture—What Individuals with Autism Spectrum Disorder might be missing. *Journal of Autism and Developmental Disorders, 37(8), 1576-1584.*

Using multisensory illusions to ameliorate chronic pain

Catherine Preston[1,2] and Roger Newport[2]
1. Nottingham Trent University
2. University of Nottingham
catherine.preston@ntu.ac.uk

There is increasing evidence that illusion therapies can be beneficial for the amelioration of chronic pain, particularly so for conditions in which the experience of

pain is thought to be cortically driven. For example, mirror therapy and size reduction illusions can reduce the experience of pain in phantom limb pain and complex regional pain syndrome type 1, respectively. Here data is presented from an exploratory experiment looking at the effectiveness of multisensory illusions applied to the painful hands of a group of participants with chronic pain from osteoarthritis. The illusions were found to produce a mean of 50% pain reduction in 85% of those tested. Some participants also spontaneously reported greater range of movement during the illusions. In a second experiment, control participants were asked to rate feelings of ownership and make judgments concerning their movements whilst undergoing a similar illusion. The findings demonstrate that, despite being visually distorted during the illusion, participants still considered the seen hand as their actual hand. In addition, the perceptual judgments for range of movement with that hand were significantly affected as a result of the illusion.

Guns trigger visual orienting

Jason Tipples
University of Hull
j.tipples@hull.ac.uk

Two experiments were designed to test the idea that guns automatically trigger visual orienting. Participants were asked to either detect (Exp 1) or locate (Exp 2) a target that appeared either 105 milliseconds (ms) or 900 ms after the onset of a gun cue. The gun appeared either alone, or with eyes (above the gun) looking in the same direction, or with eyes looking in the opposite direction. The gun and eye direction were uninformative and participants were told to ignore the direction indicated by both cue types. Guns triggered orienting automatically: Responses were faster to targets cued by guns pointing toward a target compared to guns that pointed away from the target location and moreover, this effect was largest after only 105 ms after the gun onset. However, when the eyes looked in the opposite direction to the gun the orienting effect was eliminated. In short, the gun orienting effect can be considered conditionally automatic (Bargh, 1989).

Bargh, J. A. (1989). Conditional automaticity: Varieties of automatic influence in social perception and cognition. In J. S. Uleman & J. A. Bargh (Eds.), Unintended thought (pp. 3-51). London: Guilford.

Mirror neurons are not mandatory for fast and accurate action understanding – Insight from a case of upper limb aplasia

Gilles Vannuscorps[1, 2], Michael Andres[3], and Agnesa Pillon[1, 2]
1. Université catholique de Louvain
2. University of Ghent
gilles.vannuscorps@uclouvain.be

What is the role of mirror neurons (MN) in action understanding? According to the “direct-matching hypothesis” (Rizzolatti et al., 2001), MN play a “fundamental” role in action understanding. Here we evaluated their contribution to fast and accurate action understanding. We presented DC, who suffers a congenital absence of arms and hands, and six control subjects with actions (videotapes, photographs, pantomimes, point light

displays) they had to name as fast as possible. These actions were either (i) actions DC had already performed with the same effector, (ii) manual actions DC performed with his feet, or (iii) actions DC had never performed. If MN play a role in action understanding, we should expect DC to be less accurate or at least less fast for observed actions he cannot match onto its effector congruent (ii and iii) or goal congruent (iii) motor repertoire, than observed actions he can match onto its motor repertoire trough mirror neurons (i). The results indicated that DC named equally well all three types of actions when compared to the controls. These findings showed that the involvement of MN is not mandatory for fast and accurate action understanding.

Rizzolatti, G., Fogassi, L., & Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Review Neuroscience, 2*, 661-670.

Visual adaptation to emotional actions

Joanna Wincenciak[1], Jennifer Ingham[1] and Nick E. Barraclough[1,2]
1. University of Hull
2. University of York
j.wincenciak@2010.hull.ac.uk

We are able to recognise the emotions of other individuals by observing characteristic body movements during their actions. In this study we investigated mechanisms involved in coding emotional actions using a visual adaptation paradigm. We found that after adapting to an action (e.g. walking, lifting a box, sitting) performed conveying one emotion (happy or sad), the subsequent action performed was more likely to be judged as having the opposite emotion. This aftereffect showed similar characteristic dynamics as for other motion and face adaptation aftereffects, for example increasing magnitude with repetition of the adapting action. These emotional action aftereffects cannot be explained by low level adaptation, as they remain significant when actor identity and action differs between the adapting and test stimuli. We also found that emotional aftereffects transferred across faces and whole body actions indicating that emotions may be partially coded irrespective of body part. Our findings provide behavioural support for neuroimaging evidence for body-part independent visual representations of emotions in high-level visual brain areas (Peelen et al, 2010)

Peelen, M.V., Atkinson, A.P., & Vuilleumier, P. (2010). Supramodal representations of perceived emotions in the human brain. *The Journal of Neuroscience, 30*, 10127-10134.

NOTES

Local Information

Accommodation close to campus

The nearest and most reasonably priced hotels to the Conference venue are:

Holiday Inn Express, 7 Chapel Bar, Chapel Quarter, Maid Marian Way, Nottingham, NG1 6JS
Tel: 0115 941 9931. http://www.holidayinn-expressnottingham.co.uk/
From £69.95 per room/night

The Britannia Hotel, St James St, Nottingham, NG1 6BN
Tel: 0871 222 0098. http://www.britanniahotels.com/hotels/nottingham
From £43.00 per room/night

The Rutland Square Hotel, St James St, Nottingham, NG1 6FJ
Tel: 0115 941 1114. http://www.rutlandsquarehotel.co.uk/
From: £49.50 per room/night

Ibis, 16 Fletcher gate, Nottingham, NG1 2FS
Tel: 0115 985 3600. http://www.ibishotel.com/gb/hotel-6160-ibis-nottingham-centre/index.shtml
From £48.00 per room/night

Holiday Inn, Castle Bridge Road, Castle Marina Park, Nottingham, NG7 1GX
Tel: 0115-9935000. http://www.holidayinn.com/
Room from £91.00 per room/night

Wollaton Park Traveloge, Derby Road, Wollaton Vale, Nottingham, NG8 2NR
Tel: 0115 922 1691. http://www2.travelodge.co.uk/
Rooms from £32.50 per room/night

For full details on hotels and places to stay in Nottingham please follow either of the links below:
http://www.booking.com/nottingham
http://www.nottingham.ac.uk/accommodation/visitoraccommodation/offcampusaccommodation.aspx

There are also rooms available on campus. To find out more information please follow the link below:
http://www.nottingham.ac.uk/accommodation/visitoraccommodation/oncampusaccommodation.aspx

Conference Dinner

The conference dinner will be held at the Hemsley Restaurant on Thursday 7th July at 8pm (The Hemsley is located on the University of Nottingham, University Park Campus – No 8 on the campus map, http://www.thehemsley.co.uk). It will take approx 15 minutes to walk from the conference venue to the Hemsley.

The cost will be £32, for 3 courses. EPS members please book and indicate any dietary requirements on the enclosed form which should be returned to Mark Haselgrove, School of Psychology, University of Nottingham, University Park, Nottingham, NG7 2RD before 17th June 2011.

Local Information

Travel

To find the conference venue we recommend that you download and print the University Park Campus Map from The University of Nottingham website (www.nottingham.ac.uk/about/datesandcampusinformation/mapsanddirections/mapsanddirections.aspx).

From Nottingham – approximately 3 miles

By rail: There is one train station in Nottingham city centre. From the train station it is approx 3 miles and a 40-50 minute walk to the conference venue. Alternatively you can take a taxi. There are taxi ranks throughout the city centre and immediately adjacent to the main railway and bus stations. The journey to the campus takes about 15 minutes. You could also catch a local bus (see below).

The National Rail telephone enquiry number is 08457 48 49 50. For train times and live updates see the National Rail Enquiries website (www.nationalrail.co.uk).

By bus: Trent Barton buses – from the Broadmarsh bus station, about 250 metres walk from the railway station, catch one of the following:

North and West Entrances to the University: indigo
East, South and West Entrances: indigo, 18, 32

The following Nottingham City Transport services also pass near or through the campus and can be picked up from stops near Market Square in the city centre. The location in brackets pin points where they stop near the University.

- 13 and 14 (University Boulevard)
- 34 (Portland Hill in the Campus)
- 35/35B (Derby Road)
- 36 (Derby Road)
- 37 (QMC)

The University provides a free Hopper Bus service which runs from University Park Campus to Jubilee Campus, Sutton Bonington Campus and King's Meadow Campus.

From East Midlands Airport – approximately 10 miles

By bus: From East Midlands Airport you can take the Trent Barton indigo service, or the Nottingham City Transport Skylink service. Buses leave from outside the Airport Arrivals hall.

By taxi: The taxi rank is on the terminal forecourt and taxis are normally available 24 hours.

From M1 Motorway

Leave the M1 motorway at Junction 25 to join the A52 to Nottingham. Turn right at The Priory roundabout (about 4 miles from M1), then left at next roundabout to enter the University's West Entrance.

Local Information

Local Taxis

If you wish to call a taxi during your stay, a reliable operator based in central Nottingham is D&G Cars (0115 960 7607). A taxi from Nottingham Station to the conference venue on University Park will cost around £7.50. For the School of Psychology ask the driver to drop you off at the University of Nottingham, South Entrance (off University Boulevard). The School of Psychology is located just through the Security Check in point on the right hand side.

Eating and Drinking on Campus

The Lakeside Arts Centre is home to the Aqua and Cafe L which offer freshly cooked dishes on a daily basis. They offer food from classic hot dishes to deli sandwiches on speciality breads and bagels, and from delicious pastries to freshly baked muffins and cakes, all our items are passionately prepared by our chefs on site.

Portland Building has a Boots and a Student Union shop both of which sell a selection of sandwiches, salads and snacks ideal for lunchtime. The Portland building also has the Mooch Bar which also serves hot and cold snacks during the day time.

Evening meal: Restaurants in Nottingham

There are many restaurants in the centre of Nottingham catering for all tastes and budgets. For a comprehensive list with reviews and menus visit the Go Dine website (http://www.godine.co.uk/restaurants-nottingham-city-centre). Listed below are a few places we would personally recommend.

British – Restaurant 1877, 128 Derby Road, Canning Circus, Nottingham, NG1 5FB
Tel: 0115 958 8008 http://www.restaurant1877.com/

French – Petit Paris, 2 Kings Walk, Nottingham, NG1 2AE
Tel: 0115 947 3767. http://www.petitparisrestaurant.co.uk/

Italian – Strada, The Cornerhouse, Trinity Row, Nottingham,NG1 4DP
Tel: 0115 947 5009 http://www.strada.co.uk/location/nottingham

Thai – The Pretty Orchid, 12 Pepper St (off Bridlesmith Gate), Nottingham, NG1 2GH
Tel: 0115 958 8344. http://www.pretty-orchid.co.uk/

Japanese – Chino Latino, 41 Maid Marion Way, Nottingham, NG1 6GD
Tel: 0115 947 7444. http://www.chinolatino.eu/nottingham

Spanish – La Tasca, 9 Weekday Cross, Nottingham, NG1 2GB
Tel: 0115 959 9456. http://www.latasca.co.uk/nottingham/

South American – Las Iguanas, 4 Chapel Quarter, Chapel Bar, Nottingham, NG1 6JS
Tel: 0115 959 6390. http://www.iguanas.co.uk/nottingham.asp

Local Information

Indian - Laguna, 43 Mount Street, Nottingham, Nottinghamshire. NG1 6HE
Tel: 0115 941 1632. http://www.lagunatandoori.co.uk/

Greek – Eviva Taverna, Gothic House, Barker Street, Nottingham,NG1 1JU
Tel: 0115 958 0243. http://www.eviva-taverna.co.uk/

Seafood – Loch Fyne, 17 King Street, Nottingham, NG1 2AY
Tel: 0115 988 6840. http://www.lochfyne.com/

Places of Interest

As the city stands on a mound of Sherwood sandstone that is riddled with unique man-made caves, one of Nottingham's most intriguing attractions is the **City of Caves exhibition**. Accessed through the Broadmarsh Shopping Centre, this museum gives you the chance to explore part of the **700-year-old cave system**, with highlights including an air-raid shelter and a Victorian slum dwelling.

To learn more about the city's illustrious history head to the **Galleries of Justice**, housed in the imposing Shire Hall, where you can travel through time and learn about **300 years of crime, punishment and law**.

If it's a taste of Nottingham's wonderful architecture you want to see then there are a number of buildings in the city centre and beyond to ensure you won't be disappointed. There's **St Mary's Church** on High Pavement in the trendy Lace Market district, which is reputedly one of the **finest medieval buildings** in the city. Also in the city centre is **Ye Olde Trip to Jerusalem** at the base of Nottingham Castle, which is the **oldest pub in England**.

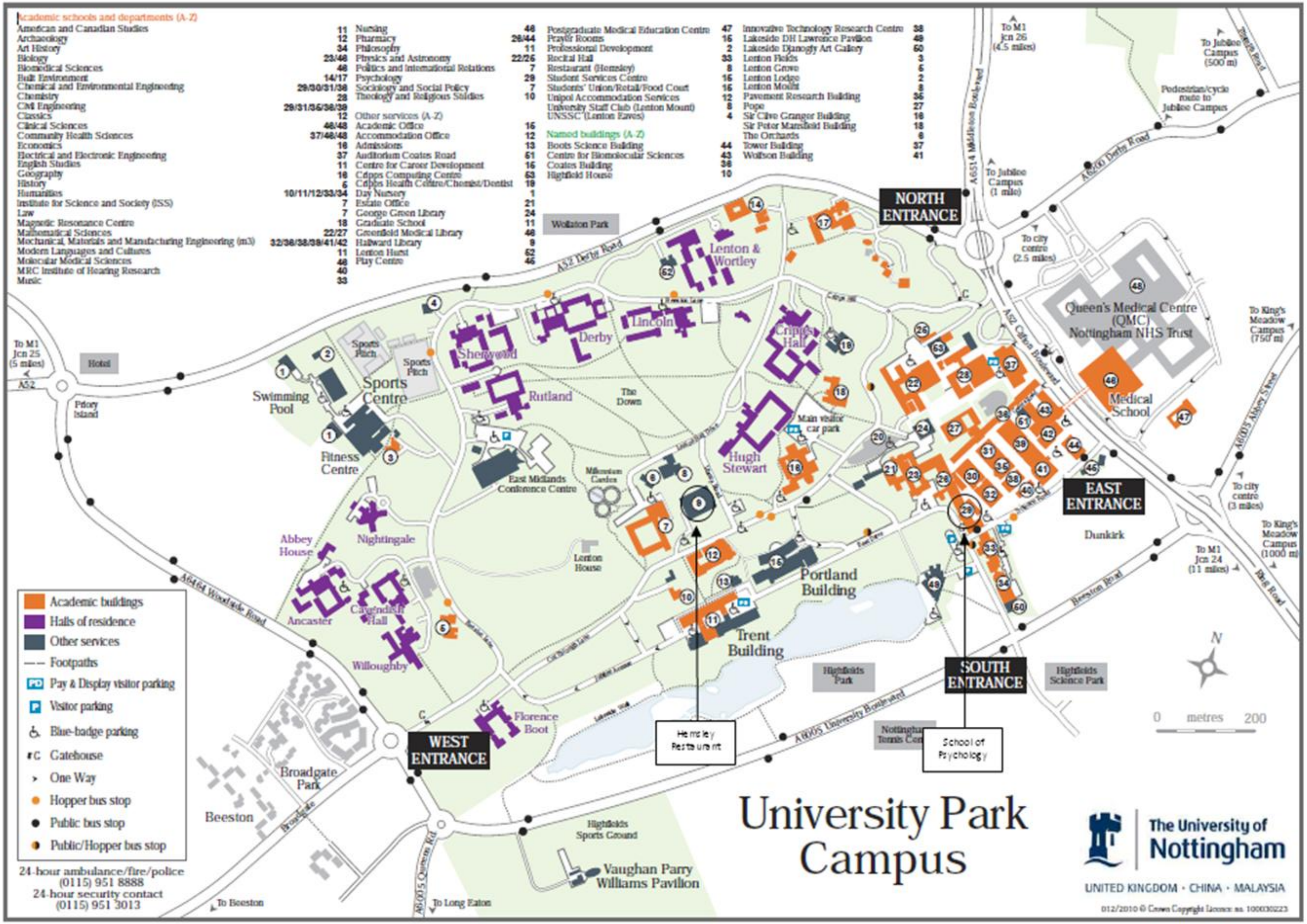
On the outskirts of Nottingham there's **Wollaton Hall**, a fine example of **extravagant Tudor architecture** dating back to 1588, while at Sneiton there's **Green's Mill**, a fully operational windmill and science centre that was once owned by physicist George Green.

Back in the 1700s Nottingham was famous for its lace and there are plenty of attractions here today to commemorate the industry, including the **Lace Centre** on Castle Road, a medieval building where you can see and buy lace, and the **Lace Market Centre** on High Pavement, which has a visitors centre with shop and café.

To stand where the legendary Robin Hood has stood, head out of the city to **Sherwood Forest Country Park**, where you'll find the historic **Major Oak** and a visitors centre depicting how Robin and his Merry Men would have lived.

Also out of town is the **D.H. Lawrence Birthplace Museum** in Eastwood, a heritage centre dedicated to the writer's life housed in his old home. There's also the magnificent **Newstead Abbey** at Ravenshead, the former home of **Lord Byron** set in 200 acres of parkland.

Back in the city centre there is plenty more to see when night falls, thanks to the spooky **Nottingham Ghost and Pub Tours**. The tour starts at the **Salutation Inn** on Main Marian Way and takes you through the older parts of Nottingham near the castle, where the street plan is almost 1,000 years old. A well-informed guide tells you lots of ghost stories on the way round, but not just where ghosts haunt, also why they haunt and the different types of ghosts that exist.



University Park Campus
The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA
Academic schools and departments (A-Z)
Other services (A-Z)
Named buildings (A-Z)
NORTH ENTRANCE
EAST ENTRANCE
SOUTH ENTRANCE
WEST ENTRANCE
Queen's Medical Centre (QMC) Nottingham NHS Trust
Medical School
Dunkirk
Wollaton Park
Hotel
Priory Island
Swimming Pool
Sports Centre
Fitness Centre
Sports Pitch
Sherwood
Rutland
Derby
Lincoln
Lenton & Wortley
Cripps Hall
Hugh Stewart
Main visitor car park
The Downs
East Midlands Conference Centre
Millennium Garden
Lenton House
Portland Building
Trent Building
Abbey House
Nightingale
Ancaster
Cavendish Hall
Willoughby
Florence Boot
Highfields Park
Highfields Science Park
Nottingham Tennis Centre
Highfields Sports Ground
Vaughan Parry Williams Pavilion
Broadgate Park
Beeston
Hemsley Restaurant
School of Psychology
A52 Derby Road
A52 Clifton Boulevard
A6514 Middleton Boulevard
A6005 University Boulevard
A6464 Woodside Road
A6005 Queens Rd
A6200 Derby Road
A6005 Abbey Street
Beeston Road
Ring Road
To M1 Jcn 26 (4.5 miles)
To M1 Jcn 25 (5 miles)
To M1 Jcn 24 (11 miles)
To Jubilee Campus (500 m)
To Jubilee Campus (1 mile)
Pedestrian/cycle route to Jubilee Campus
To city centre (2.5 miles)
To city centre (3 miles)
To King's Meadow Campus (750 m)
To King's Meadow Campus (1000 m)
To Beeston
To Long Eaton
N
0 metres 200
Academic buildings
Halls of residence
Other services
Footpaths
Pay & Display visitor parking
Visitor parking
Blue-badge parking
Gatehouse
One Way
Hopper bus stop
Public bus stop
Public/Hopper bus stop
24-hour ambulance/fire/police (0115) 951 8888
24-hour security contact (0115) 951 3013
012/2010 © Crown Copyright Licence no. 100030223