EPS

Experimental Psychology Society

MANCHESTER MEETING

7-9 JULY 2010

A scientific meeting will be held in the Samuel Alexander Building, The University of Manchester on 7-9 July 2010. The local organiser is Andrew Stewart (Andrew.Stewart@manchester.ac.uk)

Seventeenth EPS Prize Lecture
Thursday 8 July 6.00pm

What is "Theory of mind"?
Dr Ian Apperly, University of Birmingham

Symposium - To accompany the Prize Lecture

Thursday 8 July 2.30pm – 5.30pm

Reading other people's minds
Organiser: Dr Dana Samson

Symposium

Friday 9 July 1.00pm-5.00pm

Sleep and memory
Organiser: Dr Penny Lewis

Poster Session
This will be held in conjunction with the drinks reception on Wednesday evening at 6pm in the Undergraduate Common Room of Coupland Building 1 which is located on Coupland Street (Building 43 on the Campus Map). Delegates may put up posters from 4pm and should take them down at the end of the session.

Platform Presentations
Platform presentations will be held in the Arts Theatre and Lecture Theatre A113 of the Samuel Alexander Building (Building 67 on the Campus Map). Both theatres 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, Andrew Stewart (Andrew.Stewart@manchester.ac.uk)

Refreshments will be served in the Ground Floor Foyer of the Samuel Alexander Building.

The conference dinner will be at the Olive Press (4 Lloyd Street, Manchester, M2 5AB) at 8pm on Thursday 8 July 2010. A booking form/menu is enclosed.

START OF PARALLEL SESSIONS

Session A

Arts Theatre

10.00 **Clare Allely* and Luke Jones** (University of Manchester)
Exploring the role of arousal in experimental manipulations of time perception and information processing.

10.30 **John Wearden** (Keele University)
Are auditory and visual stimuli timed by a common clock? Evidence from a study of interference in temporal memory.

11.00 COFFEE

11.30 **Daniel Müllensiefen*, Andrew Cooper* and Lauren Stewart** (Goldsmiths, University of London)
Predicting item difficulty in a melodic discrimination task using item response theory and computational structure analysis.

12.00 **Tom Mercer* and Denis McKeown** (University of Leeds)
Novelty-based interference in auditory short-term memory.

12.30 **Robert W. Hughes, John E. Marsh*, Francois Vachon* and Dylan M. Jones** (Cardiff University, Université Laval)
Visual attentional load and auditory distraction in serial short-term memory: Support for the duplex-mechanism account.

1.00-2.00 LUNCH

START OF PARALLEL SESSIONS

Session B

Lecture Theatre A113

10.00 **M. Jane Riddoch, Sarah J. Rappoport* and Glyn W. Humphreys** (University of Birmingham)
The effects of stored knowledge on visual selection: Evidence from colour-form coding.

10.30 **Luc Boutsen** (Aston University)
Category-specificity in visual search for objects: Effects of domain and attentional set.

11.00 COFFEE

11.30 **Rebecca Lawson and Sarah Powell*** (University of Liverpool)
How do we classify everyday objects into groups?

12.00 **Rhodri Cusack, Michele Veldsman*, Lorina Naci*, Daniel J. Mitchell* and Annika Linke*** (MRC Cognition and Brain Sciences Unit, University of Cambridge)
Ventral visual tuning to sensory and semantic features differs by object.

12.30 **Daniel J Mitchell* and Rhodri Cusack** (MRC Cognition and Brain Sciences Unit)
Decoding sensory, semantic and emotional feature tuning, during perception and imagery, from occipitotemporal responses to 200 objects.

1.00-2.00 LUNCH

Session A

Arts Theatre

2.00 **EPS/British Science Association Prize – Samantha Wilkinson*** (Lancaster University)
The effects of biasing story contexts on 7- and 11-year-olds' false recognition compared to recognition on standard DRM lists.

2.30 **Steve Dewhurst and Rachel Anderson*** (Lancaster University, Leeds Metropolitan University)
Individual differences in susceptibility to false memories: The role of retrieval style.

3.00 **Susan Sherman*, Akira Mukai*, Emma Byatt* and Jeanette Fellows*** (Keele University, Takamatsu University) (Sponsor John Wearden)
False memories for famous names and faces.

3.30 **Ciara Greene*, Pooja Bahri* and David Soto** (Imperial College London)
Musical induction of emotion following encoding modulates subsequent memory.

4.00 TEA

4.30 **Rachel J. Anderson*, Stephen A. Dewhurst and Robert A. Nash*** (Leeds Metropolitan University, Lancaster University)
The effect of retrieval style on specificity of future thought.

5.00 **John E. Marsh*, Robert W. Hughes, C. Philip Beaman and Dylan M. Jones** (Cardiff University, University of Reading)
A competitor inhibition account of semantic auditory distraction.

5.30 **Geoff Cole and Gustav Kuhn** (University of Essex, Brunel University)
What the experimenter's prime tells the observer's brain.

6.00-8.00 POSTERS AND DRINKS RECEPTION - Undergraduate Common Room, Coupland Building 1

Session B

Lecture Theatre A113

2.00 **Tom Stafford*, Tom Walton* and Peter Redgrave*** (University of Sheffield) (Sponsor Elizabeth Milne)
A novel task for the investigation of action learning.

2.30 **Emma Gowen*, Claire Bradshaw*, Adam Galpin*, Adam Lawrence* and Ellen Poliakoff** (University of Manchester, University of Salford)
Examining the effect of time course, view point and attention on visuomotor priming.

3.00 **Rachael Ludford*, M. Jane Riddoch and Glyn Humphreys** (University of Birmingham)
Hand dominance and the affordance effect: The same difference?

3.30 **Christoph Teufel*, Arjun Kingdon*, James Ingram*, Daniel Wolpert* and Paul Fletcher*** (University of Cambridge) (Sponsor Ian Apperly)
Deficits in sensory prediction correlate with schizotypy.

4.00 TEA

4.30 **Marco Bertamini, Callum Wright* and Nicola Bruno*** (University of Liverpool, University of Parma)
Haptic perception of object size after a change in hand size.

5.00 **Laura Mirams*, Ellen Poliakoff, Richard Brown* and Donna Lloyd** (University of Manchester)
"Seeing is believing"- Vision of the body increases interference on the somatic signal detection task.

5.30 **Rochelle E. Cox*, Amanda J. Barnier*, Robyn Langdon* and Max Coltheart** (Macquarie University) (Sponsor Glyn Humphreys)
Using experimental hypnosis to create laboratory analogues of clinical delusions.

6.00-8.00 POSTERS AND DRINKS RECEPTION - Undergraduate Common Room, Coupland Building 1

Session A

Arts Theatre

9.00 **Briony D. Pulford, Poonam Gill* and Scarlett E. Richard*** (University of Leicester)
Experiencing a lucky event reverses ambiguity aversion

9.30 **Rosey Stock*, John E. Fisk*, Cathy Montgomery* and Steve Fairclough*** (Liverpool John Moores University, University of Central Lancashire) (Sponsor Ruth Ogden)
Investigating the involvement of thinking styles in probabilistic reasoning.

10.00 **Julia Badger*, Laura Shapiro, Alan Bates*, Sophie Stevens* and Joanna Hardy*** (Aston University, Twycross Zoo)
Evidence that category induction develops through domain-specific knowledge and experience

10.30 COFFEE

11.00 **David A. Booth and Suzanne Higgs*** (University of Birmingham)
Why should extreme sweetness make us feel like smiling?

11.30 **Megan Freeth*, Tom Foulsham* and Alan Kingstone** (University of Sheffield, University of British Columbia)
Patterns of eye movements during an interview.

12.00 **Sarah White, Jan Zwickel* and Uta Frith** (University College London, Ludwig Maximilians University)
Agents without mental states: Pinpointing the divide in Asperger Syndrome.

12.30 **Heather Ferguson* and Richard Breheny***(University of Kent, University College London) (Sponsor Ian Apperly)
What do listeners' eyes reveal about communicating false beliefs?

1.00-2.00 LUNCH

Session B

Lecture Theatre A113

9.00 **Cathy Montgomery*, Matt Field*, Amanda Atkinson*, Andrew Goudie, Jon Cole* and Harry Sumnall*** (Liverpool John Moores University, University of Liverpool) (Sponsor Ruth Ogden)
Effects of alcohol preload on attentional bias towards cocaine related cues.

9.30 **Jeannie Judge, Rebecca A. Harris* and Paul J. Taylor*** (University of Central Lancashire)
Individual differences in selective visual attention: The role of perceptual load, case mixing and everyday distractibility.

10.00 **Patrick Rabbitt, Mary Lunn* and Dan Lunn*** (University of Oxford, University of Western Australia).
Good days and bad days: Individual differences and variability in performance.

10.30 COFFEE

11.00 **Anna Weighall* and Gerry T.M. Altmman** (Sheffield Hallam University, University of York)
Explaining sentence complexity effects in children: Children's comprehension of spoken centre-embedded sentences.

11.30 **Nina Kazanina*** (University of Bristol) (Sponsor Sven Mattys)
Morphological representations in the lexicon: Evidence from homonym suffixes.

12.00 **Lesya Ganushchak*, Andrea Krott and Antje Meyer** (University of Birmingham)
Lexical representations of SMS shortcuts.

12.30 **Linda Mortensen and Antje S. Meyer*** (Max Planck Institute for Psycholinguistics, University of Copenhagen, University of Birmingham)
Naming associated objects: Evidence for parallel processing.

1.00-2.00 LUNCH

Session A

Arts Theatre

2.00 **Milena Dzhelyova*, Davis Bulls*, Vinet Coetzee*, Ian Stephen*, Dengke Xiao*, Ines Jentzsch and David Perrett** (University of St. Andrews)
Heads down: A postural cue to cooperation.

Symposium: Reading other people's minds
Organiser: Dr Dana Samson

2.30 **Hannes Rakoczy*** (University of Göttingen)
The development of belief-desire psychology and executive function in early childhood.

3.00 **Victoria Southgate*** (Birkbeck, University of London)
Motivations for mindreading in infancy.

3.30 TEA

4.00 **Stephen Butterfill*** (University of Warwick)
Joint action and knowing others' minds.

4.30 **Nathan J. Emery*** (Queen Mary University of London)
What birds can tell us about how to read minds.

5.00 **Roland Zahn*** (University of Manchester)
Social knowledge and values - a neurocognitive perspective.

End of Symposium

5.30 **EPS Business Meeting** – (Lecture Theatre A113, Samuel Alexander Building - Building 67 on the Campus Map)

6.00 **EPS Prize Lecture – Dr Ian Apperly** (University of Birmingham)
What is "theory of mind"?
(Arts Theatre, Samuel Alexander Building - Building 67 on the Campus Map)

Session B

Lecture Theatre A113

2.00 **Sarah J. Rappaport*, M. Jane Riddoch and Glyn W. Humphreys** (University of Birmingham)
From helping to hurting: Shifting the effects of similarity on visual extinction.

2.30 **Christopher Kent and Christina Howard*** (University of Bristol)
The speed of information processing within the focus of visual attention.

3.00 **Louise A. Brown* and James R. Brockmole** (University of Edinburgh, University of Notre Dame)
Binding visual features in working memory draws upon attentional resources in both younger and older adults.

3.30 TEA

4.00 **Snehlata Jaswal* and Robert H Logie** (University of Edinburgh) (Sponsor Dana Samson)
The contextual interference effect in visual feature binding: What does it say about the role of attention in binding?

4.30 **Lucy S. Andrews* and Jason J. Braithwaite** (University of Birmingham)
Re-examining the capacity limits of negative priming: Evidence for negative priming with multiple distractors.

5.00 **Catherine Thompson* and David Crundall** (University of Nottingham) (Sponsor Antonia Hamilton)
Carry-over of scanning behaviour between two unrelated visual search tasks.

5.30 **EPS Business Meeting** – (Lecture Theatre A113, Samuel Alexander Building - Building 67 on the Campus Map)

6.00 **EPS Prize Lecture – Dr Ian Apperly** (University of Birmingham)
What is "theory of mind"?
(Arts Theatre, Samuel Alexander Building - Building 67 on the Campus Map)

Session A

Arts Theatre

9.00 **Sven Mattys and Lukas Wiget*** (University of Bristol)
Interface between cognitive load and spoken-word recognition

9.30 **Jonathan Catling and Emma Preece*** (University of Worcester)
Pathways to age of acquisition: The effects of filler words on AoA effects in word naming.

10.00 COFFEE

10.30 **Julie A. Kirkby*, Hazel I. Blythe, Denis Drieghe and Simon P. Liversedge** (University of Southampton, Ghent University)
Reading text increases binocular disparity in dyslexic children.

11.00 **Chuanli Zang*, Guoli Yan*, Xuejun Bai*, Qian Bian*, Lei Cui*, Wei Qi*, Keith Rayner and Simon P. Liversedge** (Tianjin Normal University, University of California, University of Southampton)
Using stroke removal to investigate Chinese character identification during reading: Evidence from eye movements.

11.30 **Abubaker A. A. Almabruk*, Kevin B. Paterson and Timothy R. Jordan** (University of Leicester)
Investigating hemispheric asymmetries in foveal word recognition: Evidence from Arabic.

12.00-1.00 LUNCH

Session B

Lecture Theatre A113

9.00 **Daniel T. Smith and Amanda Ellison*** (Durham University)
Deficits of spatial working memory induced by abduction of the eye.

9.30 **David Soto, Sabira K. Mannan*, Christopher Kennard*, Daniela Potter* and Yi Pan*** (University of Oxford, Imperial College London, Zhejiang University)
Early oculomotor capture by new onsets driven by the contents of working memory.

10.00 COFFEE

10.30 **Clive R. Rosenthal*, Christopher Kennard* and David Soto** (University of Oxford, Imperial College London)
Visuospatial sequence learning without seeing.

11.00 **Anthony Lambert, Myoung-Ju Shin* and Narisa Marrett*** (University of Auckland)
The role of dorsal and ventral pathways in visual orienting and conscious perception.

11.30 **Deborah Talmi*, Dominik R. Bach*, René Hurlemann*, Alexandra Patin* and Raymond J. Dolan*** (University of Manchester, University College London, University of Bonn) (Sponsor Dana Samson)
Relevance detection in the absence of a functional amygdala.

12.00-1.00 LUNCH

Session A

Arts Theatre

Symposium: Sleep and memory
Organiser: Dr Penny Lewis

1.00 **Eus J.W. Van Someren*, Ysbrand D. Van Der Werf*, Ellemarije Altena*, Joukje Oosterman* and Rixt Riemersma-van der Lek*** (Netherlands Institute for Neuroscience, VU University, Leiden University Medical Center)
Cognitive vulnerability to disturbed sleep in elderly people.

1.30 **Bjorn Rasch*** (University of Basel)
Maintaining memories by reactivation.

2.00 **Lisa Marshall*** (University of Lübeck)
Slow wave sleep, EEG slow oscillations and the formation of memory.

2.30 **Atsuko Takashima*, Eelco van Dongen*, Markus Barth*, David G. Norris* and Guillén Fernández*** (Radboud University Nijmegen)
Offline-consolidation of face-location association in shallow sleep after learning.

3.00 TEA

3.30 **Steffen Gais*** (Ludwig Maximilian University)
Systems memory consolidation during sleep.

4.00 **Szu-Han Wang*, Dorothy Tse* and Richard G. M. Morris** (University of Edinburgh)
Information updating in mental schema: The role of the hippocampus and frontal cortex.

4.30 Discussion

End of Symposium

End of meeting

Session B

Lecture Theatre A113

1.00 **Katie L.H. Gray*, Wendy J. Adams* and Matthew Garner*** (University of Southampton) (Sponsor Nick Donnelly)
Dissociating the effects caused by emotional content and low-level visual characteristics in the unconscious processing of emotional faces.

1.30 **Philip Pell* and Anne Richards** (Birkbeck University of London)
Cross-expression adaptation aftereffects.

2.00 **Stefan R. Schweinberger, Nadine Kloth* and David M.C. Robertson*** (DFG Research Unit Person Perception, Friedrich Schiller University of Jena)
Hearing facial identities: ERP correlates of face-voice integration in speaker identification.

2.30 **Holger Wiese and Stefan R. Schweinberger** (Friedrich Schiller University of Jena)
The role of expertise for face recognition memory: ERP evidence from a combined own-race and own-age bias experiment.

3.00 TEA

3.30 **Peter J. Hills and Michael B. Lewis** (Anglia Ruskin University, Cardiff University)
One year is sufficient to develop an own-age bias in face recognition.

4.00 **Jie Sui*, Magdalena Chechlacz* and Glyn Humphreys** (University of Birmingham)
Damage to the right frontal and temporal cortex disrupt opposite uses of self-face priority.

4.30 **Gillian Slessor*, Gillian Laird*, Louise H. Phillips, Rebecca Bull* and Dimitra Filippou*** (University of Aberdeen, University of Plymouth) (Sponsor Dana Samson)
Age-related differences in gaze following: Does the age of the face matter?

End of meeting

Reserve List

Daniel Müllensiefen*, Lauren Stewart and Geraint A. Wiggins* (Goldsmiths, University of London)
What is the level of abstraction of cognitive models of melodic contour?

1. Sarah E. Bodley Scott* and Dana Samson (University of Nottingham)
Predicting empathy in self and others.

2. Jason J Braithwaite, Johan Hulleman and Dana Samson (University of Birmingham, University of Hull, University of Nottingham)
Cognitive correlates of the Out-of-Body experience (OBE) in the psychologically normal population.

3. Helen Brown*, Gareth Gaskell and Anna Weighall* (University of York, Sheffield Hallam University)
Word learning in children benefits from a period of offline consolidation.

4. Tom Bullock* and Elizabeth Milne (University of Sheffield)
The effects of cognitive load on change-blindness.

5. Mingyuan Chu* and Antje S. Meyer (University of Birmingham, Max Planck Institute for Psycholinguistics)
Name-picture verification as a control measure for object naming: Data from British English speakers.

6. Emily Connaughton*, Robyn Langdon*, Shannon Cooper*, Kate Martin*, Greg Savage* and Max Coltheart (Macquarie University, Royal Rehabilitation Centre Sydney)
Voice-identity processing and misidentification delusions.

7. Rachel Cooper*, Peter Hills, Mike Pake* and Eamon Strain (Anglia Ruskin University)
Eye-tracking the own-race and own-gender biases in face recognition.

8. Nicola Cutting*, Sarah Beck and Ian Apperly (University of Birmingham)
Children's difficulties innovating tools: A mental flexibility problem?

9. Katherine Donnelly*, Nathalia Gjersoe* and Bruce Hood (University of Bristol)
When pictures lie: Children's misunderstandings of photographs.

10. Simon Durrant*, Charlotte Taylor* and Penelope A. Lewis* (University of Manchester, University College London) (Sponsor Matthew Lambon Ralph)
Statistical representations are strengthened over a night of sleep.

11. Tiina M. Eilola* and Jelena Havelka (Nottingham Trent University, University of Leeds)
Behavioural and physiological responses to the emotional and taboo Stroop tasks in native and non-native speakers of English.

12. Marios Eliades*, Isabelle Blanchette* and Warren Mansell* (University of Manchester, University of Quebec) (Sponsor Andrew Stewart)
How do emotional contents modulate the belief-bias effect?

13. Rachel Grenfell-Essam* and Geoff Ward (University of Essex)
List length effects and strategy use in free and serial recall.

14. Matthew Haigh* and Andrew J. Stewart (University of Manchester)
Promises and tips: Are readers sensitive to conditional indirect meaning?

15. Becky Haynes*, Kevin A. Davies*, Paul S. Tofts*, Nick G. Dowell* and Jennifer M. Rusted (Brighton and Sussex Medical School, University of Sussex)
Quantitative MRI and cognitive performance in Systemic Lupus Erythematosus (SLE).

16. Lai-Sang Iao* and Susan Leekam* (Cardiff University) (Sponsor William Macken)
Non-specificity of theory of mind in children with and without Autism Spectrum Disorder (ASD): Evidence from a new non-verbal false sign task.

17. Pauline Insch*, Louise H. Phillips, Rebecca Bull*, Gillian Slessor* and Donald Mowat* (University of Aberdeen, Royal Cornhill Hospital) (Sponsor Dana Samson)
Older adults show differential slowing during theory of mind reasoning.

18. Amy Irwin*, Kathryn Mearns* and Margaret Watson* (University of Aberdeen) (Sponsor Deborah Hall)
Why do dispensing errors occur? A cognitive approach to pharmacist dispensing error.

19. Donna Lloyd, Victoria Gillis*, Elizabeth Lewis*, India Morrison* and Martin Farrell* (University of Manchester, Göteborg University)
The effect of variations in tactile stimulation on the rubber hand illusion.

20. Kirsten J. McKenzie*, Donna M. Lloyd, Richard J. Brown* and Ellen Poliakoff (University of Manchester)
Investigating the mechanisms of visually evoked touch.

21. Eleanor Miles*, Richard Brown* and Ellen Poliakoff (University of Sheffield, University of Manchester)
Is the experience of perceptual illusions related to body experience in everyday life? An investigation using the Rubber Hand Illusion.

22. Erika Nurmsoo*, Shiri Einav*, Tara Webb* and Bruce Hood (University of Bristol, Oxford Brooks University)
Use of gaze to judge friendliness: A study of ASD and typical development.

23. Ruth S. Ogden and Luke A. Jones (Liverpool John Moores University, University of Manchester)
Speeding up the clock using click-trains: An extension into vibrotactile timing.

24. Shekeila Palmer*, Jelena Havelka and Johanna van Hooff (University of Leeds, Vrije Universiteit Amsterdam)
The consolidation of recognition memory over time: An ERP investigation into vocabulary learning.

25. Amy Pearson*, Antonia Hamilton and Danielle Ropar* (University of Nottingham)
Spatial perpspective taking: How do we mentally transform bodies and objects?

26. Adrian Roper* and Andrew Mayes (University of Manchester)
Is the contribution of familiarity to associative recognition related to component domain or the specific components themselves?

27. Zeshu Shao*, Ardi Roelofs* and Antje S. Meyer (University of Birmingham, Radboud University Nijmegen, Max Planck Institute for Psycholinguistics)
Naming speed is negatively related to working memory capacity.

28. Jakke Tamminen*, M. Gareth Gaskell, Jessica D. Payne*, Erin J. Wamsley* and Robert Stickgold* (University of Manchester, University of York, University of Notre Dame, Harvard Medical School, Beth Israel Deaconess Medical Centre)
Sleep spindle activity correlates with integration of newly learned words in the mental lexicon.

29. Alejandro Vicente-Grabovetsky* and Rhodri Cusack (MRC Cognition and Brain Sciences Unit)
Individual differences in Multi-Voxel Pattern Analysis of retinotopy predict performance in a visual short-term memory task.

30. Jessica J. Wang* and Ian A. Apperly (University of Birmingham)
Automatic visual perspective-taking in adults- How much calculation can we do whilst being efficient?

Exploring the role of arousal in experimental manipulations of time perception and information processing.

Clare Allely and Luke Jones
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Treisman, Faulkner, Naish and Brogan (1990) pioneered a technique to speed up a person's internal clock using repetitive stimulation in the form of clicks trains, since replicated in a number of studies (e.g., Penton-Voak, Edwards, Percival, & Wearden, 1996; Wearden, Norton, Martin, & Montford-Bebb, 2007). We have recently shown that speeding up the internal clock also leads to an increase in information processing speed (Jones, Allely & Wearden, *submitted*), e.g. reaction time, and the speed of memory encoding. We investigated whether arousal is the factor by which clicks cause these effects. Experiment 1 used emotional visual stimuli, which had no significant effect on the verbal estimates of tones they preceded. Similarly, Experiment 2 and 3 explored the effect of emotional *auditory* stimuli and also found no significant effect. Experiment 4 investigated electrophysiological (as well as behavioural) measures in a task of verbal estimation of tones when preceded with either clicks or silence. While the effect of clicks was found in the behavioural measurement (overestimation of duration of tones on trials preceded by clicks), there was no evidence of any physiological arousal. These findings force us to reconsider the mechanism by which repetitive stimulation produces it effects.

Jones, L.A., Allely, C., & Wearden, J.H. *(submitted)*. Click trains and the rate of information processing: Does "speeding up" subjective time make psychological processes run faster? *Quarterly Journal of Experimental Psychology*.

Penton-Voak, I.S. Edwards, H., Percival, A., & Wearden, J.H. (1996). Speeding up an internal clock in humans? Effects of click trains on subjective duration. *Journal of Experimental Psychology: Animal Behaviour Processes, 22*, 307-320.

Treisman, M., Faulkner, A., Naish, P.L.N., & Brogan, D. (1990). The internal clock: evidence for a temporal oscillator underlying time perception with some estimates of its characteristic frequency. *Perception, 19*, 705-743.

Wearden, J.H., Norton, R., Martin, S., & Montford-Bebb, O. (2007). Internal clock processes and the filled-duration illusion. *Journal of Experimental Psychology. Human Perception and Performance, 33*, 716-729.

Are auditory and visual stimuli timed by a common clock? Evidence from a study of interference in temporal memory

John Wearden
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It has been known since the 19th. Century that auditory stimuli have longer subjective durations than visual ones of the same actual length, and that they are usually timed more precisely. But are stimuli in different modalities timed by fundamentally

different timing systems, or by a "common clock"? The present research uses the idea that interference between items in memory informs us about internal representations. A temporal generalization method was used, where people received a standard duration then had to judge whether or not subsequent comparison stimuli had the same duration as the standard. The experiment proceeded in blocks, and both the standards and comparisons changed between blocks. Test blocks involved a 400 ms standard, and these were interleaved with "interference" blocks where standards and comparisons were systematically longer, or shorter. Performance on test blocks was affected by the duration of stimuli in the interfering blocks, even though between-block comparisons were never required. Most interestingly, interference seemed about equal when the stimuli in different blocks came from the same modality (whether auditory or visual) or different ones, suggesting a "common code" for duration in memory, even in the absence of any explicit comparisons between auditory and visual stimuli.

Predicting item difficulty in a melodic discrimination task using item response theory and computational structure analysis

Daniel Müllensiefen, Andrew Cooper and Lauren Stewart
Goldsmiths, University of London
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Here, we interrogate data acquired from three subtests of the MBEA Test Battery of Amusia using item response theory and computational analysis of structural features of the stimuli in order determine which structural features present in the stimuli best accounted for differences in difficulty across items. Participants were administered three subtests of the MBEA requiring a same/different judgement on two melodic phrases. Then, an item response model was fitted yielding a difficulty parameter for each item. We then used classification trees to distinguish high versus low difficulty items based on measures of structural similarity between both phrases of each item. According to the classification model, the single best predictor of difficulty was similarity in interval entropy. Using only this predictor, the model accurately classified 78% of items according to difficulty level. A secondary analysis focussed on the three individual subtests with classification accuracies of 92%, 86% and 93%. Complementary to the melodic parameters that the subtests were designed to test for, other melodic features turned out to be important predictors of item difficulty. The computational approach used here provides novel insights into the rich cognitive strategies that underlie tasks of melodic discrimination even in controlled lab testing.

Novelty-based interference in auditory short-term memory

Tom Mercer and Denis McKeown
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Research exploring short-term forgetting has demonstrated that an auditory memory trace may be disrupted by perceptually similar stimuli. Although this "similarity-based" interference has been reported for both pitch and timbre comparisons between tones (e.g. Deutsch, 1970; Starr & Pitt, 1997), it remains poorly understood. In revisiting

this phenomenon for timbre comparisons in the present experiments, our participants compared standard and comparison complex tone stimuli over a five or 10 second retention interval and judged whether they differed. When the stimuli did differ, they did so in a single spectral frequency component. A distractor tone presented during the retention interval disrupted performance when it included this salient frequency component, but the distractor also reduced performance on the task when it contained entirely novel components – a finding incompatible with the notion of similarity-based interference. This "novelty-based" interference occurred regardless of the temporal position of the distractor and even persisted when the distractor was presented two seconds *prior* to the standard. These findings are fully compatible with the recent timbre memory model of McKeown & Wellsted (2009) and correspond well with a recent feature-overwriting account of interference in verbal short-term memory (Oberauer, 2009).

Deutsch, D. (1970). Tones and numbers: Specificity of interference in immediate memory. *Science*, *168*, 1604-1605.

McKeown, D., & Wellsted, D. (2009). Auditory memory for timbre. *Journal of Experimental Psychology: Human Perception and Performance, 35*, 855-875.

Oberauer, K. (2009). Interference between storage and processing in working memory: Feature overwriting, not similarity-based competition. *Memory & Cognition, 37*, 346-357.

Starr, G. E., & Pitt, M. A. (1997). Interference effects in short-term memory for timbre. *Journal of the Acoustical Society of America, 102*, 486-494.

Visual attentional load and auditory distraction in serial short-term memory: Support for the duplex-mechanism account

Robert W. Hughes[1], John E. Marsh[1], Francois Vachon[1,2] and Dylan M. Jones[1]
1. Cardiff University
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The impact of varying the attentional load involved in a visually-based serial short-term memory task on the extent to which performance of that task is disrupted by task-irrelevant sound was examined. Increased attentional load—implemented by changing the perceptual discriminability of the to-be-remembered stimuli—had no impact on the typical disruption of visual-verbal serial recall by continuously changing auditory stimuli (the changing-state effect; Experiment 1). In stark contrast, the same increase in attentional load abolished the usual disruption of serial recall produced by a single deviant sound (the deviation effect). This selective impact of attentional load is problematic for attention-depletion accounts of the changing-state effect but is in line with a duplex-mechanism account of auditory distraction: Serial memory can be disrupted either through a general attentional capture mechanism (by a deviant) or through interference-by-process in which a continuously changing sound sequence competes specifically with the serial rehearsal process engaged to perform the focal task.

The effects of stored knowledge on visual selection: Evidence from colour-form coding

M. Jane Riddoch, Sarah J. Rappoport and Glyn W. Humphreys
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Influential theories of visual attention, such as Treisman's (1980) Feature Integration Theory, assume that serial attention is required in order to achieve the binding of perceptual features. We report evidence from both normal participants and neuropsychological patients that contradicts this proposal, suggesting that colour and form can be bound pre-attentively when the stimuli have a learned relationship (red strawberry, yellow banana). For example, in visual search with normal participants, targets defined by a conjunction of colour and shape can pop-out against distractors if the object appears in its standard colour, whereas in control conditions there is evidence of serial search when the items carry incorrect colours. In neuropsychological studies, objects that carry their standard colours are found to group more effectively, and through this facilitate recovery from extinction. These data suggest that for objects with a diagnostic colour, the colour and shape are inextricably linked in their stored representations (Tanaka, Weiskopf, & Williams, 2001), and these bound colour-form representations can be accessed in a spatially parallel manner prior to the application of serial attention. The implications for understanding processes involved in visual binding are discussed.

Tanaka, J. W., Weiskopf, D., & Williams, P. (2001). The role of colour in high-level vision. *Trends in Cognitive Sciences, 5*, 211-215.

Treisman, A., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology, 12*, 97-136.

Category-specificity in visual search for objects: Effects of domain and attentional set

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Object processing can be influenced by the semantic category of the target at different levels of specificity (superordinate: animal, plant; domain: living, non-living). This study investigated the effect of domain on object selection in visual search. Search displays contained objects from living and nonliving categories, with the target always present. The target belonged to a unique category (e.g., animal, a living category) and was accompanied by distractors from different categories belonging either to the same domain as the target, or not (e.g., same domain: plant, fruit; different domain: vehicle, tool). In Experiment 1, observers judged whether the target belonged to one of two pre-defined categories which were from the same domain. Performance was affected by the domain context: Discrimination of a living target was faster among nonliving distractors, and vice versa. Experiment 2 examined whether this domain-specific interference was dependent upon attentional set. The same objects were surrounded by shapes for which observers performed a conjunction search. If attention to the target shape caused automatic semantic processing of the object within, similar domain-specific effects could

be expected. However, there was no effect of domain context. The results suggest that semantic interference at the domain level is contingent on top-down selection.

How do we classify everyday objects into groups?

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Object classification is necessary for many cognitive tasks but little is known about how people sort items into sets in the absence of explicit guidance or feedback. One long-standing claim is that there is a developmental trend with children primarily sorting thematically (dog/kennel/lead) and adults mainly sorting taxonomically (dog/cat/pig). However, Murphy (2001) demonstated that adult sorting strategies were sensitive to the stimuli provided whilst Milton and Wills (2009) reported that people often persisted with their initial sorting strategy. We extended these small-scale studies by asking three groups of adults to do a simultaneous free sort of 150 pictures of diverse, familiar objects. Before the main sorting task, the taxonomic and thematic groups sorted nine items which were chosen to encourage taxonomic and thematic sorting respectively. The control group did only the main sort. All participants produced both taxonomic and thematic sets in the main task. The first few sets created were predominantly taxonomic. Later sets were mainly thematic. Finally, priming modulated these effects. The taxonomic group produced more taxonomic sets than the thematic group. However, this priming was relatively weak, with effects due to the stimuli dominating performance. These results suggest that earlier findings were strongly influenced by task demands.

Milton, F., & Wills, A. J. (2009). Long-term persistence of sort strategy in free classification. *Acta Psychologica, 130*, 161-167.
Murphy, G. L. (2001). Causes of taxonomic sorting by adults: A test of the thematic-to-taxonomic shift. *Psychonomic Bulletin and Review*, 8, 834-839.

Ventral visual tuning to sensory and semantic features differs by object

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A key challenge of object recognition is achieving a balance between selectivity (for features that distinguish object classes) and invariance (to differences within classes). Computational and cognitive models predict that optimal selectivity for features will differ by object, and here we investigate whether this is reflected in visual representations in the human ventral stream. We describe a new real-time neuroimaging method, Dynamically Adaptive Imaging, that enabled measurement of neural selectivity along multiple feature dimensions for single referent objects. The neural response evoked by a referent was compared to that evoked by 91 naturalistic objects using multi-voxel pattern

analysis. Iteratively, the objects evoking the most similar responses were selected and presented again, to converge upon a subset that characterizes the referent's "neural neighborhood". This was used to derive the feature selectivity of the response. For three different referents, we found strikingly different selectivity, both in individual features and in the balance of tuning to sensory versus semantic features. Additional analyses placed a lower bound on the number of distinct activation patterns present. The results suggest that either the degree of specificity available for object representation in the ventral stream varies by class, or that different objects evoke different processing strategies.

Decoding sensory, semantic and emotional feature tuning, during perception and imagery, from occipitotemporal responses to 200 objects

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A new Dynamically Adaptive fMRI (DAI) method is used to characterise multidimensional neural tuning across a large set of 200 naturalistic images. Sensitivity is focused on the representational space in the neighbourhood of a predefined reference object, by iteratively discarding those stimuli that evoke the most dissimilar activity patterns to this referent. In two critical manipulations, we vary the identity of the reference object, and whether it is imagined or freely viewed. We find significant encoding of semantic and emotional information in the occipitotemporal region of interest, during both perception and mental imagery. For example, when participants are imagining a picture of knives, the two images that evoke the most similar activity pattern to this mental image are a sword and a knife; the other images that are neurally similar tend to be inanimate and rated as unpleasant more often than would be expected by chance. These images are not especially similar in their basic visual characteristics, and selection of lower-level sensory features is less robust. The balance of tuning along the various feature dimensions is dependent on the particular referent (knives/dolphin), and whether it is being viewed or imagined.

EPS/British Science Association Prize

The effects of biasing story contexts on 7- and 11-year-olds' false recognition compared to recognition on standard DRM lists

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This talk presents a research study that investigated the effects of embedding standard Deese-Roediger-McDermott (DRM) (Deese, J., 1959 and Roediger, H.L., III & McDermott, K.B., 1995) lists into stories whose context was either biased toward or away from the overall theme of the DRM list. Children aged 7- and 11- years-old heard these stories and their false recognition was assessed. Relative to standard DRM lists it

was found that both the 7- and 11-year-olds' false memory rates increased when they heard the 'bias-toward' stories and decreased when they heard the 'bias-away' stories.

Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology, 58*, 17-22.

Roediger, H. L., III, & McDermott, K. B. (1995). Creating false memories: Remembering words not presented on lists. *Journal of Experimental Psychology: Learning, Memory and Cognition, 21*, 803-814.

Individual differences in susceptibility to false memories: The role of retrieval style

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Previous studies of false memories have found substantial individual differences in susceptibility to the Deese/Roediger-McDermott (DRM) illusion. The current study investigated whether susceptibility to the DRM illusion is influenced by retrieval style. Participants completed the Sentence Completion for Events from the Past Test (Raes et al., 2007) to determine whether they had a specific or general style of retrieving autobiographical memories. They then studied ten DRM lists and were given tests of free recall after each list. There were no group differences in correct recall, but participants categorised as having a specific retrieval style showed higher levels of false recall relative to participants categorised as having a general retrieval style. The findings show that habitual styles of autobiographical memory retrieval influence susceptibility to associative memory illusions.

Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology, 58*, 17-22.

Raes, F., Hermans, D., de Decker, A., Eelen, P., & Williams, J. M. G. (2003). Autobiographical memory specificity and affect regulation: An experimental approach. *Emotion, 3*(2), 201-206.

Roediger, H.L., & McDermott, K.B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 21*, 803-814.

False memories for famous names and faces

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The Deese-Roediger-McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995) enables the creation of false memories for non-presented stimuli, typically words, in a laboratory setting. Bredart (2000) used this paradigm to investigate false memories for famous names and found that they occur at a much lower rate than for typical DRM lists. As yet no-one has explored whether photographs of famous people will also give rise to the effect or indeed what happens to such false memories when a time delay is introduced. Therefore in the current experiment, we used the DRM paradigm to explore just that. Participants studied lists of famous names or faces (e.g., Brad Pitt, Courtney Cox-Arquette, David Schwimmer) before completing a maths task. Participants then completed a free recall task, on the same day and again a week later. Key related but non-presented famous individuals (e.g., *Jennifer Aniston*) were falsely recalled. Levels of false recall rose over time whilst correct recall fell, whilst overall recall of faces increased over time. Since the literature predominantly reports that false memories should not increase over time, implications for theory as well as for eye witness testimony are discussed.

Bredart, S. (2000). When false memories do not occur: Not thinking of the lure or remembering that it was not heard? *Memory, 8*, 123-128.

Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology, 58,* 17-22.

Roediger, H.L., & McDermott, K.B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 803-814.

Musical induction of emotion following encoding modulates subsequent memory

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Emotional states linked to arousal and mood are known to affect the efficiency of cognitive performance including memory and attention (Anderson, Wais, & Gabrieli, 2006; Jefferies, Smilek, Eich, & Enns, 2008). However, the extent to which memory processing may be affected by arousal, mood or their interaction is not well understood. We had participants listen to self-selected music varying in the arousal and mood dimensions in order to induce a particular emotional reaction: (i) positive mood-high arousal; (ii) positive mood-low arousal; (iii) negative mood-high arousal; (iv) negative mood-low arousal. Musically induced emotion occurred after participants were exposed to a study phase composed of several abstract shapes which they were instructed to remember. Immediately following the emotional induction, participants performed a memory recognition test where they were required to classify the shapes as either old or new and to rate their confidence in these judgements. Subjective ratings of mood and arousal did not differ at the encoding phase of each test block, but varied significantly following music presentation. Strikingly, recognition performance showed the highest accuracy and confidence ratings after induction of either a positive mood-high arousal or a negative mood-low arousal emotional state. This is the first study to show an interaction between mood and arousal on memory processing after initial encoding.

Anderson, A.K., Wais, P.E., & Gabrieli, J.D.E. (2006). Emotion enhances remembrance of neutral events past. *Proceedings of the National Academy of Sciences of the United States of America, 103(5),* 1599-1604.

Jefferies, L.N., Smilek, D., Eich, E., & Enns, J.T. (2008). Emotional valence and arousal *interact in attentional control. Psychological Science, 19(3*), 290:295.

The effect of retrieval style on specificity of future thought

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A growing interest has emerged in the role that autobiographical memory retrieval plays in simulation of future events. The constructive episodic simulation hypothesis put forward by Schacter and colleagues (e.g. Schacter, Addis, & Buckner, 2008) argues for shared neural and cognitive processes underlying past and future episodic thought, with memory supporting the simulation of future events through a process of extraction and recombination of stored episodic information. The current series of studies examined whether experimental manipulation of memory retrieval style influenced specificity of future thinking. Alongside a traditional cue-word paradigm, a sentence completion task (SCEFT: Anderson & Dewhurst, 2009) assessed spontaneous future thought. When autobiographical memory retrieval style was manipulated by instructing participants to either 'be specific' or 'be general' in response to cue words (Experiment 1), a corresponding effect on future specificity was found. However, when autobiographical memory specificity was manipulated using high- or low-imageable cue words (Experiments 2 and 3), neither cued nor spontaneous future thought was affected. These findings are in contrast to earlier findings by Williams et al (1996) and suggest that habitual styles of autobiographical retrieval and simulation may not be as intimately related as the constructive episodic simulation hypothesis suggests.

Anderson, R. J., & Dewhurst, S. A. (2009). Remembering the past and imagining the future: Differences in event specificity of spontaneously generated thought. *Memory, 17*, 367-373.

Schacter, D. L., Addis, D. R., & Buckner, R. L. (2008). Episodic simulation of future events: concepts, data, and applications. *Annals of the New York Academy of Sciences, 1124*, 39-60.

Williams, J. M. G., Ellis, N. C., Tyers, C., Healy, H., Rose, G., & MacLeod, A. K. (1996). The specificity of autobiographical memory and imageability of the future. *Memory & Cognition, 24*(1), 116-125.

A competitor inhibition account of semantic auditory distraction

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In semantic auditory distraction, to-be-ignored distractors that are drawn from the same, as opposed to a different, semantic-category as the target items impair free recall performance (Beaman, 2004; Marsh, Hughes, & Jones, 2008). Here we provide evidence for a *competitor inhibition* account (e.g., Anderson, 2003) of this phenomenon using a negative priming design in which in the critical *ignored-repetition* condition the distractors on one trial (the prime) became the targets on the next trial (the probe). Consistent with the competitor inhibition account, negative priming—as indexed by poorer free recall on the probe—was produced but only when, during the prime: 1) targets and distractors were semantically related and 2) distractors were dominant members of the target category. For prime trials in which distractors were low dominant members of the target category or were unrelated to that category, positive priming was found. The results are considered in terms of inhibitory approaches to long-term memory retrieval and negative priming (Anderson, 2003; Tipper, 2001) and are contrasted with non-inhibitory accounts of these phenomena (Neill, 1997; Rundus, 1973).

Anderson, M. C. (2003). Rethinking interference theory: Executive control and the mechanisms of forgetting. *Journal of Memory and Language, 49,* 415-445.

Beaman, C. P. (2004). The irrelevant sound effect revisited: What role for working memory capacity? *Journal of Exprerimental Psychology*: *Learning, Memory*, *and Cognition*, *30*, 1106-1118.

Rundus, D. (1973). Negative effects of using list items as recall cues. *Journal of Verbal Learning and Verbal Behavior, 12*, 43-50

Marsh, J. E., Hughes, R. W., & Jones, D. M. (2008). Auditory distraction in semantic memory: A process-based approach. *Journal of Memory and Language, 58,* 682-700.

Neill, W. T. (1997). Episodic retrieval in negative priming and repetition priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 6*, 1291-1305.

Tipper, S. P. (2001). Does negative priming reflect inhibitory mechanisms? A review and integration of conflicting views. *Quarterly Journal of Experimental Psychology, 54A*, 321-343.

What the experimenter's prime tells the observer's brain

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The negative compatibility effect refers to the observation that a centrally presented arrow 'prime' can slow responses to a centrally presented arrow target if the prime points in the same direction as the target; when the prime points in the opposite direction responses are relatively fast. Various explanations have been suggested including accounts based on masking and inhibition. In a series of experiments we examined whether the prime shifts spatial attention from the location of the target and what consequence this has for target processing. Results showed that the prime typically employed in the negative compatibility effect does indeed shift spatial attention. As a result the representation of direction is affected leading to slower responses when the last shift of attention before response is incompatible with the target direction (e.g., last shift is left, target points to the right). By contrast, responses are relatively fast when the shift and target are compatible (e.g., last shift is left, target points to the left). We argue that a shift of attention can generate a negative compatibility-like effect and posit that this occurs due to the shared representations of perception and action.

A novel task for the investigation of action learning

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We present a novel behavioural task for the investigation of how actions are added to an animal's repertoire. Our interest is in how those elements of total behaviour which cause an unexpected outcome are identified and stored. This process is necessarily prior to the attachment of value to different actions (Redgrave & Gurney, 2006). The task allows for critical tests of reinforcement prediction error theories (e.g. Shultz et al, 1997), as well as providing a window on a number of other issues in action learning. We present data on the effect of reinforcement signal delay that demonstrate the utility and distinctiveness of the task. The task provides a paradigm where the exploratory motive drives learning and such we view it as in the tradition of Thorndike (1911). We present data that show that our task is easily scalable in difficulty, adaptable across species, and that a rich set of behavioural measures are provided throughout the action learning process. Targets can be defined in spatial, temporal or gestural terms and the task also allows the concatenation of actions to be investigated.

Redgrave, P. G., & Gurney, K. (2006). The short-latency dopamine signal: a role in discovering novel actions? *Nature Reviews Neuroscience, 7*(12), 967.

Schultz, W., Dayan, P., & Montague, P. R. (1997). A neural substrate of prediction and reward. *Science, 275*(5306), 1593.

Thorndike, E. L. (1911). *Animal intelligence*. New York

Examining the effect of time course, view point and attention on visuomotor priming

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Observation of human actions influences the observer's own motor system, termed visuomotor priming, and is believed to be caused by automatic activation of mirror neurons. Evidence suggests that priming effects are enhanced when viewing stimuli in mirror compared to anatomical orientation and are larger for human as opposed to object stimuli. However, little is known about the time course of priming and there is conflicting evidence concerning the extent of differences between human and non-human stimuli. Over three experiments, we examined how visuomotor priming produced by human and object stimuli were affected over time, over views and when attention to the moving stimulus was manipulated. The results indicated that the strength of priming, according to view and stimulus, was dependent on attentional location and load: greater attentional focus appeared to enhance priming in the mirror view as well as increasing differences in priming between human and object stimuli when cognitive demands were low. These findings highlight that visuomotor priming is not an automatic process and provide possible explanations for conflicting evidence regarding the differential effects of biological and non-biological stimuli.

Hand dominance and the affordance effect: The same difference?

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Tucker & Ellis (1998) have shown effects of motor affordance based on congruity effects between hand of response and orientation of the handle of a tool. We were interested to see whether similar motor affordances might be observed with pairs of objects oriented for action and whether effects might be modulated by dominance of responding hand. Left and right-hand dominant participants viewed pairs of objects that were or were not correctly oriented for action, presented either simultaneously or sequentially with a varying inter-stimulus interval (ISI) and were asked to respond with either their dominant or non-dominant hand. When stimuli were presented simultaneously, all participants showed an effect of correctly co-locating objects for action. When there was an ISI there was no effect of action-relation, instead RTs were faster when the tool was congruent with the dominant hand of the participant. Both effects were modulated by dominance of responding hand, and whether the participant was left or right handed. The data suggest that action-related effects on visual processing can have two components - a visual 'affordance' when objects are co-located for action and a motor affordance based on the location of an object in relation to the hand the participant would normally use for the response.

Tucker, M., & Ellis, R. (1998). On the relations of seen objects and components of potential actions. *Journal of Experimental Psychology: Human Perception and Performance, 24*, 830–846

Deficits in sensory prediction correlate with schizotypy

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Predicting the sensory consequences of self-initiated movements is a key component in motor control. Previous research has demonstrated a deficit in sensory prediction in schizophrenic patients, possibly contributing to their disrupted sense of agency. Here we employed the force-matching task and administered schizotypy questionnaires in healthy participants in order to investigate the relationship between prediction of the sensory consequences of one's own actions and clinically relevant individual differences. We found a strong correlation between a participant's schizotypal personality traits and deficits in sensory prediction. Schizotypal traits represent neuro-cognitive variations normally distributed in the healthy population. In moderate degree these traits are perfectly healthy, adaptive characteristics but the more extreme forms at the higher end of the spectrum are thought to put the individual at risk for acute psychosis. The finding that schizotypy correlates with deficits in sensory prediction corroborates the concept of a continuum between the healthy and the mentally ill and has important etiological implications for schizophrenia.

Haptic perception of object size after a change in hand size

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To gather information about objects by touch, the brain must rely on an internal model of the body. The processes responsible for forming and maintaining such a model are not well understood. To change this internal model we used a well known multisensory illusion (Botvinick & Cohen, 1996) in which a fake hand is perceived to become the participant's hand. We compared haptic size perception after experiencing the illusion with a fake hand that was either smaller or larger than the participant's hand. We observed a change in haptically perceived object size. These results demonstrate that the brain rapidly recalibrates haptic signals using an internal model of the hand and that this model is multisensory rather than merely visual.

Botvinick, M. & Cohen, J. (1996). Rubber hands 'feel' touch that eyes see. *Nature*, *391*, 756.

"Seeing is believing"- Vision of the body increases interference on the somatic signal detection task

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Research suggests that viewing part of one's body enhances the tactile sensitivity of that body part (e.g. Tipper et al, 2001). The current study investigated the effect of viewing the hand on the frequency of erroneous reports of touch made during the Somatic Signal Detection Task (SSDT). During the SSDT, participants are required to detect near-threshold tactile stimulation of their fingertip. Participants erroneously report touch sensations in the absence of a stimulus on this task and that such false alarms are increased when a simultaneous light flash is presented next to their fingertip (Lloyd et al., 2008). Thirty-seven participants completed the SSDT under two conditions: non-informative vision of the hand and no vision of the hand. False alarms were significantly higher in light trials in the non-informative vision condition compared to light trials in the no-vision condition, while the sensitivity to touch was unchanged. Thus, viewing the body increased somatic interference, possibly due to raised awareness of internal bodily sensations. Studies investigating the effect of raising interoceptive awareness on SSDT performance are currently being undertaken to investigate this possibility. Preliminary findings suggest that raised interoceptive awareness increases touch reports during the SSDT.

Lloyd, D. M., Mason, L., Brown, R. J. and Poliakoff, E. (2008). Development of a paradigm for measuring somatic disturbance in clinical populations with medically unexplained symptoms. *Journal of Psychosomatic Research, 64(1)*, 21-24.

Tipper, S. P., Phillips, N., Dancer, C., Lloyd, D., Howard, L. A. and McGlone, F. (2001). Vision influences tactile perception at body sites that cannot be viewed directly. *Experimental Brain Research, 139*(2), 160-167.

Using experimental hypnosis to create laboratory analogues of clinical delusions

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Delusions are relatively difficult to study because they often occur in conjunction with other clinical symptoms. However, researchers are using experimental hypnosis as an alternative means to investigate delusions in the laboratory. This paper describes our construction of credible, albeit temporary, hypnotic analogues of clinical delusions. I highlight our techniques for recreating delusions in the laboratory and how we index the features and processes shared by clinical and hypnotic delusions, including their impact on information processing and memory. I illustrate with hypnotic versions of mirrored-self misidentification (the belief that I see a stranger in the mirror), somatoparaphrenia (the belief that my arm belongs to someone else) and erotomania (the belief that I am loved from afar by another individual). Across these experiments, we have found that high hypnotisable subjects: (a) experience compelling delusions with features that are

remarkably similar to clinical cases (b) resist challenges to their delusional beliefs, and (c) selectively process information and generate confabulations to support their delusional beliefs. Findings are discussed in light of a dominant theory of delusions and highlight the strengths and limitations of this approach.

Experiencing a lucky event reverses ambiguity aversion

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Ambiguity aversion has been a robust finding since Ellsberg (1961) proposed that decision makers tend to prefer taking gambles with known-risk probabilities than ambiguous probabilities. Recently Pulford (2009) showed that optimistic people are less ambiguity averse and speculated that feelings of luck may be influential. The current study aims to test this speculation by directly manipulating how lucky participants feel and then measuring ambiguity aversion. 74 undergraduates completed one condition; either *Lucky* (just missed the bankrupt panel on a computerized fruit machine game and won 10 tokens), *Unlucky* (just missed the jackpot but also won 10 tokens), or *Control* (did not play the game). Participants then completed a positively framed and a negatively framed Ellsberg urns task, choosing between an ambiguous and a known-risk option. In both urns tasks the control and the unlucky groups showed normal levels of ambiguity aversion, preferring to choose the known-risk option, but the group who experienced the lucky event showed a dramatic shift towards choosing the ambiguous option (77% and 58% in the positive and negative task). Both the lucky and unlucky groups experienced an identical positive win on the first game, but their perceptions of luck significantly influenced subsequent decisions in opposite directions.

Ellsberg, D. (1961). Risk, ambiguity and the Savage axioms. *Quarterly Journal of Economics, 75,* 643–699.

Pulford, B. D. (2009). Is luck on my side? Optimism, pessimism, and ambiguity aversion. *Quarterly Journal of Experimental Psychology, 62,* 1079-1087.

Investigating the involvement of thinking styles in probabilistic reasoning

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Research participants are frequently very poor at probabilistic reasoning, committing fundamental reasoning fallacies more often than not. Presenting the tasks in natural frequencies significantly reduces the incidence of these reasoning fallacies, but does not eliminate them entirely. The presented research looks at one of the individual differences, specifically thinking styles, which may help to further account for the variance in our ability to make accurate judgements of both conjunctive and disjunctive probability. As well as measuring the occurrence of reasoning fallacies, the current study also measures probabilistic reasoning performance on an interval scale, having devised a

measure of 'reasoning error' that is designed to give greater insight into the types of judgements being made. A consistent effect of format was found, whereby the frequency format did significantly improve performance, with the error measure showing a greater effect size than the fallacy measure. There was also a significant effect of task type (conjunctive, inclusive disjunctive or exclusive disjunctive), and this effect size was larger for the fallacy measure. Thinking styles, as measured by the Thinking Dispositions Questionnaire and Rational Experiential Inventory (Kokis *et al.*, 2002; Epstein *et al.*, 1996), did not account for significant levels of variance in reasoning performance.

Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical rational thinking styles. *Journal of Personality and Social Psychology, 71*, 390-405.

Kokis, J. V., Macpherson, R., Toplak, M. E., West, R. F., & Stanovich, K. E. (2002). Heuristic and analytic processing: Age trends and associations with cognitive ability and cognitive styles. *Journal of Experimental Child Psychology, 83*, 26-52.

Evidence that category induction develops through domain-specific knowledge and experience

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Our previous research using novel examples of animals indicates that young children are biased towards perceptual induction, and only shift towards category induction from around age six-seven. The current study investigates whether children's strategies differ for novel vs. real examples, and whether experience with animals can boost the development of more sophisticated reasoning. Seventy-six children age five – seven, took an interactive educational session at Twycross Zoo. One week before and after this session, children participated in inductive reasoning tasks with real and novel examples. Each task involved training on categorising the animals into kinds, followed by induction trials in which hidden properties were generalised from a target (e.g., adult squirrel) to one of two test items in which category membership conflicted with appearance, e.g., adult chinchilla (perceptual distractor), baby squirrel (category choice). A shift from perceptual to category induction with age was observed for both real and novel examples. However, all ages showed a stronger category preference for real examples. Importantly, the educational sessions caused a boost in category preference for all examples. Our findings suggest that category induction is not an early bias, and instead develops gradually as a consequence of knowledge and experience within a domain.

Why should extreme sweetness make us feel like smiling?

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As a result of past learning, a fruit juice near to its usual sweetness is maximally desirable as a drink. A mouthful of it also improves mood and elicits nice feelings of moving the fluid around in the mouth. Samples of juice that are considerably sweeter, as well as less sweet samples, are not liked as a full drink. Yet when an extremely sweet sample is tasted, it elicits an even better mood and nicer feelings of movement than an ideally sweet sample. At this intolerable level of sweetness only, the tasters feel that they are smiling. Our intepretation of these findings is that the inborn reflex, 'the sweeter the better,' overpowers the learnt rejection of substantial departures from ideal sweetness and, even in adulthood, creates some sensual pleasure. The question remains why this gustomotor reflex is allied with a sense of smiling. Could the social impact of an adult's smile at undrinkably strong sweetness have had some survival function? Alternatively, do adults retain a capacity for infantile delight while the benefit to inclusive fitness is confined to a tendency of the suckling infant to smile at the mild sweetness of human milk while looking at the nurser?

Patterns of eye movements during an interview

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Understanding eye movements in the context of behaviour is essential if we are to fully understand how attention affects the way we perceive and construct interpretations of the world. In the reported study 16 participants completed a one-to-one interview with an experimenter whilst their eye movements were recorded using a head mounted mobile eye-tracking system. Participants completed an Autism-spectrum Quotient (AQ) self-report questionnaire to establish whether they exhibit "high" or "low" levels of autistic traits. Participants answered four questions, two of which they had been able to pre-prepare answers to. The interviewer made eye contact with the participant whilst asking and listening to the answers for two of the questions and looked at her notes for the other two questions. Distinct patterns of attention emerged from analysis of eye movements. Participants tended to look at the interviewer's face more when they were being asked a question than when they were answering it. This effect was stronger when the question was unanticipated. Participants fixated more on the interviewer's face and less on the body when the interviewer made eye contact with them. Differences in patterns of attention emerged between high AQ scorers and low AQ scorers.

Agents without mental states: Pinpointing the divide in Asperger Syndrome

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Individuals with autism are widely acknowledged to have Theory of Mind difficulties. But just how specific is this impairment? Here we tested high functioning adults with Asperger Syndrome who displayed a lack of spontaneous mentalising (Senju et al., 2009). These adults and matched controls watched the Frith-Happé animated triangles whilst their eye movements were monitored and also responded to the location of dots appearing on either side of the triangles. Consistent with their lack of spontaneous mentalising, these adults' verbal descriptions of the animations were less appropriate and involved less intentional language. Despite these ToM impairments, they showed normal eye movements in all animation conditions, spending the same proportion of time watching each triangle as the controls. Furthermore, they showed the same interference effect as controls on the dot task when required to respond in opposition to the triangle's point of view. While high-functioning individual's with Asperger Syndrome appear to guide their eye movements in the same way as controls, take in the same visual information from these animations, and even represent the triangles as agents whose viewpoints can be opposed to their own, this information is not sufficient in order to understand the intricacies of mental state interactions.

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What do listeners' eyes reveal about communicating false beliefs?

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When interpreting others' actions, we typically refer to our understanding of their current mental states: their knowledge, beliefs and intentions (Apperly et al., 2006; Keysar et al., 2003).We report an interactive visual-world study, where two communicators watched short videos and subsequently described the events to each other. Forty pairs of communicators took part; we tracked 'listeners's' eye-movements, time-locked to related auditory descriptions provided by the 'speaker'. Critically, on half the trials a screen blocked the speakers' (but not the listeners') view part-way through the video, therefore establishing a false belief. Eye-tracking analyses revealed that listeners' anticipatory eye-movements showed a significantly stronger bias to the target's 'real' location when knowledge was shared between the communicators compared to when listeners held privileged knowledge of the object's location (Fs >13.4). In false belief trials, listeners showed no bias to either potential object locations (ts <1). These results demonstrate that during interactive communication, we rapidly integrate contextual cues, including perspectives, to direct expectations about forthcoming language reference. Our results argue against an absolute egocentric bias, but demonstrate some interference from

knowledge of the actual location. We discuss these results in terms of a 'curse of knowledge' (Birch, & Bloom, 2003), which we see here operating independently of lower-level language-driven effects established in Barr (2008).

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Effects of alcohol preload on attentional bias towards cocaine related cues.

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Background: Drug and alcohol users have an 'attentional bias' for substance-related cues, which is likely to reflect the incentive-motivational properties of those cues. Furthermore, administration of alcohol increases attentional bias for alcohol and tobacco-related cues in heavy drinkers and tobacco smokers, respectively. The present study investigated attentional bias for cocaine cues in cocaine users and non-users following administration of either alcohol or placebo. *Method:* Thirty-two regular cocaine users and 40 nonusers took part. Participants were administered alcohol or placebo and administration was double-blind. After drink administration, a Visual Probe task and Modified Stroop task were used to assess attentional bias. *Results:* There was a significant interaction between group and drink type on the visual probe task indicating that cocaine users who had received alcohol had increased attentional bias for cocaine pictures compared to non-users and cocaine users who received placebo. The cocaine Stroop revealed no differences between cocaine users and non-users. Correlations between bias measures and craving were non-significant. *Conclusions:* Alcohol preload in regular cocaine users increases attentional bias for cocaine cues. However, cocaine users who received placebo did not show bias for cocaine stimuli. Future research should investigate the effects of alcohol preload on attentional bias in cocaine dependent individuals.

Individual differences in selective visual attention: The role of perceptual load, case mixing and everyday distractibility

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Previous studies have shown that perceptual load determines the level of distractor-interference on visual attention tasks. We examined whether distractor-interference was modified by perceptual load and/or the level of participants' distractibility in everyday life. Fifty adults completed a semantic flanker-congruency task; participants made manual reaction time responses to target words that were 'flanked' by distractors from the same (congruent) or different (incongruent) semantic category. Target words were either presented in the same case (low load) or in mixed case (high load). Participants' distractibility in everyday-life was measured using the Cognitive Failures Questionnaire. Our results revealed a trend for faster responses in the low than high distractibility group. While the high distractibility group showed a similar non-significant congruency effect (i.e. faster responses to congruent than incongruent trials) for same and mixed case target words, the low distractibility group showed a larger significant congruency effect for same case targets than mixed case targets (ns). These results are consistent with the view that the high distractibility group have less attentional resources available and therefore find low and high load conditions equally demanding. However, the low distractibility group found the high load condition more demanding as more attentional resources were required.

Good days and bad days: Individual differences and variability in performance

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We show that variability in performance from moment to moment, from day to day, and between different tasks performed on the same day are all shown to be driven by the same statistical and logical constraints. Older individuals and those who score lower on paper and pencil intelligence tests are more variable from moment to moment and so, also, from day to day and between tasks performed during the same testing session. However other kinds of systematic variability, such as circadian variability, are not simply driven by statistical necessity, but are also stable characteristics of individuals. To these two different kinds of systematic variability we now can add a third: systematic variability between days, such that individuals have "good days" on which they perform relatively better on all of 6 different tasks that they are asked to carry out within a 1 hour session, and, equally, "bad days" on which, if they perform relatively poorly on one task they also perform relatively poorly on all the others. We explore, and suggest reasons for, systematic individual differences in this third type of variability.

Explaining sentence complexity effects in children: Children's comprehension of spoken centre-embedded sentences.

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Given a sentence like *The cat that bumped the bear will hug the cow* deciding who *hugged the cow* is difficult for children, whereas knowing that *the cat bumped the bear* is less error prone (Weighall & Altmann, 2001). It has been suggested that this difficulty arises because the main clause is interrupted by the subordinate clause of the sentence which increases processing complexity (i.e. through working memory costs). Two contrasting explanations have further specified the locus of this cost in adults. The *integration cost* account (Gibson, 1998) suggests that the number of unique discourse referents mentioned in the interruption determines processing difficulty; the properties of each referent (e.g., animacy, frequency) do not further contribute to processing cost. In contrast, the *similarity-based interference* account (Gordon, Hendrick & Johnson, 2001) suggests that the confusability of referents (e.g., from the same syntactic category) mediates sentence complexity. Three experiments directly contrasted these explanations using an auditory comprehension task with 6- to 8- year-old children (N= 30 in each experiment). The data indicated that reducing the confusability of referents improves processing of the interrupted main clause, consistent with the similarity-based interference account. However, confusability does not entirely explain sentence complexity effects in children of this age and other factors are implicated, including animacy and plausibility.

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Morphological representations in the lexicon: Evidence from homonym suffixes

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The need for an independent morphological dimension in the lexicon (e.g., Marslen-Wilson Tyler, Waksler & Older, 1994) has been challenged by approaches that view morphological effects as artefacts resulting from similarity along the orthographic, phonological and semantic dimensions ('Convergence theory', Seidenberg & Gonnerman, 2000). We investigated the status of morphology in the lexicon in a masked priming task using the French homonym suffix *-eur*. The suffix *-eur* can either attach to verbs to express an agent (*-eur*$_1$: *briseur* 'breaker/wrecker'←*brise* 'break'+*-eur*) or to an adjective to form a noun expressing a property/state (*-eur*$_2$: *largeur* 'width' ← *large* 'wide' + *-eur*). Moreover, sometimes a final letter string *-eur* is not a suffix, e.g., *rumeur* 'rumour'. We examined an effect of a masked prime that ended in *-eur*$_1$ (*amuseur* 'entertainer') on targets that ended in *-eur*$_1$ (*briseur*), *-eur*$_2$ (*largeur*) or in a non-suffixal *-eur* (*rumeur*). The Convergence theory predicts similar priming effects for pairs *amuseur*

– *largeur* and *amuseur – rumeur* as in both cases the prime and the target share the same amount of ortho-phonological overlap and are semantically unrelated. Our results show differential effects for the two cases, thus arguing against the Convergence theory and for an independent morphological dimension.

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Lexical representations of SMS shortcuts

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As the popularity of sending messages electronically increased, so did the necessity of conveying messages more efficiently. A popular way of increasing efficiency is to use shortcuts such as *gr8* "great" or *cu* "see you". The aim of the study was to investigate whether such abbreviations have their own lexical representations or whether they are recorded into the words they stand for. We used associative masked and overt priming in lexical decision tasks. Primes were text shortcuts and their corresponding words. Targets were words that were associatively related to the prime (e.g., cu/see you – GOODBYE), associatively related to a part of the prime (e.g., cu/see you – LOOK) or unrelated to the prime and any part of the prime (e.g., 4u/for you – GOODBYE; 4u/for you – LOOK). In both tasks, responses were faster to targets preceded by related compared to unrelated primes (shortcuts and words). In the overt priming task, we in addition found faster responses when the target was related to a part of the prime. However, this effect was present only for word but not for shortcut primes. These results indicate that shortcuts have their own lexical representations that are independent of the representations of the individual words they replace.

Naming associated objects: Evidence for parallel processing

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Earlier research has shown that speakers naming object pairs can retrieve their names in parallel, but often fail to do so. The conditions for the occurrence of parallel object processing are largely unknown. We examined how associations between objects affected the speakers' processing strategies. In Experiment 1, participants named object triplets in a left-right-bottom order. During the saccade towards the right object (interloper), it was replaced by a new object (target). We varied the relationship between

interloper and target (conceptually related or unrelated) and between interloper and left object (categorically related, associated, unrelated). Target gaze durations were shorter after related than unrelated interlopers. However, this preview effect was independent of the interloper-left object relationship, suggesting that the left and right object were processed sequentially. In Experiments 2 and 3, participants named pairs of associated or unrelated objects. The left objects were repeated several times in each test block to facilitate their processing. Gaze durations for the *left* objects were *longer* in associated than unrelated pairs, consistent with parallel processing of the associated objects and interference among them. We will discuss how the difficulty of processing the objects and the relationship between them jointly determine speakers' processing strategy.

Heads down: A postural cue to cooperation

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Subtle facial cues influence the perception of trustworthiness and cooperation. Posture might enhance some of the relevant aspects for deciding whether to cooperate with someone given that posture affects perception of status and emotion. The study investigates whether the perception of cooperativeness is linked to head posture. An interactive experiment asked 42 students to rotate 3D facial images in the vertical plane so that they looked most cooperative. The results revealed that participants tilted the stimuli significantly down (-2.49 ± 0.7; mean ± standard error). Additional stepwise linear regression analysis suggested that the postural effects are as a consequence of a similarity to both dominance and positive emotional signals. Moreover, the extent to which these characteristics are important varied based on the physical and social dominance of the participants. Generally, when evaluators' social dominance is considered, postural cues of cooperation were attributable to associations with emotional expression. On the other hand, when respondents' physical dominance is taken into account, the postural cues of cooperation were related to cues signalling status. Thus, the results indicated that head posture influences cooperativeness perception. Furthermore, the interpretation of the postural signals is determined by observers' characteristics.

Symposium **Reading other people's minds**
Organiser: Dr Dana Samson

The development of belief-desire psychology and executive function in early childhood

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There has been considerable debate in theory of mind research regarding children's developing abilities to ascribe beliefs and desires. According to the symmetry

account (Perner et al., 2005), children come to understand both beliefs and desires as truly subjective attitudes at the same time around 4 years of age. The asymmetry account, in contrast, claims that children develop a grasp of truly subjective desires before they develop an analogous grasp of beliefs (Wellman, 1990). In my talk I will first present recent studies that try to test between the accounts and that speak in favor of the asymmetry account: young children at ages 3-5 were more proficient at ascribing subjective, mutually incompatible desires and desire-dependent emotions to two persons than they were at ascribing analogous subjective false beliefs (Rakoczy, in press; Rakoczy et al., 2007). Second, potential explanations for this asymmetry in children's folk psychology will be explored, in particular the claim that the crucial difference lies in the different normative structures of the two kinds of attitudes (e.g. Sabbagh et al., 2006): beliefs, in contrast to desires, have mind-to-world direction of fit and thus essentially involve a normative default (truth) that needs to be suppresses in the ascription of false beliefs. Consequently, beliefs are more difficult due to demands of executive function (inhibition). Recent studies on this issue will be presented that, however, did not find any evidence of differential involvement of executive function in belief over desire ascription (Rakoczy, in press; Rakoczy et al, in progress). Finally, potential alternative explanations for the belief-desire asymmetry to be explored in future research will be discussed.

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Motivations for mindreading in infancy

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By the end of the first year of life, infants can understand different actions as either goal-directed, or as referential. While a non-mentalistic understanding of action

might enable infants to identify goals and referents, a mentalistic action interpretation, in terms of others' communicative intentions, could benefit infants in situations where goals and referents are more ambiguous. I will suggest that it is this need to make sense of teleologically and referentially ambiguous actions that motivates young children to keep track of others' epistemic states, and it is these situations in which infants are most likely to exhibit their mindreading capacities. I will present data showing that, by 18 months, infants use their mindreading skills in order to interpret others' communicative action demonstrations, and referential communication.

Joint action and knowing others' minds

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How could abilities to engage in joint action foster developments in understanding minds? Several researchers have argued that joint action does in fact foster mentalistic understanding, but few if any have explained in detail how it could do so. In this talk I elaborate a modest conjecture: abilities to engage in joint action provide a route to knowledge of others' goals distinct from ordinary third-person interpretation. The existence of this route may partly explain how joint action fosters developments in understanding minds.

What birds can tell us about how to read minds

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Although the issue of whether non-human animals can read others' mental states remains controversial, some of the most convincing recent evidence comes, not from the great apes, but from members of the crow family, such as scrub-jays, ravens and jackdaws. One series of studies on the cache protection strategies of food-caching corvids has provided evidence that corvids can take another's perspective (i.e. hiding their caches in locations with degraded visual information for pilferers, such as behind barriers, at a distance or in the dark), recognise individuals with different knowledge states, use different protections strategies based on the identity of the potential thief and project their own experiences unto others, something akin to simulation theory of mind. A second series of studies on jackdaws, which do not cache, has revealed that they can recognise different attentional states in humans and use social cues to locate hidden food in an object-choice task, but only under certain conditions. Jackdaws only differentiate between different attentional states when the human is unfamiliar (a potential threat) and can utilise social cues to find food when a conspecific is their social partner, not a stranger. Both sets of studies highlight the important role of *who* provides the social information. This talk will not only review these studies on scrub-jays and jackdaws, but also provide some ideas for future study in humans.

Social knowledge and values - a neurocognitive perspective

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Social knowledge is of core importance for understanding our own and other people's social behaviour and enables humans to represent social and moral values (e.g. "honesty", "generosity"). Cognitive neuroscience methods can help identifying dissociable cognitive components that make up social knowledge. Evidence from fMRI in healthy participants (Zahn et al., 2009b) has supported a model of social knowledge (Moll et al., 2005) that postulates 1) representations of abstract conceptual knowledge of social behaviour (e.g. the core meaning of acting "generously") as anatomically separable from 2) representations of the associated contexts of actions and feelings (e.g. guilt for not acting generously, or gratitude for being the recipient of a generous act). Functional MRI in healthy participants (Zahn et al., 2007) and studies in patients with focal cortical neurodegeneration (Zahn et al., 2009a) have corroborated domain-selective representations for concepts describing social behaviour (e.g. "generous") within the right anterior temporal cortex when compared with less socially relevant concepts that described animal behaviour (e.g. "trainable") while controlling for psycholinguistic differences. Evidence on the dissociable representation of moral feeling and action contexts within fronto-mesolimbic regions is discussed. The postulated neural architecture of social and moral values may allow humans to communicate about the core meaning of values across socio-cultural contexts while retaining the ability to flexibly associate the same moral value with different feelings and actions in different contexts.

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End of Symposium

EPS Prize Lecture

What is "theory of mind"?

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More than thirty years of resarch has examined "theory of mind" in non-human animals, human infants, children and adults, and human brains. This work has led to many insights, but, if anything, the object of study has become less clear as the weight of evidence has increased. By turns, researchers conceptualise "theory of mind" as a set of concepts, a collection of cognitive processes, and an individual difference variable. I shall argue that these conceptions all have their virtues, but that it is unhelpful to confound them and probably unwise to try to investigate them all with the same narrow set of experimental tasks. Newly-emerging methods have great potential for advancing our understanding of "theory of mind", all the more so if we refine our ideas about what we are studying, and why.

From helping to hurting: Shifting the effects of similarity on visual extinction

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The effect of stimulus similarity on extinction remains controversial with seemingly contrary reports of both beneficial effects of grouping (Ward, Goodrich et al. 1994; Gilchrist, Humphreys et al. 1996) and detrimental affects of task-relevant repetitions (Baylis, Driver et al. 1993; Baylis, Gore et al. 2001; Rafal, Danziger et al. 2002). Two key procedural differences may be important in understanding this discrepancy: stimulus eccentricity and the presence of a central fixation cross. The effects of these display parameters were systematically examined on patients showing extinction. Similarity was found to increase extinction when the stimuli were presented at eccentric locations (12°) and with a central fixation cross. In contrast, similarity reduced extinction in the same patients when stimuli were presented closer to fixation (3.4°). Offsetting the fixation cross also led to positive effects of similarity on report. These findings suggest that stimulus similarity mitigates extinction when arrays promote perceptual grouping but can exacerbate the deficit when the array parameters encourage stimuli to be selected consecutively and processed as distinct distal elements.

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The speed of information processing within the focus of visual attention

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Spatial attention has traditionally been thought of as a fixed architecture in which a limited set of (typically 4) spatially distinct objects can be simultaneously attended. However, recent studies have provided evidence suggesting instead, a more graded resource, producing a gradual decline in performance as the number of attended objects increases (e.g., Howard & Holcombe, 2008). In a series of four experiments, we investigated the graded nature of attention allocation by investigating the speed of information processing for simultaneously attended objects. We used a simple feature discrimination task in which observers responded whether sinusoidal luminance patches were tilted to the left or right. Using tasks involving free response time and signal-to-respond methodologies, we demonstrate, contrary to previous research (e.g., Carrasco & McElree, 2001), a clear advantage in terms of processing speed for a single object over multiple (2, 3, and 4) concurrently attended objects. This speed advantage appears to depend on the stimulus display time (a shorter display duration resulting in a greater benefit for one object over multiple objects) and the amount of target location uncertainty (in terms of cue validity and number of competing targets). Results are discussed in relation to current theories of covert attention.

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Binding visual features in working memory draws upon attentional resources in both younger and older adults.

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We investigated the role of attention in binding visual features (colour and shape) in younger and older adults. In Experiment 1, 48 younger (M = 19 yrs) and older (M = 72

yrs) adults attempted to remember colours, shapes, and colour-shape combinations while repeating a 2-digit number (articulatory suppression) or while counting backwards from this number in multiples of 3 (performance of which was consistent across task conditions and participant groups). Results revealed greater dual task costs for bound representations than for individual features, $F(2,92) = 18.95$, $p < .001$, while the memory performance of older adults was no more affected by dual tasking than was that of younger adults. In Experiment 2, 48 younger ($M = 20$ yrs) and older ($M = 72$ yrs) adults were shown three colours, shapes, or colour-shape combinations either simultaneously (as in Exp. 1) or in sequence. An age-related binding deficit was evident, $F(2,92) = 12.23$, $p < .001$, as was a general binding deficit under sequential presentation conditions, $F(2,92) = 15.81$, $p < .001$. Taken together, the results suggest a general role for attention in visual feature binding, but that age-related binding deficits are not brought about or exacerbated by attentional demands.

The contextual interference effect in visual feature binding: What does it say about the role of attention in binding?

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Contextual interference effect is the empirical observation that although performance with mixed presentation is either similar or worse than blocked presentation when tested immediately, it is better when tested after an interval. We explored whether this effect, common in psychomotor performance, would show up in visual feature binding. Stimuli were conjunctions of shape, colour, and location. A swap detection task with study-test intervals ranging from 0-2500ms was used. In Experiments 1a and 1b, participants had to ignore locations and detect shape-color bindings. In Experiments 2a and 2b they ignored shapes to detect colour-location binding. In Experiments 3a and 3b, they ignored colours to detect shape-location bindings. Whilst Experiments 1a, 2a, and 3a used blocked presentation, Experiments 1b, 2b, and 3b used mixed presentation of study-test intervals. Mixed presentation led to better performance at longer study-test intervals when shapes were ignored, and there was a similar trend when colours were ignored. However, when locations were ignored, blocked presentation resulted in better performance, but only at 2000 ms. Thus, the contextual interference effect appeared when spatial attention was engaged, but not when attention was object-based, suggesting that only binding involving locations benefits from the extra attentional resources used in mixed presentation.

Re-examining the capacity limits of negative priming: Evidence for negative priming with multiple distractors

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When new (probe) targets share features with previously ignored (prime) distractors, responses are impaired – a phenomenon referred to as the Negative Priming

Effect, (Tipper, 1985). Previous research has found this effect is strictly limited to visual displays consisting of just two stimuli, (the target and one distractor item), and is abolished at display sizes in excess of this (Neuman & DeShepper, 1992). However, these previous studies have confounded the number of items in a display with the number of item types in a display (i.e., exemplars). Here, we re-examine the claim that negative priming effects are restricted to and maximal with single distractor item displays. Evidence is presented which shows that negative priming effects can extend far beyond these previous estimates of capacity, under conditions where multiple distractor items can be grouped via a common feature (i.e., colour). We show that there is a selective cost in responding to probe targets sharing the colour of *multiple* previous prime distractors, when compared to probe targets holding a new colour value. Furthermore, this negative priming effect occurs in active visual search through complex heterogeneous letter displays. We highlight the similarity between these colour-based negative priming effects, and colour-based carry-over effects in preview search (Braithwaite et al., 2003), which also demonstrate a selective cost to new items sharing features with old irrelevant items. We suggest that these two demonstrations of impaired attentional selection may result, at least in part, from overlapping feature-based inhibitory processes.

Braithwaite, J.J., Humphreys, G.W. & Hodsoll, J. (2003). Ignoring color over time: The selective effects of color on preview-based visual search of static items. *Journal of Experimental Psychology: Human Perception and Performance, 29 (4),* 758-778.

Neuman,E. & DeShepper, B.G. (1992). An inhibition-based fan effect: Evidence for an active suppression mechanism in selective attention. *Canadian Journal of Psychology, 46,* 1-40.

Tipper, S. (1985). The negative priming effect: Inhibitory priming by ignored objects. *The Quarterly Journal of Experimental Psychology, 37A,* 571-590.

Carry-over of scanning behaviour between two unrelated visual search tasks

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Allocation of visual attention in a natural scene is controlled by the bottom-up influences in the scene and by the top-down task demands. Models of visual search attempt to predict the eye movements made to natural scenes by accounting for these influences, with varying levels of success. More recent work shows that the spread of attention is also affected by previous experience with the same or similar scenes, and adding this component to the models increases the accuracy of any predictions made. Two experiments were completed which explored a further, previously unidentified, influence upon attention in natural scenes; the influence of an initial, unrelated visual search task. In Experiment One participants completed a simple letter search and were then asked to search a picture of a natural scene. Eye movements were recorded to the picture search and results showed that the spatial layout of letters had a significant impact upon spread of search in the pictures. This finding was replicated in a second experiment which paired the letter search task with a search of dynamic video clips. The results

indicate that predictions of visual search behaviour could be further improved by accounting for the influence of a preceding, unrelated task.

Interface between cognitive load and spoken-word recognition

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The effect of cognitive load (CL) on speech recognition has received little attention despite the prevalence of such conditions in everyday life (e.g., divided attention, short-term memory load). In an attempt to assess the effect of CL on the interaction between lexically-mediated and acoustically-mediated processes, we measured the magnitude of the classic "Ganong effect" (i.e., lexical bias when categorising phonemes) under CL vs. no-CL. In the CL condition, participants heard a syllable originating from gi-ki (baseline), gift-kift, and giss-kiss continua (words underlined) while seeing a visual array. Their task was to decide whether the spoken syllable started with /g/ or /k/ and whether the visual array contained a pre-specified visual target. In the no-CL condition, participants only heard the spoken syllables and only performed the phoneme categorisation task. The CL condition led to a larger Ganong effect. However, performance on the gi-ki (baseline) continuum was unaffected by CL. This pattern remained strong under deadline and delay conditions and when other factors were controlled. The results suggest that CL enhances lexically-mediated processes, with no reduction in phonetic acuity. These findings are discussed relative to the interface between attention and spoken-word recognition models.

Pathways to Age of Acquisition: The effects of filler words on AoA effects in word naming.

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Within a series of six experiments, the impact of the frequency and imageability of filler word items on Age of Acquisition (AoA) effects in a word naming task was assessed. Experiments 1 & 2 establish a new set of early and late acquired words. Experiments 3 & 4 demonstrate a significant effect of the imageability of filler items on AoA effects. Experiments 5 and 6 show no significant effect of the frequency of filler items on AoA effects. Hence, whilst imageability modulated AoA effects, the frequency of filler items was not shown to interact with the AoA effect in word naming. The mechanisms behind these findings, and implications for accounts of AoA are discussed.

Reading text increases binocular disparity in dyslexic children

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Proponents of the magnocellular theory (Stein, 2001) claim children with developmental dyslexia have poor binocular coordination, resulting in a failure to obtain a stable single percept from the two retinal inputs, leading to reading difficulties. This theory of dyslexia has had a major impact on dyslexia research as well as intervention programmes. In two eye tracking experiments we evaluated the magnocellular theory of dyslexia. We examined binocular coordination for adult, typically developing children and children with dyslexia during reading and a non-linguistic scanning task. We observed significantly increased disparity for dyslexic children compared to that observed for adults and typically developing children during reading but not during the dot scanning task. Our data indicate that poor binocular coordination is a consequence or correlate not a cause of dyslexia in children. The exclusivity of increased disparity in dyslexics during reading for comprehension might perhaps be a result of the allocation of inadequate attentional and/or cognitive resources to the reading process, or suboptimal linguistic processing per se.

Stein, J. (2001). The magnocellular theory of developmental dyslexia. *Dyslexia, 7,* 12-36.

Using stroke removal to investigate Chinese character identification during reading: Evidence from eye movements

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We explored the effect of stroke removal from Chinese characters on eye movements during reading to examine the role of stroke encoding in character identification. Experimental sentences were comprised of characters with different proportions of strokes removed (15%, 30%, and 50%), and different types of strokes removed (beginning, ending, and strokes that ensured the configuration of the character was retained). Reading times, number of fixations and regression measures all showed that Chinese characters with 15% of strokes removed were as easy to read as Chinese characters without any strokes removed. However, when 30%, or more of a character's strokes were removed, reading characters with their configuration retained was easiest, characters with ending strokes removed were more difficult, whilst characters with beginning strokes removed were most difficult to read. The results strongly suggest that not all strokes within a character have equal status during character identification, and a flexible stroke encoding system must underlie successful character identification during Chinese reading.

Investigating hemispheric asymmetries in foveal word recognition: Evidence from Arabic

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The hemispheric projection of words presented about the point of fixation is a matter of considerable importance (Jordan & Paterson, 2009, 2010). According to split-fovea accounts, the projection of visual information from each fovea is divided precisely at the vertical midline. As a consequence, each fixated word is effectively split in two so that all letters on each side of fixation project unilaterally to the contralateral hemisphere, with considerable implications for word recognition. Unfortunately, a perceptual advantage for information to the right of fixation in languages read from left-to-right, like English, risks providing spurious "left-hemisphere" advantages for words displayed at foveal locations. We avoided this confound by investigating recognition of words in a language read from right-to-left (Arabic) presented at foveal and extrafoveal locations to the left and right of a central fixation point. Word recognition was assessed using appropriate control of fixation location and stimulus size, and monocular viewing to avoid confounding influences of fixation disparity (Jordan & Paterson, 2009). The findings revealed superior right hemifield/left hemisphere recognition for words displayed outside the fovea and no asymmetries for words displayed within foveal vision. The implications of these findings for split-fovea accounts of word recognition are presented.

Jordan, T. R., & Paterson, K. B. (2009). Re-evaluating split-fovea processing in word recognition: A critical assessment of recent research. *Neuropsychologia*, *47*, 2341-2353.

Jordan, T. R., & Paterson, K. B. (2010). Where is the Evidence for Split Fovea Processing in Word Recognition? *Neuropsychologia,* in press.

Deficits of spatial working memory induced by abduction of the eye

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Working memory and spatial attention have typically been studied as independent processes using different experimental paradigms. However, there is a growing volume of empirical work that argues for a very tight coupling between the contents of working memory and the locus of attention (e.g. Soto, Hodsoll, Rotshtein, & Humphreys, 2008). Indeed, one controversial proposal is that working memory and attention actually reflect different expressions of activity in the same underlying system. If this suggestion is correct, experimental manipulations that are known to disrupt the mechanisms of spatial attention should also disrupt working memory. Here, we test this prediction using a paradigm in which the eye is abducted 40° away from the midline, a manipulation that is known to create deficit of spatial attention (Craighero, Nascimben, & Fadiga, 2004; Smith, Ball, Ellison, & Schenk, 2010). Participants' verbal and spatial working memory spans were established with the eye in the normal position and with the eye in the abducted position. Abduction of the eye caused a significant reduction in spatial working

memory span, but had no effect on verbal memory span. These results are consistent with the view that spatial working memory and spatial attention rely on similar control mechanisms.

Craighero, L., Nascimben, M., & Fadiga, L. (2004). Eye position affects orienting of visuospatial attention. *Current Biology, 14*(4), 331-333.

Smith, D. T., Ball, K., Ellison, A., & Schenk, T. (2010). Deficits of reflexive attention induced by abduction of the eye. *Neuropsychologia, 48*, 1269-1276.

Soto, D., Hodsoll, J., Rotshtein, P., & Humphreys, G. W. (2008). Automatic guidance of attention from working memory. *Trends in Cognitive Sciences, 12*(9), 342-348.

Early oculomotor capture by new onsets driven by the contents of working memory

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Oculomotor capture can occur automatically in a bottom-up way through the sudden appearance of a new object or in a top-down fashion when a stimulus in the array matches the contents of working memory. It has been suggested that bottom-up capture of the eyes occurs early in time, with the earliest saccadic reactions drawn purely by salience (cf. van Zoest, Donk, & Theeuwes, 2004). According to these models, top-down factors may only affect saccadic programming at a later processing stage, after initial saliency effects by the abrupt onset have elapsed. Here we show that working memory processing can influence the early stages of oculomotor capture by abrupt onsets. Interestingly, the matching between the properties of a new object onset and verbal/visual knowledge held in memory influenced the direction of the fastest saccades made in search, saccadic latencies and the curvature of the scan paths made to the search target. This pattern of results arose even though the contents of working memory were detrimental for search. The data indicate there can be rapid top-down mediation of oculomotor onset capture through the contents of working memory. We discuss the relevance of these findings for current models of saccadic programming and oculomotor capture.

van Zoest, W., Donk, M., & Theeuwes, J. (2004). The role of stimulus-driven and goal-driven control in visual selection. *Journal of Experimental Psychology: Human Perception and Performance*, *30*, 746-759

Visuospatial sequence learning without seeing

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The ability to detect and integrate associations between unrelated items that are close in space and time is a key feature of human learning and memory. Learning sequential associations between non-adjacent visual stimuli –higher-order visuospatial dependencies– can occur either with or without awareness (explicit vs. implicit learning) of the products of learning. Existing behavioural and neurocognitive studies of explicit and implicit sequence learning, however, are based on conscious access to the target locations and, typically, on conditions where orienting, or motor, responses lead to the development of spatially-contingent response mappings to the target sequence. Dichoptic stimuli were presented on a modified version of the serial reaction time task using a mirror stereoscope to mask the eye-of-origin of visual input from conscious awareness. We demonstrate that conscious access to the target sequence and a correlation between the target sequence and responses are dispensable features when learning higher-order visuospatial associations. Sequence knowledge was expressed in the ability of participants to identify the trained higher-order visuospatial sequence on a recognition test, even though trained and untrained sequences were identical when viewed at a conscious binocular level, and differed only at the level of the masked sequential associations. These results demonstrate that unconscious processing can support the learning of higher-order visuospatial associations through interocular integration of retinotopic-based codes stemming from monocular eye-of-origin information. Furthermore, unlike other forms of perceptual associative learning, visuospatial attention did not need to be directed to the locations of the target sequence. More generally, the results pose a challenge to neural models of learning to account for a previously unknown capability of the human visual system to support the detection, learning and recognition of higher-order sequential associations under conditions where observers are unable to see the target sequence or perform spatially contingent responses to the target sequence.

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The role of dorsal and ventral pathways in visual orienting and conscious perception

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Two experiments explored the role of dorsal and ventral processing streams in visual orienting and conscious perception. Both experiments included an Attention Task - where participants responded to peripheral letters by orienting attention towards a target location; and a Perception Task – where participants made an explicit, conscious response to the same letters. Experiment 1 manipulated the luminance contrast of the peripheral letters. Perception of low contrast letters was massively slower and less accurate; but rapid visual orienting in response to peripheral letters was unaffected by contrast. This pattern is consistent with differences in luminance sensitivity between the dorsal and ventral processing streams, and with the hypothesis that visual encoding of objects that trigger attention movements occurs in the dorsal stream. In Experiment 2

participants performed the Attention and Perception Tasks, while neural activity was recorded with high density EEG. The hypothesis of rapid dorsal activation in the Attention Task was confirmed, and this activation preceded top-down enhancement of target processing in occipital cortex. In the Perception Task early ventral activation was seen. These findings highlight the role of re-entrant processes in attention, and support a dual stream, bi-directional model of vision.

Relevance detection in the absence of a functional amygdala

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The notion that the amygdala is crucially involved in prioritising relevant events mainly rests on a single lesion study (Anderson & Phelps, 2001) where a patient with bilateral amygdala lesions, acquired in adulthood, was impaired in recall facilitation during the attentional blink. Here, in a comparable task, we show that two individuals with congenital bilateral amygdala lesions retain facilitated recall of arousing words during the attentional blink. Recall facilitation was statistically significant for both patients and akin to that seen in young students and age- and education-matched controls. We reconcile our findings with previous data by proposing that early amygdala lesions can be compensated for and that there might be a critical developmental period during which the amygdala acquires its functional role in the prioritisation of relevant events.

Anderson, A.K., & Phelps, E.A. (2001) Lesions of the human amygdala impair enhanced perception of emotionally salient events. *Nature, 411*, 305-309.

Symposium: **Sleep and memory**
Organiser: Dr Penny Lewis

Cognitive vulnerability to disturbed sleep in elderly people.

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Vulnerability of memory systems in elderly people may facilitate studies on sleep involvment. A focus on older people is also justified by the higher prevalence of problems with both sleep and memory. We thus demonstrated that sleep fragmentation has predictive value for memory performance (Oosterman et al., 2009). Structural MR

scans indicated that fragmentation of the actigraphic sleep-wake rhythm was even a better predictor for medial temporal lobe atrophy than the accepted best predictor 'age' (unpublished). We subsequently applied a brain-computer-interface feedback system for selective slow wave suppression, to demonstrate that even mild sleep disturbance affects memory encoding and hippocampal activation (Van Der Werf al., 2009). Of note, the sleep deprivation procedure left total sleep duration intact and may provide a better experimental model for the study of age-related sleep changes and insomnia. These findings trigger the question whether enhancement of sleep might ameliorate age-related or dementia-related memory problems. In a long-term study in demented residents of homes for the elderly we showed that enhancement of the 24-hour rhythm in environmental light improves the sleep-wake rhythm, and ameliorates cognitive dysfunction (Reimersma-van der Lek et al., 2008). Concertedly, the studies in humans support animal studies suggesting that hippocampal function may to be particularly sensitive to even mild sleep disruption, especially at advanced age.

Oosterman, J. et al. (2009). Fragmentation of the rest-activity rhythm predicts age-related cognitive deficits. *Journal of Sleep Research, 18*, 129–135.

Riemersma-van der Lek, R. et al. (2008). Effect of bright light and melatonin on cognitive and non-cognitive function in elderly residents of group care facilities: a randomized controlled trial. *Journal of the American Medical Association, 299*, 2642-2655.

Van Der Werf, Y. D. et al. (2009). Sleep benefits subsequent hippocampal functioning. *Nature Neuroscience, 12*, 122-3.

Maintaining memories by reactivation

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According to a widely held concept, the formation of long-term memories relies on a reactivation and redistribution of newly acquired memory representations from temporary storage to neuronal networks supporting long-term storage. I will review evidence showing that this process of system consolidation takes place preferentially during sleep as an "off-line" period during which memories are spontaneously reactivated and redistributed in the absence of interfering external inputs. In addition, I will compare sleep-related reactivation processes with reactivation by retrieval or a reminder during wakefulness, which leads to a transient destabilization of memory traces. I will propose that reactivation serves distinct functions in the maintenance of long-term memories depending on the brain state, allowing for updating of existing memories during wakefulness and integration of newly acquired knowledge in pre-existing knowledge networks during sleep.

Rasch, B., Buchel, C., Gais, S., & Born, J. (2007) Odour cues during slow wave sleep prompt declarative memory consolidation. *Science 315*(5817), 1426-9.

Slow wave sleep, EEG slow oscillations and the formation of memory

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Slow-wave sleep (SWS) facilitates the consolidation of declarative memory a process assumed to involve the redistribution of the memory representations from temporary hippocampal to neocortical long-term storage sites. Evidence will be provided indicating that this consolidation relies on a dialogue between neocortex and hippocampus which is essentially orchestrated by the <1 Hz EEG slow oscillation (SO). The SOs characterizing SWS originate from neocortical networks and temporally group neuronal activity into up-states (of strongly enhanced activity) and down-states (of neuronal silence). This grouping is induced not only in the neocortex but also, via efferent pathways, in other structures relevant to consolidation, e.g., in the thalamus, generating 10-15 Hz spindles, and in the hippocampus, generating sharp-wave ripples. The feedforward synchronizing effect of the SO enables memory-related inputs to be synchronously fed back from these (hippocampus, thalamus) and other structures to the neocortex. The co-occurrence in the neocortex of these feedback-inputs possibly plays a critical role for the long-term storage of memories in neocortical networks. Indeed, induction of slow oscillations during NonREM sleep (but not during REM sleep or waking) by slowly alternating transcranial current stimulation not only enhances and synchronizes spindle activity but also improves the consolidation of declarative memory.

Offline-consolidation of face-location association in shallow sleep after learning

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Research has shown that stabilization of memory traces following encoding involves offline co-activation within task-related areas, especially during post-acquisition sleep. We tested this by recording simultaneous functional magnetic resonance imaging – electroencephalography during the nap after training subjects on a set of face-location association. We used fusiform region of interest (FFA-ROI) derived from the retrieval test session data as the seed region to search for functional connectivity network during the nap period. Compared to wake, connectivity between the FFA-ROI and the bilateral ventral and dorsal streams was significantly increased during sleep stage 1(S1). Similarly, during sleep stage 2(S2), marked increases in fusiform connectivity were observed in the precuneus and the bilateral inferior parietal cortex. Correlation analyses relating connectivity and behavior revealed two main findings. First, fusiform–medial prefrontal connectivity during S1 and S2 was positively correlated with memory retention across the rest period; second, fusiform–hippocampus connectivity during S1 was positively correlated with new memory acquisition following the rest period.

Systems memory consolidation during sleep

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After learning, memory traces undergo a period of transformation and consolidation. During "synaptic consolidation", synaptic potentiation induced during learning is mainly made permanent. However, during "systems consolidation", which has been proposed to exist in the declarative memory domain, new memory traces are not simply strengthened, but they are thought to be transferred and integrated into existing semantic networks. Recent studies show that sleep can play a role in systems consolidation. Several properties of sleep electrophysiology and neurotransmitter activity have been linked to memory consolidation. During sleep, neuromodulators like acetylcholine and noradrenaline shift the brain into a state which favours internal stimulus generation over external stimulus reception. Thus, a dialogue between different brain regions, e.g. the hippocampus and the neocortex, becomes possible, allowing interference free transfer of information between regions. Several recent studies show that the representation of memory in the brain changes over longer time intervals, and that these changes are backed by sleep. In particular, directly sleep-related electrophysiological brain activity, like sleep spindles and slow oscillations, has been associated with memory consolidation. Together, a pattern of brain activity emerges which consists of a coordinated interplay between brainstem, subcortical and cortical areas, providing an optimal environment for off-line memory processing.

Information updating in mental schema: the role of the hippocampus and frontal cortex

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Humans have the ability to store information efficiently by organizing individual events in a coherent framework called mental schema which allows for fast incorporation of new information. We previously found that rodents can form schema in a spatial pair-association task after extensive training (Tse, Langston et al, 2007). Once the schema is acquired, new information can be updated in one trial through the hippocampus. More importantly, memory consolidation in the hippocampus can be achieved rapidly. To understand the schema representation in the brain, we investigated the role of frontal cortex. As anterior cingulate cortex (ACC) is recruited in spatial memory network over time, we asked if ACC is crucial for retrieving or updating new information in the schema. We trained rats with original flavour-location pairs and then introduced new flavour-location pairs as well as retrieval tests of new and original flavour-location pairs. We found that neural transmission in the ACC is critical for encoding and retrieving new and original information in the schema. In conclusion, hippocampus and ACC are both required for updating new information in the schema; however, hippocampus, not ACC, can be spared for retrieving information once consolidation is achieved.

Tse, D, Langston, RF, Kakeyama, M, Bethus, I, Spooner, PA, Wood, ER, Witter, MP, Morris, RGM (2007) Schemas and memory consolidation. *Science, 316*, 76-82.

End of Symposium

Dissociating the effects caused by emotional content and low-level visual characteristics in the unconscious processing of emotional faces

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Converging evidence suggests that emotional (compared to neutral) faces are prioritised to awareness. An issue in this research area is that it is difficult to dissociate the effects caused by the emotional content of the face, and effects caused by the low-level characteristics of the face. Typically spatial inversion has been used as a control for low-level characteristics, although the extent to which inversion disrupts emotion processing is unreliable. In a preliminary experiment we manipulated emotional faces until they were unrecognisable although they had vastly similar image characteristics by spatially inverting, and reversing the luminance of the faces. We presented the manipulated faces (and normal faces) unconsciously using a continuous flash suppression procedure, and measured the duration taken to emerge from suppression. The emotion effects found with the normal faces (faster emergence of fear compared to happy, angry and neutral) were replicated to the same extent in the manipulated faces. Therefore the properties that lead to the prioritisation of fearful faces in unconscious presentations are fully contained in unrecognisable images that share the same visual characteristics. This suggests that the apparent emotion effect may be due to differences in low-level stimulus characteristics between the emotions.

Cross-expression adaptation aftereffects

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Adaptation aftereffects have emerged as an important tool for probing specific dimensions of faces. In the dimension of emotional facial expression, researchers often emphasise the distinction between 'basic' emotional expressions (e.g., Ekman, 1992). However, recent evidence indicates that different expression pairs vary in their physical/perceptual similarity (e.g., anger and disgust expressions are more similar than anger and fear expressions) (Susskind et al., 2007). In four experiments we examined cross-expression adaptation aftereffects in order to probe the potential overlap between different expression pairs. In Experiment 1 we used expressions of anger, disgust, fear and sadness that varied in terms of open or closed mouth in a factorial design (Hsu and Young, 2004). In Experiments 2 and 3 we used similar methods with open mouthed expressions of anger, disgust and fear. In Experiment 4 we used a standard psychophysical approach with only anger and disgust as test faces. There was no evidence of cross-expression adaptation when open and closed mouthed expressions were used. However, when all expressions were open-mouthed we found consistent inhibition of anger expression recognition after disgust adaptation. We discuss these results in the context of the facial actions considered diagnostic for expression recognition and the wider issue of face-space.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, *6*, 169-200.

Hsu, S.M., & Young, A.W. (2004). Adaptation effects in facial expression recognition. *Visual Cognition*, *11*, 871-899.

Susskind, J.M., Littlewort, G., Bartlett. M.S., Movellan, J., & Anderson, A.K. (2007). Human and computer recognition of facial expressions of emotion. *Neuropsychologia*, *45*, 152-162.

Hearing facial identities: ERP correlates of face-voice integration in speaker identification

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Audiovisual integration (AVI) in speech perception is well-known, but integration of facial and vocal information is also important for speaker recognition. We recently demonstrated AVI in the recognition of familiar (but not unfamiliar) speakers (Schweinberger, Robertson, & Kaufmann, 2007, QJEP; Robertson & Schweinberger, 2010, QJEP). Specifically, we observed systematic behavioural benefits and costs in recognising familiar voices when these were combined with time-synchronised articulating faces of corresponding or noncorresponding speaker identity, respectively. Here we report an experiment assessing event-related brain potentials (ERPs) in this novel paradigm, while participants recognised familiar speakers presented in (1) voice only, (2) voice with identity-corresponding or (3) non-corresponding time-synchronised speaking faces, or (4) face only conditions. Audiovisual speaker identity correspondence influenced only later ERPs around 250-600 ms, with increased negativity for non-corresponding identities at central electrodes. Strikingly, when compared with the summed ERPs from both unimodal conditions, both audiovisual conditions led to a much earlier onset of fronto-central negativity, with maximal differences around 50-80 ms. These findings suggest that perception of a time-synchronised face and a voice triggers surprisingly early and mandatory mechanisms of audiovisual processing, although the correspondence or discrepancy in auditory vs. visual speaker identity may only be computed ~200 ms later.

Robertson, D. M. C. & Schweinberger, S. R. (2010). The role of audiovisual asynchrony in person recognition. *Quarterly Journal of Experimental Psychology, 63,* 23-30.

Schweinberger, S. R., Robertson, D., & Kaufmann, J. M. (2007). Hearing facial identities. *Quarterly Journal of Experimental Psychology, 60*, 1446-1456.

The role of expertise for face recognition memory: ERP evidence from a combined own-race and own-age bias experiment

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Humans are often considered to be face experts. Such expertise, however, may vary as a function of perceptual experience with a particular class of faces. Accordingly, young Caucasian participants have been observed to more accurately remember faces from both their own age- and ethnic groups. The present study examined the combined effects of such own-age and own-race biases, by asking young Caucasian participants to learn and remember old and young Caucasian as well as old and young Asian faces. Underlying neural processes were assessed by recording, event-related potentials (ERPs). Behavioural results indicated both an own-race bias for young faces, and an own-age bias for Caucasian faces. Similarly, ERP correlates of recognition memory (i.e., an early parietal old/new effect ~300-500ms) were most pronounced for young Caucasian faces. Unexpectedly, recognition of old Asian faces was more accurate compared to both old Caucasian and young Asian faces. In line with an expertise account to face recognition memory, we suggest that those faces of presumably greatest perceptual experience, i.e., young Caucasian faces, were remembered most accurately. However, combined other-age and other-race faces do not yield additive disadvantages but instead result in relatively better performance, possibly due to enhanced attention to particularly uncommon faces.

One year is sufficient to develop an own-age bias in face recognition

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Children recognise children's faces more accurately than adult faces and adults recognise adult faces more accurately than children's faces (Anastasi & Rhodes, 2005). This is the own-age bias. Research has shown that is, at least, partially based on experience since trainee teachers show less of an own-age bias than other adults (Harrison & Hole, 2009). The present research tested the own-age bias is four groups of children (age 4 to 6, 7 to 9, 10 to 12) and a group of adults in the recognition of three age groups of faces (age 7 to 9; 20 to 22; and 65 to 90). Results showed an own-age bias in all participants. That is, if the faces were older or younger than the participants by 2 years, they were less accurate in their recognition. These results are discussed in terms of short-term experience with and/or motivation to process faces creating biases and this changes with age rapidly.

Anastasi, J. S. & Rhodes, M. G. (2005). An own-age bias in face recognition for children and older adults. *Psychonomic Bulletin and Review, 12,* 1043 – 1047.

Harrison, V. & Hole, G. J. (2009). Evidence for a contact-based explanation of the own-age bias in face recognition. *Psychonomic Bulletin & Review, 16,* 264 – 269.

Damage to the right frontal and temporal cortex disrupt opposite uses of self-face priority

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The neural basis of facial self-awareness is associated with a complex neurological network. Here we attempt to fractionate the facial self-awareness into components, focusing on self-face prioritization, in order to decompose different aspects of the network. We present neuropsychological evidence that disentangles the neural mechanisms determining self-face prioritisation from self-face perception. Non-prosopagnosic patients performed two face-perception tasks sensitive to self-priority. The task-relevance of the face (target vs. distractor) was manipulated to examine task-based and automatic-assignment of self-face priority. In a face orientation task, patients judged whether their own or others' faces were oriented to the left or right. In the 'cross' experiment, patients judged whether the horizontal or vertical element in a cross was relatively longer while ignoring a task-irrelevant face presented as background. Damage to the right superior temporal gyrus eliminated task-based self-prioritisation (in the face orientation task). In contrast, damage to the right postcentral gyrus disrupted patients' automatic assignment of self-priority. These findings indicate that the facial self-awareness consists of at least two components, a task-based self-referential framework represented within the right superior temporal gyrus, and automatic prioritisation of our own face, represented within the right postcentral gyrus.

Age-related differences in gaze following: Does the age of the face matter?

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Previous research revealed age differences in following the gaze of others. To date, however, investigations have concentrated on only young faces as target stimuli. The present study explored whether varying the age of target stimuli moderated gaze following in younger and older adults. Overall, older participants showed less evidence of gaze following, but this was qualified by the age of the face viewed. Younger participants showed an own-age bias, following the gaze cues of stimuli depicting those in their own age range to a greater extent than stimuli depicting older adults. However a similar own-age effect was not found for older participants. These findings suggest that age differences in gaze following may be driven by younger participants having an advantage for processing the gaze cues from the faces of younger adults. The possible roles of familiarity and motivational factors in making these social judgments and the potential negative implications for intergenerational interactions are discussed. These findings highlight the importance of considering the age of the stimulus when investigating age-related differences in some aspects of social cognition.

Reserve List

What is the level of abstraction of cognitive models of melodic contour?

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Many classic studies have shown that the contour (ie the abstract shape of up and down movement) of a melody or a melodic phrase is one of the most important features for storage in memory. Yet it is still unclear at which level of abstraction melodic contour is actually represented in memory. The aim of this exploratory study was to test four different contour representation models for their cognitive adequateness. The models are formalized as computer implementations and differ in the number of free parameters. Participants were tested using an audio-visual matching paradigm where they were asked to pick one of four visual contour shapes that matches best the auditory contour. Choice of visual shape and reaction time are recorded as experimental data. Dependent variables capture participants' accuracy and consistency. Results indicate greater accuracies and consistencies for the contour model with the largest number of free parameters. Reaction times were also longest for this model, suggesting a serial recognition strategy. Contrary to a lot of previous research, the results of this study indicate that melodic contour seems to be represented at a very low abstraction level and appears to be a rather information-rich cognitive representation.

Predicting empathy in self and others

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In social situations we often experience emotional events in the presence of others and sometimes those others may have different emotional experiences to ourselves. The emotional states of others are often a source of our own emotions and therefore how we respond to events may be affected by the emotional experiences of others around us. For example, when asked to predict how we would feel if we passed an exam while a friend simultaneously failed theirs, we might need to take into account effects of empathy as well as our emotional response to the fortune received. In three studies, we examined whether individuals anticipate empathy both in themselves and others. Participants were presented with written scenarios depicting positive and negative events happening to themselves and/or close friends. We found that participants were sensitive to the concurrent (negative but not positive) experiences of others present in the social situation when predicting how they or how someone else would feel in response to emotional events, predicting sympathy (but not empathic joy) in both themselves and others. However, participants predicted slightly less sympathy in others than themselves. The results are discussed in relation to theories of cognitive bias and perspective-taking.

Cognitive correlates of the Out-of-Body Experience (OBE) in the psychologically normal population

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Recent findings from studies of epileptic patients and samples showing elevated scores on measures of schizotypy have suggested that disruptions in multi-sensory integration processes are an important factor underlying predisposition to Out-of-Body Experiences (OBEs: Blanke et al., 2004; Mohr et al., 2006). However, previous studies have not investigated these effects in direct relation to OBEs occurring in the psychologically normal population. The present study provides the first investigation of predisposition to OBEs in the psychologically normal population as measured by the recently devised Cardiff Anomalous Perception Scale (CAPS; Bell et al, 2006) and performance on the Own-body-Transformation task (Blanke et al. 2005). In the first study, 63 university students participated, seventeen of whom (26%) claimed to have experienced at least one OBE in their lifetime. OBEers reported significantly more perceptually anomalies and these were associated with elevated scores on measures of temporal-lobe instability and body distortion processing. A follow-up study demonstrated that OBEers (and those scoring high on measures of temporal-lobe instability / body-distortion processing) were significantly impaired, relative to controls, at a task requiring mental Own-Body-Transformations (Blanke et al. 2005). These results are consistent with an account positing both a disruption in temporal-lobe and body-based processing underlying OBE-type experiences.

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Blanke, O., Mohr, C., Michel, C. M., Pascual-leone, A., Brugger, P., Seeck, M., Landis, T., & Thut, G. (2005). Linking out-of-body experience and self-processing to mental own-body imagery at the temporoparietal junction. . *The Journal of Neuroscience, 19*, 550-557.

Mohr, C., Blanke, O., & Brugger, P. (2006). Perceptual aberrations impair mental own-body transformations. *Behavioural Neuroscience, 120*(3), 528-534.

Word learning in children benefits from a period of offline consolidation

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Adult research has demonstrated that newly learned spoken words are accurately recognised immediately after exposure, but do not become fully integrated into the mental lexicon until after sleep (Dumay & Gaskell, 2007). In this study we examined whether children show a similar time-course in vocabulary learning. Children were familiarized with novel non-words (e.g. *biscal*) and tested on their ability to recognise and recall these non-words both immediately after study and again one day later. We found that although children accurately recognised the novel non-words immediately after exposure, cued recall was initially poor, showing improvements only the following day. These findings suggest that children, like adults, show effects of consolidation on the processing of newly learned words.

Dumay, N., & Gaskell, M. G. (2007). Sleep-associated changes in the mental representation of spoken words. *Psychological Science, 18*(1), 35-39.

The effects of cognitive load on change-blindness

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Recent evidence suggests that an increase in cognitive load in an attended auditory task can impair concurrent processing of task-irrelevant (ignored) visual stimuli (Klemen et al., 2010). In the current study, a dual-task paradigm was designed to test whether increasing cognitive load (i.e. by increasing the difficultly of an *n*-back auditory working memory task) also impairs processing of attended visual stimuli, as measured by visual change-detection. An attended auditory *n*-back task was presented to 21 participants (mean age = 19 years) at either low (1-back) or high (2-back) working

memory load, concurrently with a change-blindness "flicker paradigm", thus allowing the effects of cognitive load on change detection performance to be directly assessed. The results indicated that an increase in cognitive load had no significant effect on change detection accuracy or reaction time. These findings suggest that although an increase in cognitive load in an attended auditory task can impair concurrent processing of task-irrelevant visual stimuli (Klemen et al., 2010), it does not impair the processing of task-relevant visual stimuli when the task requires focussed visual attention.

Klemen, J., Büchel, C., Bühler, M., Menz, M., and Rose, M. (2010). Auditory Working Memory Load Impairs Visual Ventral Stream Processing: Towards a Unified Model of Attentional Load. *Journal of Cognitive Neuroscience 22*(3): 437-46.

Name-picture verification as a control measure for object naming: Data from British English speakers

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The name-picture verification task is often used to assess the difficulty of pre-lexical processes (object recognition and semantic access) during picture naming. However, whether to use responses from word-picture match or from mismatch trials to index the difficulty of pre-lexical processes is debated. Levelt (2002) argued for the use of mismatch trials because on match trials the printed object name might facilitate picture recognition. However, in a study with speakers of Spanish Stadthagen-Gonzalez et al. (2009) showed that visual and conceptual properties of objects only correlated with the latencies of match responses but not with those of mismatch responses and therefore advocated the use of match responses. The present study aimed to replicate Stadthagen-Gonzalez et al. (2009) findings using native British English speakers and English norms for non-lexical and lexical variables. We replicated the finding that non-lexical variables affected the speed of match, but not mismatch responses. However, in addition, we found that lexical variables also affected the speed of match responses, which means that these latencies need to be interpreted with caution. In other words, neither match nor mismatch responses seem ideally suited to assess the difficulty of pre-lexical processes in picture naming.

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Voice-identity processing and misidentification delusions

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Misidentification delusions involve the mistaken identity of a person or persons (e.g., the Capgras delusion – the delusional belief that a loved one has been replaced by an impostor). While the role of face processing impairments in these delusions has been established (e.g., Ellis, Young, Quayle & de Pauw, 1997), limited research has investigated the role of other person-identity information, such as voice, in these delusions (Lewis, Sherwood, Moselhy & Ellis, 2001). The aim of this study was to investigate the contribution of voice processing to the development and maintenance of these delusions. A series of single case studies was conducted including two cases of the Capgras delusion, and another patient who believed a member of the nursing staff was his ex-partner. Voice processing tasks were individually tailored, including assessment of voice-identity recognition, accent identification, and vocal-affect recognition. Face processing (face-identity recognition and facial affect recognition) was also investigated. The person-identity processing skills of the patients varied. In general we can conclude that voice-identity processing is impaired in some misidentification delusions. Furthermore, in cases where voice-identity processing remains intact, this information is insufficient to override the delusion.

Ellis, H.D., Young, A.W., Quayle, A.H., de Pauw, K.W. (1997). Reduced autonomic responses to faces in Capgras delusion. *Proceedings of the Royal Society: Biological Sciences*, B264, 1085-1092.

Eye-tracking the own-race and own-gender biases in face recognition

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Own-race and own-gender faces are recognised more accurately than other-race and other-gender faces (Meissner & Brigham, 2001; Wright & Sladden, 2003). These biases in face recognition may be based on the same mechanisms (Bernstein, Young & Hugenberg, 2007) and differences in eye-tracking for own-race vs other-race faces have been found. Specifically, other-race faces are viewed with fewer and longer fixations to different features and with more dilated pupils than own-race faces (Goldinger, He & Papesh, 2009). This study explored these effects in the own-race and own-gender biases. Eighty White participants (29 male) viewed White and Black, male and female faces in a standard old/new recognition paradigm in which eye-tracking measures such as pupilometry and fixation time were recorded. Areas of interest were the eyes, top of the face, and bottom of the face. No own-race bias was found in this study despite face distinctiveness being accounted for, although an own-gender bias was evident. No differences in pupilometry were found. Overall, participants made more fixations to the bottom of the face than the eyes or the top of the face. The lack of own-race bias in recognition is discussed in terms of beneficial fixations to the lower areas of faces.

Bernstein, M. J., Young, S. G., & Hugenberg, K. (2007). The cross category effect: mere social categorization is sufficient to elicit an own-group bias in face recognition. *Psychological Science, 18,* 706 – 712.

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, and Cognition, 35,* 1105-1122.

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Wright, D. B., & Sladden, B. (2003). An own gender bias and the importance of hair in face recognition. *Acta Psychologica, 114,* 101-114.

Children's difficulties innovating tools: A mental flexibility problem?

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Human life revolves around the use of tools. Despite being proficient tool users, young children have surprising difficulty in innovating tools (making a novel tool to solve a problem). A recent study showed that children do not make a simple hook tool needed to retrieve a bucket from a tall transparent tube until around 8-years old (Beck, Apperly, Chappell, Guthrie & Cutting, under submission). We tested whether 4- to 7-year olds' difficulties in tool innovation can be explained by a lack of mental flexibility. In experiment 1 (N=51), children's difficulty in tool innovation generalised to a new tool innovation task, unbending. However, neither positive nor negative transfer effects were seen between the two tasks (hooks and unbending): Children did not perseverate on a previously successful technique across tasks, nor was flexible thinking facilitated after being shown how to successfully complete the first task. In experiment 2 (N=92), children were not aided by the instruction to 'make' something. Difficulties innovating tools cannot be explained by the inflexible behaviour of becoming functionally fixed on the materials. We conclude that the late development of tool innovation ability is not explained by perseverative, inflexible cognitive behaviours.

Beck, S.R., Apperly, I.A., Chappell, J., Guthrie, C. & Cutting, N. (Under submission). Making hooks isn't child's play.

When pictures lie: Children's misunderstandings of photographs

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Our research addresses young children's understanding of the relationship between photographs and objects. Previous studies have shown that infants will grasp at photographs as if they are attempting to pick up the depicted object (Deloache et al., 1998). Other studies have shown that even older children (3-5 years) do not seem to track both an object and a representation as separate entities (Beilin & Pearlman, 1991; Robinson, Nye & Thomas, 1994; Zaitchik, 1990). Here we report that 3-year-old children who have seen a sticker placed on a photograph of an object that is out of view tend to select a stickered object in preference to the (non-stickered) original in a subsequent retrieval task. Control procedures rule out a bias towards stickered objects in general; children could successfully identify and retrieve the original object when a sticker had been placed on a photograph of another object. We situate this work in the context of children's tendency to make errors with regards to the nature of representations, and suggest that such errors may underlie an implicit belief that "the image equals the object" which may continue into adulthood.

Beilin, H. & Pearlman, E.G. (1991). Children's iconic realism: Object vs. property realism. In H. W. Reese (Ed.), *Advances in child development and behaviour*, Vol 23. pp93 – 111. San Diego, CA: Academic Press.

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Statistical representations are strengthened over a night of sleep

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The consolidation of memory during sleep has been increasingly documented in the last decade, but exposure learning is currently under-represented in this research. Here, we evaluate the contribution of sleep to the offline consolidation of higher-order statistical patterns. Participants were exposed to a 7-minute stream of 1818 pure tones generated stochastically from a transition matrix specifying a particular second-order transition structure while eliminating significant first-order and zero-order transition information. Following the exposure period, participants were presented with 84 two-alternative-forced-choice (2AFC) trials in which each trial contained one sequence generated using the same transition matrix as the exposure stream and one random sequence. Subjects indicated which sequence was familiar. 12hrs after the first session, participants were retested with another 84 2AFC stimuli. 24 participants were divided equally between Wake and Sleep groups, with the Wake group trained at 8am and retested at 8pm on the same day and the Sleep group at trained at 8pm and 8am the next morning. Comparison of session1 and session2 revealed that the Sleep group improved by 7.5% between test sessions (T-test $p=0.0025$), but showed no improvement for the

Wake group (T-test p=0.901). This result extends recent observations of enhanced abstraction after overnight retention intervals.

Behavioural and physiological responses to the emotional and taboo Stroop tasks in native and non-native speakers of English

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Bilinguals frequently report greater emotionality associated with their first (L1) than second language (L2). Yet this has not always been replicated in studies using single word stimuli (e.g. Eilola, Havelka & Sharma, 2007). The aim of the present study was to extend the investigation of emotional word processing in L1 and L2 using emotional and taboo Stroop tasks combined with skin conductance recording. Significantly slower response times to negative and taboo words when compared to neutral words were found in both groups of participants, but positive words were not found to differ from neutral words. No differences between native and non-native speakers in their behavioural responses were present. Skin conductance levels (SCLs), however, did reveal differences between the native and non-native participants: Native English speakers responded with significantly higher SCLs to negative and taboo words when compared with neutral and positive words. This difference was not observed in non-native speakers. This suggests that, although the two groups responded in a very similar manner on a behavioural level, the level of arousal produced by the negative and taboo words for native English speakers was greater than that for non-native speakers.

Eilola, T. M., Havelka, J., & Sharma, D. (2007). Emotional activation in the first and *second language. Cognition & Emotion, 21, 1064 – 1076.*

How do emotional contents modulate the belief-bias effect?

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Our ability to reason deductively is highly influenced by the prior believability of a conclusion. This 'belief-bias' phenomenon has been robustly reported across experimental conditions and stimuli contents (Goel & Dolan, 2003). Yet, little is known about how the emotional nature of stimuli affect this tendency to rely on beliefs instead of logic. This study addressed this question by investigating belief-bias effects in a categorical syllogisms task on a student sample of 64 women. Three content categories were used: neutral, generally emotional and sexual abuse-related, to test the hypothesis that belief-bias effects would be elevated in the two emotional categories compared to the neutral category. The results supported the hypothesis. Participants relied more on their beliefs when reasoning about emotional contents compared to neutral contents. Nevertheless, unbelievable conclusions were even less likely to be endorsed when the contents were related to sexual abuse (compared to other contents), especially for

logically valid conclusions. This novel finding of a somehow differential effect of generally emotional and sexual abuse contents on logicality suggests that there might be something about processing the informational value attached to an emotion that affects logicality in deductive reasoning. An argument is made for that '*something*' being '*salience*'.

Goel, V., & Dolan, R. J. (2003). Explaining modulation of reasoning by belief. *Cognition, 87*(1), B11-B22.

List length effects and strategy use in free and serial recall

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In a recent study, Ward, Tan and Grenfell-Essam (in press) tested immediate memory for lists of unknown length (between 1 and 15 words). They observed an important shift in output order: for short lists, participants tended to initiate recall with the first word, leading to elevated recall of early list items. As list length increased, so there was an increased tendency to initiate recall with one of the last four words, leading to extended recency effects. However, one potential concern might be that participants adopted atypical strategies due to the unknown list length. To test this possibility, participants in the current study either knew the list length before the next trial or did not. Advance knowledge of the list length did not affect this shift in output order for IFR (Experiment 1) or ISR (Experiment 2), demonstrating that this finding generalizes to trials in which the list length was known in advance (as is common in most published immediate memory literature). Moreover, close examination of the IFR data suggests that knowing when the list will end results in more S-shaped recency effects, a finding that informs differences between recent IFR theories and data sets.

Ward, G., Tan, L., & Grenfell-Essam, R. (in press). Examining the relationship between free recall and immediate serial recall: the effects of list length and output order. *Journal of Experimental Psychology: Learning, Memory, & Cognition.*

Promises and tips: Are readers sensitive to conditional indirect meaning?

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Comprehending the speech acts communicated by implicit performative statements is central to language comprehension. People often use conditional statements of the form *if p then q* to implicitly communicate speech acts such as promises (e.g., if you wash the car, I'll pay you five pounds) and tips (e.g., if you want to lose weight, you need to exercise more). Comprehension of these statements requires an inference to determine the type of speech act being performed. We used self-paced reading to examine readers' sensitivity to this conditional indirect meaning during reading. A processing penalty was associated with reading an explicitly named speech act (i.e., promise or tip) when it mismatched with the speech act that had been indirectly

communicated by a preceding conditional (F1 (1, 31) = 4.31, p = .046; F2 (1, 31) = 10.72, p = .003). We take this as evidence that readers represent conditional indirect meanings during comprehension. Although the majority of psychological research on conditionals treats them as locutionary acts that express logical propositions, a full account requires an understanding of their associated illocutionary force.

Quantitative MRI and cognitive performance in Systemic Lupus Erythematosus (SLE)

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This study seeks to relate cognition in Systemic Lupus Erythematosus (SLE) to quantitative changes in the brain. Patients (mean age 44.29±11.51) with a primary diagnosis of SLE were compared to matched controls on a broad cognitive test battery, neuropsychological measures and quantitative MRI (magnetization transfer and diffusion tensor imaging (DTI)). Using DTI we measured the extent (ADC) and directionality (FA) of diffusion which are sensitive measures of brain structural integrity. Initial results indicate that cognitively, the patient group performed worse than controls. Significant differences emerged on episodic memory (AVLT), speed of processing tasks and fluency tasks. Deficits showed no interaction with task difficultly, suggesting perhaps motor problems or motivation issues. Consistent with this the patients had lower baseline recall scores on the AVLT but comparable rates of learning to controls, and no differences in approach to task. On DTI measures the patient group showed increased ADC and decreased FA, changes which are consistent with subtle brain damage. These however did not correlate with cognitive performance. Future work will involve investigate whether correlations exist between specific brain regions and cognitive domains, and exploring whether other possible corrrelates of cognition exist in clinical variables that define SLE.

Non-specificity of theory of mind in children with and without Autism Spectrum Disorder (ASD): Evidence from a new non-verbal false sign task

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We present preliminary evidence from a new non-verbal false sign task showing that children with and without ASD's difficulty on false beliefs may be explained as a problem in understanding representations rather than mental states specifically. This non-verbal false sign task was modelled on the non-verbal false belief and false photograph tasks devised by Apperly et al. (2004, 2007) which used a minimum level of language, eliminated the requirement of inhibiting one's knowledge about reality, and controlled for incidental executive demands. Two groups of 9 children, one with ASD and the other without ASD, were matched with verbal mental age and tested with the false sign, false belief, and false photograph tasks. Preliminary results showed no significant difference between groups on all three tasks. Their performance was also not significantly different

between the tasks. Moreover, performance on the false belief trials was significantly correlated with that on the false sign trials when the groups were collapsed. These findings showed that the equivalence previously found between false belief and false sign tasks still held in the current non-verbal reality-unknown context, suggesting the tasks are probably based on the same underlying skills in representational understanding rather than language and executive functions.

Apperly, I., Samson, D., Chiavarino, C., & Humphreys, G. (2004). Frontal and temporo-parietal lobe contributions to theory of mind: Neuropsychological evidence from a false-belief task with reduced language and executive demands. *Journal of Cognitive Neuroscience, 16,* 1773-1784.

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Older adults show differential slowing during theory of mind reasoning

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Theory of mind is the ability to understand the beliefs, thoughts and intentions (mental states) of others. This knowledge allows predictions to be made as to how another person is likely to behave. Decoding these social cues accurately allows appropriate responses to be exchanged thereby maximizing the effectiveness of the interaction occurring. Previous research into the trajectory of theory of mind into older adulthood has produced mixed results however these studies have tested small numbers of participants, used a limited number of stimuli and been subject to ceiling effects. The current study aimed to delineate first order theory of mind tasks by evaluating the reaction times of younger and older adults on theory of mind stories (Apperly et al., 2004). The stories used minimized demands on language ability and executive function, both of which have been highlighted as potential contributors to age related decline in theory of mind ability. Reaction times and levels of accuracy were measured for questions pertaining to false belief, memory, reality and counterfactual information presented in the story text. Older adults were slower for all conditions but differentially greater slowing for memory and false belief questions indicating age related declines in theory of mind reasoning.

Apperly, I. A., Samson, D., Chiavarino, C., & Humphreys, G. W. (2004). Frontal and left temporo-parietal contributions to theory of mind: Neuropsychological evidence from a false belief task with reduced language and executive demands. *Journal of Cognitive Neuroscience, 16*, 1773–1784.

Why do dispensing errors occur? A cognitive approach to pharmacist dispensing error.

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This study comprises one aspect of the patient safety research conducted by the Scottish Patient Safety Network. Seventeen participants took part in a computer-based simulation of accurate drug selection from a pharmacy shelf; an important aspect of dispensing medication. They were asked to identify a target drug name from a 3D perceptual array featuring 20 mock drug packets. Variables included the manipulation of task complexity through the inclusion of one to four drug names which were orthographically similar to the target drug name and the use of textual enhancements in an attempt to disambiguate similar drug names. The results showed that mean reaction times for drug selection when there were four similar non-targets present were significantly slower than reaction times for drug selection when only one similar non-target was present; $t(15)$ 3.357, $p. < 0.05$. Similarly, the number of drug names accurately identified was significantly lower when four non-targets were present as opposed to a single non-target; $t(15)$ -2.335, $p. < 0.05$. There was no significant effect of using textual enhancements. Our results suggest that orthographic similarity between drug names can negatively affect accurate drug selection, with a significantly greater effect seen when more than one similar non-target is present.

The effect of variations in tactile stimulation on the rubber hand illusion

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Previous studies have shown that when a rubber hand is stroked synchronously with a participant's own hidden hand, an illusion is elicited whereby tactile sensations produced by the stroking of the participant's hand are felt to be located in the rubber hand and participants report ownership over the fake hand. Thus far, little attention has been paid to other factors that are likely to influence the strength of the illusion, such as the nature of the tactile stimulation. We investigated whether unmyelinated tactile C afferents (CT afferents) with mechanoreceptive properties to light touch play a necessary role in the illusion. The strength of the illusion was measured at two speeds of tactile stimulation (3cm/s and 30cm/s) on two stimulation sites – back and palm of the hand as CT afferents respond maximally to slow touch and are found only in hairy skin (Olausson, et al., 2010). Our results show that, despite participants showing a strong effect of the illusion and rating the slow stroking speed as most pleasant, illusion strength as measured by perceptual drift and questionnaire measures was not affected by hand orientation or speed of stroking. Based on these results, we cannot confirm a role for CT afferents in the rubber hand illusion.

Olausson, H., Wessberg, J., Morrison, I., McGlone, F., & Vallbo, Å. (2010, available on-line). The neurophysiology of unmyelinated tactile afferents. *Neuroscience & Biobehavioral Reviews, 34,* 185-191.

Investigating the mechanisms of visually evoked touch

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When attempting to detect an ambiguous signal, participants often report the presence of the signal when no such stimulus has been delivered, particularly when a stimulus in an orthogonal modality is presented simultaneously (Johnson, Burton & Ro, 2006; Lloyd, Mason, Brown & Poliakoff, 2008; Lovelace, Stein, & Wallace, 2003). Here, we demonstrate that despite never having received a paired light and pulse stimulus, participants still made more false alarms in the presence of the light, suggesting that these 'false alarms' may be a consequence of an existing association, rather than an association learned during the experiment. We then sought to manipulate the strength of any association between the two stimuli by using a training protocol prior to the task. While both 'low' and 'high' association groups exhibited an increased number of illusory touch reports during light trials, individuals in the 'high' group made no more illusory touch responses than a control group, in contrast to those in the 'low' group, who showed significantly fewer false alarms. This suggests that the light-evoked false alarms rely on associations built up during everyday multi-modal experience, the effect of which can be reduced but not increased by a short training protocol.

Johnson, R.M., Burton, P.C. & Ro, T. (2006) Visually induced feelings of touch. *Brain Research*, 1073-1074, 398-406.

Lloyd, D.M., Mason, L., Brown, R.J. & 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.

Lovelace, C.T., Stein, B.E. & Wallace, M.T. (2003). An irrelevant light enhances auditory detection in humans: a psychophysical analysis of multisensory integration in stimulus detection. *Cognitive Brain Research,* 17. 447-453.

Is the experience of perceptual illusions related to body experience in everyday life? An investigation using the Rubber Hand Illusion

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Previous studies have found considerable individual differences in the experience of perceptual illusions such as the Rubber Hand Illusion (RHI), but it is unclear what underlies this large variation in experience. Some studies have found relationships between illusion experience and questionnaire measures of the experience of the body in everyday life (e.g. Burrack & Brugger, 2005), which suggests that the way we usually experience our bodies influences our responsivity to these illusions. The current study investigated individual differences in RHI experience in relation to self-reported medically unexplained symptoms (MUS), which are potentially disabling physical

symptoms with no medical explanation. We identified a non-clinical group with high scores on the Somatoform Dissociation Questionnaire (indicating a tendency to experience MUS) and a control group with low scores on this scale. We then assessed experience of the RHI in these groups using both questionnaire and proprioceptive measures. On both measures, the control group responded more strongly to the RHI, suggesting that susceptibility to the illusion is related to individual differences in everyday bodily experience. The findings also support the notion of a link between MUS and disturbances in body representation (Brown, 2004).

Burrack, A. and P. B. Brugger (2005). Individual differences in susceptibility to experimentally induced phantom sensations. *Body Image*, 2, 307-313.

Brown, R. J. (2004). Psychological Mechanisms of Medically Unexplained Symptoms: An Integrative Conceptual Model. *Psychological Bulletin, 130*, 793-812.

Use of gaze to judge friendliness: A study of ASD and typical development

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Levels of eye contact between individuals can reveal a friendly, indifferent, or hostile relationship. There has been little research into whether children consistently interpret eye gaze as a cue to affiliation, in the way that adults tend to (for a review see Kleinke, 1986). Following from Baron-Cohen et al. (1995), there has been considerable interest in gaze processing and mentalising in individuals with Autism Spectrum Disorder (ASD). In two studies, we explore children's tendency to use direct gaze as a measure of approachability. Participants were presented with photographs of pairs of people, one looking at the camera and one looking away. Performance was compared in egocentric (who would *you* like to play with) and allocentric (who would *he* like to play with) situations. In Experiment 1, typically-developing 3- through 6-year-olds performed similarly in egocentric and allocentric conditions, generally choosing the direct gazer as the approachable character both for themselves and for a third party. Experiment 2 presents pilot data with adolescents diagnosed with ASD, who behaved similarly to the typically developing participants only in the allocentric condition, showing no preference for direct gaze in the egocentric condition, despite correctly identifying the character showing direct gaze.

Baron-Cohen, S., Campbell, R., Karmiloff-Smith, A., Grant, J., & Walker, J. (1995). Are children with autism blind to the mentalistic significance of the eyes? *British Journal of Developmental Psychology, 13*, 379–398.

Kleinke, C. L. (1986). Gaze and eye contact: A research review. *Psychological Bulletin, 100*(1), 78-100.

Speeding up the clock using click-trains: An extension into vibrotactile timing

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Previous research has demonstrated that subjective estimates of duration can be lengthened if the stimulus being timed is preceded by a 5-second click-train of 5Hz auditory clicks (Treisman et al., 1990). This lengthening effect is not unique to auditory stimuli and also occurs when visually presented durations are preceded by 5Hz visual flickers (Droit-Volet & Wearden, 2002). It is generally accepted that this lengthening effect occurs because of an increase in the speed of the internal clock (Penton-Voak et al., 1996). The current experiments explored whether this speeding up the clock effect would also occur when the to be timed stimulus was preceded by a train of vibrations. A verbal estimation paradigm was employed in which participants were required to estimate the duration of a temporal standard (Exp-1 vibrotactile, Exp-2 visual) in milliseconds. On 50% of trials the temporal standard was preceded by a 5-second train of 5Hz vibrations, on the remaining trials the standards were preceded by 5-seconds of silence. The results indicate that the duration of vibrotactile and visual temporal standards was overestimated when preceded by a train of clicks, relative to when preceded by silence. However regression analysis indicated that although the click-trains did lengthen estimates of duration they did so in a manner consistent with them providing an attentional cue rather than an increase in internal clock speed.

Droit-Volet. S., & Wearden, J.H. (2002). Speeding up an internal clock in children? Effects of visual flicker on subjective duration. *The Quarterly Journal of Experimental Psychology 55B,* 193-211.

Penton-Voak, I.S., Edwards, H., Percival, A., & Wearden, J.H. (1996). Speeding up an internal clock in humans? Effects of click trains on subjective duration. *Journal of Experimental Psychology: Animal Behavior Processes*, *22*, 307-320.

Treisman, M., Faulkner, A., Naish, P. L. N., & Brogan, D. (1990). The internal clock: Evidence for a temporal oscillator underlying time perception with some estimates of its characteristic frequency. *Perception, 19*, 705–748.

The consolidation of recognition memory over time: An ERP investigation into vocabulary learning

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It seems intuitive to assume that recognition memory fades over time when information is not reinforced. However recent evidence suggests that some aspects of word learning may benefit from a period of consolidation (e.g. Dumay & Gaskell, 2007). In the present study, event-related potentials (ERP) were used to examine the effect of

consolidation on the recognition of familiar and newly learned (novel) words. Native English speakers were taught novel words associated with English translations, and subsequently performed an Episodic Memory task in which they made old/new decisions in response to both words (trained word verses untrained word), and novel words (trained novel word verses untrained novel word). The Episodic task was performed 45 minutes after training (day 1) and then repeated the following day (day 2) with no additional training session in between. On day 2 ERPs indicated a significant reduction in the familiarity of learned words, and a significant increase in the recognition of learned novel words in comparison to day 1. The data suggests that while recognition memory for familiar items may fade over time, recognition of novel items seems to benefit from a period of consolidation.

Dumay, N. & Gaskell, G. (2007). Sleep-associated changes in the mental representation of spoken words. *Psychological Science, 18,* 35-39.

Spatial perpspective taking: How do we mentally transform bodies and objects?

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Spatial perspective taking (SPT) is the ability to imagine things from a different point of view. Previous research suggests objects and bodies are processed differently in SPT and that distinct neural substrates are involved in each (Zacks et al. 2003). Depending on circumstances, bodies can be processed in relation to one's own point of view (egocentrically) or as if the body were shifting (object-based transformations). Recent work suggests egocentric PT is related to mentalising (Hamilton et al. 2009) and embodiment. However, previous work has contrasted SPT of bodies with non-human stimuli in dissimilar mental rotation tasks. We used Zacks 2002 mental rotation paradigm to examine the different ways of processing human and non-human stimuli. Participants made a same-different judgement on pairs of stimuli presented at different orientations (rotated about a vertical axis), or a left-right judgement on a single stimulus, also varying in orientation. Based on Zacks 2002 findings, we predict monotonic increase in same/different RT's with angle of disparity. Kessler and Thomson, 2010 found SPT to be influenced more by embodiment than proprioception, so we may also expect to see a difference between human/non-human stimuli RT's. Results will be discussed in relation to current theories of spatial object/body representation.

Hamilton, A.F.C., Brindley, R. & Frith, U (2009). Visual perspective taking impairment in children with autistic spectrum disorder. *Cognition 113(1): 37-44.*

Kessler, K. and L. A. Thomson (2010) The embodied nature of spatial perspective taking: Embodied transformation versus sensorimotor interference. *Cognition 114(1): 72-88.*

Zacks, J. M., J. M. Ollinger, et al. (2002). A Parametric Study of Mental Spatial Transformations of Bodies. *NeuroImage 16(4):857-872.*

Zacks, J. M., J. M. Vettel, et al. (2003). Imagined Viewer and Object Rotations Dissociated with Event-Related fMRI. *Journal of Cognitive Neuroscience 15(7): 1002-1018*.

Is the contribution of familiarity to associative recognition related to component domain or the specific components themselves?

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The Domain Dichotomy Perspective specifies under which conditions familiarity contributes to associative recognition. Initial formulations of this view suggested that a simple "within- vs. between-domain distinction" was sufficient. However, recent behavioural findings suggest that this distinction is insufficient. When the task requirements are kept constant and stimulus pairs to be remembered are varied, associative recognition performance differs considerably. This leads to potential confounds with ceiling and floor effects for recognition of different types of association. Nonetheless, using a proportional measure of familiarity, its contribution can be examined effectively. Other work has tried to match recognition performance with similar results. This research has shown clear differences in familiarity's contribution for different kinds of pairs, although not for within- versus between-domain pairs. This suggests that the key factors which affect familiarity's contribution are stimulus specific. To investigate this, a running recognition fMRI study was conducted to explore which regions of the brain (and specifically the medial temporal lobes) are involved for different kinds of stimulus. Degree of overlap between different stimuli was taken as a guide to the likely amount of familiarity support for associations between these stimuli. These results are discussed within the context of the above behavioural work.

Naming speed is negatively related to working memory capacity

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Individuals differ greatly on how efficiently they can retrieve words from the mental lexicon in spoken word production. Little is known about how this individual difference might be related to individual difference in other cognitive abilities. The present study investigated the relationship between individuals' working memory capacity and their efficiency of lexical access. Speeded naming of drawings of actions and objects was used to measure the efficiency of lexical access. To assess working memory capacity, we used the Operation Span (OSPAN) task (Turner & Engle, 1989), in which participants memorize unrelated words while making judgments on simple mathematic operations. We found that action naming response time (RT) was significantly longer than object naming RT. More importantly, there was a significant negative correlation between the action naming RT and the OSPAN score. There was no correlation between object naming RT and the OSPAN score. Ex-Gaussian analyses of the RT distributions revealed that the negative relationship between OSPAN and RT was evident throughout the distributions (i.e., reflected in the Gaussian part of the distribution). These results suggest that when words are difficult to select (our

verbcondition) people with larger working memory capacity outperform people with lower working memory capacity.

Turner, M. L., & Engle. R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language, 28,* 127-154.

Sleep spindle activity correlates with integration of newly learned words in the mental lexicon

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When novel spoken words become integrated in the mental lexicon, they influence the recognition of similar-sounding familiar words (e.g., learning "cathedruke" will slow recognition of "cathedral"). This lexical competition effect emerges preferentially after sleep (Dumay & Gaskell, 2007). We examined aspects of sleep architecture associated with this effect and the recall of novel words. Participants studied novel words in the evening (sleep group) or in the morning (wake group) and were then tested on three occasions: immediately, following a 10hr delay (across wakefulness or a night of polysomnographically monitored sleep), and a week later at the same circadian time. Free and cued recall rates increased across a night of sleep, but remained unchanged or decayed across a day of wakefulness. Compared to the 10hr delay test, recall rates increased at the 1-week test in the wake group. Recognition speed showed similar patterns. Novel words engaged in lexical competition at the 10hr and 1-week delay tests. Emergence of this effect was associated with sleep spindle activity: the magnitude of change in competition overnight was positively correlated with spindle count. We argue that spindles are central for integrating new memories with existing memories, but may be less important for enhancing item recall.

Dumay, N., & Gaskell, M. G. (2007). Sleep-associated changes in the mental representation of spoken words. *Psychological Science, 18*, 35-39.

Individual differences in Multi-Voxel Pattern Analysis of retinotopy predict performance in a visual short-term memory task.

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Visual Short-Term Memory (VSTM) lets us to retain chunks of information and manipulate their representations, so we need not rely on immediate visual input. The deployment VSTM in change detection tasks is not a single unitary construct, but depends on several processes: encoding of information, its maintenance in memory and the comparison and decision processes leading to response. While we have some understanding of which areas are involved in VSTM as a whole, our comprehension of each of these phases is limited. We decided to test the impact of the encoding, maintenance and response phases on performance in a VSTM task, and the neural substrates mediating this. To this effect, we we ran a fMRI experiment where participants had to remember visual, retinotopically presented sectors. Univariate analysis showed activation in parietal areas during all three phases of the task, and activation and deactivation here was related to behavioural performance. Retinotopic analysis using MVPA showed that occipital visual cortex and posterior parietal cortex code spatial information during the encoding and maintenance phase, but that the strength of this spatial pattern only impacted performance during the encoding phase.

Automatic visual perspective-taking in adults- How much calculation can we do whilst being efficient?

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Classical theory of mind findings suggested that children cannot infer one's mental states until they celebrate their fourth birthday (e.g., Wimmer & Perner, 1983). However, recent studies on young infants (e.g., Onishi & Baillargeon, 2005) and non-human animals (e.g., Tomasello et al., 2003) demonstrated a theory of mind capacity that draws few demands on executive control processes. The current study examined adults' visual perspective taking capacity as a potential explanation to the discrepant findings in the developmental and animal studies. We have inspected the capacity and limits on adults' automatised visual perspective taking (Samson et al., in press) with additional enumeration and information selection load. Basic egocentric intrusion and altercentric intrusion were replicated from Samson and colleagues' finding (in press), suggesting that adults do automatically process self and other's visual perspective. Moreover, such mechanism is not restricted to efficient enumeration (Kaufman et al., 1949); both egocentric and altercentric intrusions were found in "unsubitizable" numbers. Adults also have the cognitive capacity to select the relevant perspective content from the irrelevant information, only processing genuine self and other perspective content. The present study demonstrated an automatic, flexible and purposeful visual perspective taking mechanism that does not rely heavily on executive control processes.

Kaufman, E. L., Lord, M. W., Reese, T. W., & Volkmann, J. (1949). The discrimination of visual number. *American journal of psychology, 62(4)*, 498-525.

Onishi, K. H., & Baillargeon, R. (2005). Do 15-month-old infants understand false beliefs? *Science, 308*, 255-258.

Samson, D., Apperly, I. A., Braithwaite, J. J., Andrews, B. J., & Bodley Scott, S. E. Seeing it their way: Evidence for rapid and involuntary computation of what other people see. (In press).

Tomasello, M., Call, J., & Hare, B. (2003). Chimpanzees understand psychological states- the question is which ones and to what extent. *Trends in cognitive science, 7(4)*, 153-156.

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition, 13*, 102-128.

NOTES

Local Information

Accommodation close to campus

The closest hotels and guest houses are located in the city centre, approximately half a mile from the conference venue. With Visit Manchester (www.visitmanchester.com/) you can search for accommodation and book online.

Hotels surrounding Piccadilly Gardens are the most conveniently located for public transport links, with Manchester Piccadilly Station, Manchester Central Coach Station and local bus services within a few minutes walk. Hotels near Piccadilly Gardens include the Britannia Hotel (www.britanniahotels.com/hotels/manchester) and the Thistle Manchester Hotel (www.thistle.com). The closest hotel to the conference venue is the Palace Hotel on Oxford Road (www.palace-hotel-manchester.co.uk/) which is a 10-15 minute walk, while just round the corner is one of the most affordable hotels; The Premier Inn on Portland Street (www.premierinn.com).

Travel

To find the conference venue we recommend that you download and print both the City Map and Campus Map from The University of Manchester website (www.manchester.ac.uk/aboutus/travel/maps/). Platform presentations will take place in the Samuel Alexandra Building (Building 67 on the Campus Map, behind the Students' Union) while the Poster Session and Drinks Reception will be held in Coupland Building 1 on Coupland Street (Building 43 on the Campus Map). Both buildings are located just off Oxford Road.

By Rail

There are three train stations in the city centre; Manchester Piccadilly, Manchester Victoria and Manchester Oxford Road. From Piccadilly and Victoria it is a half hour walk to the conference venue. Alternatively you can take a taxi or local bus (see below). For further information see the University's online travel guide (www.manchester.ac.uk/visitors/travel/train) 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 Coach

National Express (www.nationalexpress.com) operate regular daily services from Manchester to all over the UK and most airports. See their website for full details. Megabus also offer regular low cost services from selected cities across the UK (www.megabus.com/uk/). All coaches arrive and depart from Manchester Central Coach Station on Chorlton Street. From Chorlton Street you can walk to the conference venue in approximately 20 minutes or take a local bus from nearby Piccadilly gardens (see below).

By Car

Detailed directions to the Oxford Road area can be found on the University's online travel guide (www.manchester.ac.uk/visitors/travel/directions/**).** All approach routes are clearly signposted 'The University of Manchester'.

Both the Manchester Aquatics Centre multi-storey car park on Booth Street East and the multi-storey on Charles Street offer paid public parking that is convenient and secure.

Local Information

Local Bus Services

Piccadilly Gardens is the hub for local bus services. The conference venue is approximately a 10 minute bus ride from here. The bus route between Piccadilly Gardens and the conference venue is the busiest in Europe, with buses departing every few minutes. Services 142, 143, 41, 42 and 43 will take you to the conference venue (Magic Bus and Finglands services are cheaper and more frequent than Stagecoach). Ask the driver to drop you off opposite the University of Manchester Students' Union (UMSU). The Samuel Alexander Building is just behind UMSU.

From Piccadilly Station you can take the Oxford Road Link bus (service 147) to the conference venue. The service starts at Bus Stop C outside the Fairfield Street entrance. Alternatively, the station approach leads directly to Piccadilly Gardens, where you can take a local bus to the conference venue (see above). From Victoria Station it is a five minute walk to Piccadilly Gardens. If you arrive at Oxford Road station the conference venue is a short 5-10 minute walk.

For all further information on local bus timetables and other public transport, call Traveline on + 44 871 200 22 33 or visit the Greater Manchester Public Transport Enterprise website (www.gmpte.com).

Local Taxis

There are taxi ranks outside each of the main train stations. If you wish to call a taxi during your stay, a reliable operator based in central Manchester is Mantax (0161 230 3333). A taxi from Piccadilly Station or Victoria Station to the conference venue on Oxford Road will cost around £5. For the Samuel Alexander Building ask the driver to drop you off at the University of Manchester Students' Union on Oxford Road. The Samuel Alexander Building is located just behind the Students' Union. For Coupland 1 Building ask to be dropped off outside Manchester Museum. Walk under the archway and past the entrance to the Museum, Coupland 1 is on your right hand side.

Eating and Drinking on Campus

For lunch and coffee, we would recommend Café Muse (Couture) which is located on the Ground Floor of Manchester Museum. For a quieter option, Christies Bistro (located within the quadrangle behind Whitworth Hall) is also conveniently located for refreshments and light bites. Kro Bar (opposite the Students' Union) serves food during the day along with a good selection of real ales and continental lagers. Alternatively the University Precinct Centre on Oxford has a branch of Spar while Blackwell's book shop has a café located on its ground floor.

Local Information

Evening meal: Restaurants in Manchester

There are many restaurants in the centre of Manchester catering for all tastes and budgets. For a comprehensive list with reviews and menus visit the Restaurants of Manchester website (http://www.restaurantsofmanchester.com). Listed below are a few places we would personally recommend.

British – Sam's Chop House, Back Pool Fold off Cross Street, Manchester, M2 1HN Tel: 0161 834 3210 http://www.samschophouse.co.uk/

French – Malmaison Brasserie, Malmaison Hotel, Piccadilly, Manchester, M1 3AQ Tel: 0871 978 9611. http://www.malmaison-manchester.com/indulge/brasserie

Italian – The Olive Press, 4 Lloyd Street, Manchester, M2 5AB Tel: 0871 978 9615. http://www.heathcotes.co.uk/olivepress/

Thai – Chaophraya, Chapel Walks, Off Cross Street, Manchester, M2 1HN, Tel: 0871 978 9602. http://www.chaophraya.co.uk/manchester.html

Japanese – Samsi, 36-38 Whitworth Street, Manchester, M1 3NR, Tel: 0871 230 5325. http://www.samsi.co.uk/samsi-manchester.htm

Spanish (tapas) – La Viña, 105-107 Deansgate, Manchester, M3 2BQ, Tel: 0161 8353144. http://www.lavina.co.uk/

Central American – Panama Hatty's, 43a Brown Street off King Street, Manchester, M2 2JJ, Tel: 0161 839 3671. http://www.panama-hatties.co.uk/Manchester_home.html

Conference Dinner

The conference dinner will be held at the Olive Press on Thursday 8th July at 8pm (4 Lloyd Street, Manchester, M2 5AB, http://www.heathcotes.co.uk/olivepress/). The cost will be £25, for 3 courses. EPS members please book and indicate any dietary requirements on the enclosed form which should be returned to Andrew Stewart, School of Psychological Sciences, Coupland Building 1, University of Manchester, Oxford Road, Manchester M13 9PL before 17th June 2010.

Please note that the restaurant is located in the city centre (see above for transport options from the conference venue). It is about a 30 minute walk from the conference venue, or 5 minutes by bus.

Local Information

Places of Interest

Manchester is a vibrant city with much to offer. The Tourist Information Office website is a useful place for information on what's on in Manchester (http://www.visitmanchester.com). For up to date information on theatre and concerts see the Pride of Manchester website (http://www.prideofmanchester.com). Here are some ideas of activities you may wish to enjoy during your stay.

John Rylands Library - Located on Deansgate in the city centre, this Victorian Gothic library houses the special collections of the John Rylands University Library (JRUL). Open Tues-Sat 10am-5pm, Sun-Mon 12pm-5pm. Free entry. http://www.library.manchester.ac.uk/specialcollections/

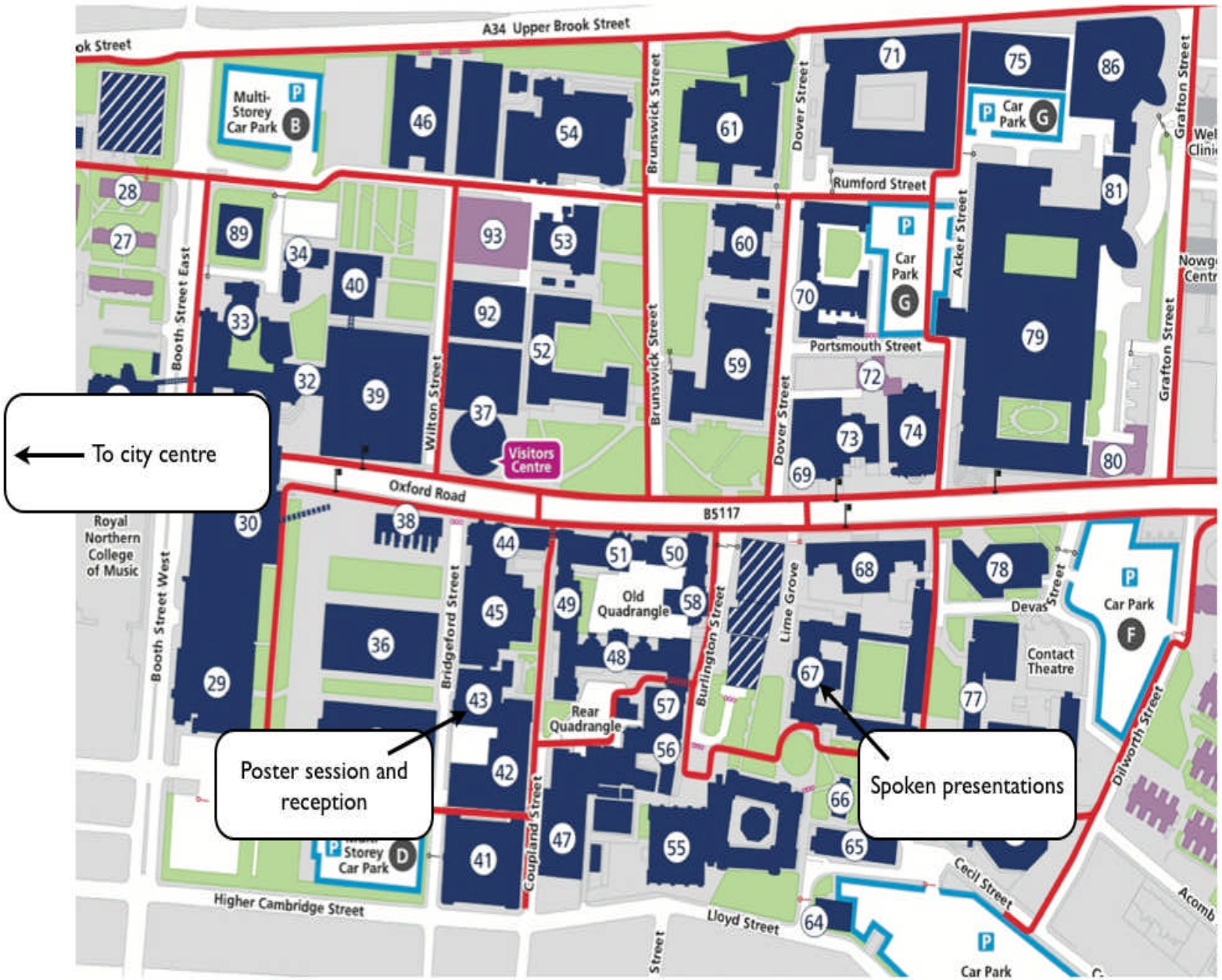
Manchester Museum - Located on Oxford Road close to the conference venue. Open Tues-Sun 10am-5pm. Free entry. http://www.museum.manchester.ac.uk/

Whitworth Art Gallery – Located on Oxford Road close to the conference venue. Open Mon-Sat 10am-5pm, Sun 12pm-4pm. Free entry.

Museum of Science and Industry - Liverpool Road, Manchester M3 4FP. Open Mon-Sun 10am-5pm. Free entry to permanent exhibitions. http://www.mosi.org.uk/

Imperial War Museum North – Trafford Wharf Road, M17 1TZ. From Piccadilly Gardens take the Eccles tram service, alight at Harbour City and follow pedestrian signs to The Lowry (approximately 10 minutes). The Museum is a short walk across the canal by footbridge. Open Mon-Sun, 10am-6pm. http://north.iwm.org.uk/

The Lowry – The Lowry Gallery houses over 400 paintings and drawings by LS Lowry. From Piccadilly Gardens take the Eccles tram service, alight at Harbour City and follow pedestrian signs to The Lowry. Open Sun-Fri 11am-5pm, Sat 10am-5pm. Free entry, but a donation is requested. http://www.thelowry.com/


To city centre
Poster session and reception
Spoken presentations
A34 Upper Brook Street
Multi-Storey Car Park B
Brunswick Street
Dover Street
Rumford Street
Car Park G
Grafton Street
Acker Street
Portsmouth Street
Booth Street East
Wilton Street
Visitors Centre
Oxford Road
B5117
Royal Northern College of Music
Booth Street West
Bridgeford Street
Old Quadrangle
Rear Quadrangle
Burlington Street
Lime Grove
Devas Street
Car Park F
Contact Theatre
Dilworth Street
Multi-Storey Car Park D
Higher Cambridge Street
Coupland Street
Lloyd Street
Cecil Street
Car Park