A scientific meeting will be held at the Department of Cognitive, Perceptual & Brain Sciences, University College London, 26 Bedford Way, WC1 on 6/7 January, 2011. The local organiser is Shelley Channon.

**Thirty-ninth Bartlett Lecture**

**Thursday 6 January 6.00pm**

The specificity of processing in prefrontal cortex: From reaction times to problem-solving

Professor Tim Shallice, University College London and International School for Advanced Studies (SISSA)

**Symposium - To accompany the Prize Lecture**

**Thursday 6 January 1.30pm – 5pm**

The cognitive functions of rostral prefrontal cortex

Organiser: Professor Paul Burgess, University College London

**Symposium**

**Friday 7 January 2.30pm – 5.30pm**

Neuroplasticity in the language system after stroke

Organiser: Dr Jenny Crinion, University College London

**Poster Session**

This will be held in conjunction with the drinks reception on Thursday evening at 7pm at UCL, 26 Bedford Way, WC1. Drinks will be served in the Third Floor Common Room, Room 308, and posters will be displayed in Rooms 305 and 308. Delegates may put up posters from 5pm and should take them down by the end of the session.

**Platform Presentations**

Sessions will be held in the Ground Floor and Lower Ground Floor Lecture Theatres of 26 Bedford Way, WC1. 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 which run Office XP under Windows NT/2000. Any queries about facilities in the theatres should be sent to the local organiser, Shelley Channon (s.channon@ucl.ac.uk).

Coffee will be served in Room 308 (Third Floor Common Room)

The conference dinner will be at 8.30pm at Pescatori, 57 Charlotte Street, London. W1T 4PD – (020-7580 3289). A booking form is enclosed.
START OF PARALLEL SESSIONS

Session A

Ground Floor Lecture Theatre

9.30 Kielan Yarrow, Frederik Eichelbaum* and Anna Lambrechts*
(City University, École Normale Supérieure)
Humans don’t time intervals like a stopwatch.

10.00 Catharine Montgomery*, John E. Fisk* and Ruth S. Ogden
(Liverpool John Moores University, University of Central Lancashire)
The relationship between delayed discounting, executive functioning and timing.

10.30 COFFEE

11.00 Laurence White*, Sven L. Mattys and Lukas Wiget* (International School for Advanced Studies, University of Bristol)
Language discrimination is based on sensitivity to durational cues, not rhythm class.

11.30 Fang Liu*, Cunmei Jiang*, Yi Xu*, Yufang Yang* and Lauren Stewart (University College London, Chinese Academy of Science, Fujian Normal University, Goldsmiths University of London)
Tone and intonation processing in Chinese-speaking congenital amusics.

12.00 Victoria Williamson*, Gianna Cocchini* and Lauren Stewart
(Goldsmiths University of London)
The relationship between pitch and space in congenital amusia.

12.30 LUNCH
START OF PARALLEL SESSIONS

Session B

Lower Ground Floor Lecture Theatre

9.30  Ian McLaren, Mike Le Pelley, Rossy McLaren*, Chris Longmore* and Stephen Monsell (University of Exeter, University of Cardiff, University of Hull)
Given that perception of an object increases subsequent estimates of its recency of occurrence, does associative activation of an object's representation in the mind also augment its apparent recency?

10.00  Aidan J. Horner* and Rik N. Henson (Otto-von-Guericke University, University College London, MRC Cognition and Brain Sciences Unit)
Stimulus-Response contributions to repetition priming: is attention necessary for the encoding and retrieval of S-R bindings?

10.30  COFFEE

11.00  Helen L. Williams*, Martin A. Conway and Chris J.A. Moulin (University of Richmond, University of Leeds)
Source judgments are speeded by the recollective experience accompanying them but judgments of recollective experience are not.

11.30  Gabriel Radvansky (University of Notre Dame)
The Event Horizon Model: The influence of event boundaries on retrieval.

12.00  Maarten Speekenbrink, Nick Chater and David R. Shanks (University College London)
Adaptive design for model discrimination.

12.30  LUNCH
Session A

Ground Floor Lecture Theatre

Symposium: The cognitive functions of rostral prefrontal cortex
Organiser: Professor Paul W. Burgess

1.30 Paul W. Burgess (University College London)
A beginner’s guide to the functions of the rostral prefrontal cortex.

2.00 Emmanuelle Volle*, Gil Gonen-Yaacovi*, Richard Levy* and Paul W. Burgess (Institut National pour la Santé Et la Recherche Médicale, University College London)
Lesion evidence for critical functions of rostral prefrontal cortex.

2.30 Etienne Koechlin* (Institut National pour la Santé Et la Recherche Médicale)
How the human prefrontal function drives the pursuit of concurrent goals simultaneously?

3.00 TEA

3.30 Roland G. Benoit*, Sam J. Gilbert and Paul W. Burgess (MRC Cognition and Brain Sciences Unit, University College London)
Rostral prefrontal cortex: Future thinking.

4.00 Iroise Dumontheil*, Sam J. Gilbert, Kalina Christoff* and Sarah-Jayne Blakemore (Karolinska Institute, University College London, University of British Columbia)
Development of abilities associated with rostral prefrontal cortex function during adolescence.

4.30 Silvia A. Bunge* (University of California at Berkeley)
Comparing mental representations

End of Symposium

5.00 63rd Annual General Meeting - Room 215, 2nd Floor (members only)

6.00 Bartlett Lecture – Professor Tim Shallice (University College London and International School for Advanced Studies)
The specificity of processing in prefrontal cortex: From reaction times to problem-solving. (Lower Ground Floor Lecture Theatre)

7.00 POSTERS AND DRINKS RECEPTION - Drinks will be served in the Third Floor Common Room, Room 308, and posters will be displayed in Rooms 305 and 308.

8.30 CONFERENCE DINNER, PESCATORI
Session B

Lower Ground Floor Lecture Theatre

1.30  Eva Belke (Ruhr-Universität Bochum)
Cumulative and non-cumulative semantic context effects in lexical retrieval arise from long-lasting facilitation at the conceptual level.

2.00  Antje S. Meyer, Lesya Y. Ganushchak* and Stephen Lupker* (Max Planck Institute for Psycholinguistics, University of Western Ontario)
Sandwich priming effects in picture naming.

2.30  Nick Riches* (University of Newcastle) (Sponsor Chloe Marshall)
Sentence repetition as a diagnostic marker of Specific Language Impairment.

3.00  TEA

3.30  Régine Kolinsky*, José Morais, Arlette Verhaeghe* and Tânia Fernandes* (Le Fonds de la Recherche Scientifique, Université Libre de Bruxelles, Universidade de Lisboa, Universidade do Porto)
Enantiomorphy through the looking-glass: Literacy acquisition and the processing of mirror images.

4.00  Franck Ramus, Stéphanie Iannuzzi*, Sylviane Valdois* and Genedys consortium (Ecole Normale Supérieure, Université de Toulouse, Université Pierre Mendès France)
Phonological vs. visual deficits in developmental dyslexia: Insights from a population of French children.

4.30  Thomas Dornbusch* and Eva Belke (Technische Universität Dortmund, Ruhr-Universität Bochum)
Orthographic influences on L2 auditory speech processing.

5.00  63rd Annual General Meeting - Room 215, 2nd Floor (members only)

6.00  Bartlett Lecture – Professor Tim Shallice (University College London and International School for Advanced Studies)
The specificity of processing in prefrontal cortex: From reaction times to problem-solving. (Lower Ground Floor Lecture Theatre)

7.00  POSTERS AND DRINKS RECEPTION - Drinks will be served in the Third Floor Common Room, Room 308, and posters will be displayed in Rooms 305 and 308.

8.30  CONFERENCE DINNER, PESCATORI
Session A

Ground Floor Lecture Theatre

9.00  Francis McGlone*, Håkan Olausson*, Rochelle Ackerley*, Steve Guest* and Greg Essick* (Liverpool John Moores University, Gothenburg University, University of North Carolina) (Sponsor Steve Tipper)
Touching and feeling – two states/two systems: A neuroimaging and psychophysical study.

9.30  Patrick Haggard, Matt Longo*, Marjolein Kammers*, Giandomenico Iannetti*, Flavia Mancini* and Elisa Ferre*
(University College London, University of Milan Bicocca, University of Pavia)
Multisensory modulation of pain.

10.00 David Pitcher*, Brad Duchaine*, Vincent Walsh* and Nancy Kanwisher* (Massachusetts Institute of Technology, University College London, Dartmouth College) (Sponsor Lauren Stewart)
TMS reveals two functionally distinct time periods for early face and body perception.

10.30  COFFEE

11.00  Bahador Bahrami*, Karsten Olsen*, Dan Bang*, Andreas Roepstorff*, Geraint Rees and Chris Frith (University College London, Aarhus University)
The role of verbal and non-verbal communication in collective decision making.

11.30  Ut Na Sio*, Danni Witt* and Padraic Monaghan (Lancaster University)
Sleep promotes insight for verbal and spatial problems.

12.00  Daniel Heussen*, Wouter Voorspoels*, Steven Verheyen*, Gert Storms* and James A. Hampton (University of Leuven, City University London) (Sponsor Dana Samson)
Can negative evidence raise argument strength in category-based property induction?

12.30  Gillian M. Waters* and Sarah R. Beck (University of Bradford, University of Birmingham)
Does young children's understanding of aspectuality depend on the phrasing of the question?

1.00-2.00  LUNCH
Session B

Lower Ground Floor Lecture Theatre

9.00 Kevin Dent*, Harriet A. Allen*, Jason J. Braithwaite and Glyn W. Humphreys (University of Birmingham) (Sponsor: Vicki Bruce) Selective conjunctive suppression in visual search.

9.30 Nikos Konstantinou* and Nilli Lavie (University College London) Contrasting effects of different types of processing load on visual awareness.

10.00 Duncan Astle*, Anna C. Nobre* and Gaia Scerif* (Royal Holloway University of London, University of Oxford) (Sponsor Chris Jarrold) Subliminally presented and stored objects capture spatial attention.

10.30 COFFEE

11.00 Li Zhaoping (University College London) Gaze capture by a task irrelevant visual item in a visual search stimulus even when normal observers have a limited awareness of its presence.

11.30 Gustav Kuhn and Jason Tipples (Brunel University, University of Hull) Increased gaze following for fearful faces. It depends on what you’re looking for!

12.00 Sara Hodsoll*, Nilli Lavie and Essi Viding* (University College London) Attentional capture by irrelevant emotional faces in children with conduct problems.

12.30 Heike Elchlepp*, Stephen Monsell and Aureliu Lavric (University of Exeter) A change of tasks delays and modulates early processes in lexical tasks: Evidence from ERPs

1.00-2.00 LUNCH
Session A

Ground Floor Lecture Theatre

2.00  Chloe Marshall, Katherine Rowley* and Joanna Atkinson (City University London, University College London)
Semantic and phonological fluency in deaf adult users of British Sign Language (BSL).

Symposium:  Neuroplasticity in the language system after stroke
Organiser: Dr Jenny T. Crinion (University College London)

2.30  Dr Dorothee Saur* (University of Leipzig)
Spontaneous language recovery in acute stroke, using neuroimaging as an early prediction of outcome.

3.00  Cathy J. Price* (Wellcome Trust Centre for NeuroImaging)
Chronic stroke and long term prediction of aphasia outcome (PLORAS).

3.30  TEA

4.00  Alexander P. Leff*, Thomas M. Schofield*, Will D. Penny*, Klaas E. Stephan*, Jenny T. Crinion* and Cathy J. Price* (University College London New York University, Wellcome Trust Centre for Neuroimaging, University of Zurich.)
Phonological therapy changes connection strengths between lower levels of the auditory network in patients with severely impaired speech perception.

4.30  Agnes Flöel*, Marcus Meinzer*, Robert Kirstein*, Sarah Nijhof* and Caterina Breitenstein* (Charite Universitätsmedizin, University of Münster)
tDCS-enhanced language training – proof-of-principle studies in the healthy brain and in aphasia.

5.00  Jenny T. Crinion* (University College London)
Phonological priming and concurrent tDCS effects on the picture naming network in healthy older controls, implications for the treatment of anomia.

End of Symposium

End of Meeting
Session B

Lower Ground Floor Lecture Theatre

2.00 Carlo De Lillo and Joël Fagot* (University of Leicester, Université de Provence)
A comparative study of serial spatial recall in monkeys (Papio papio) using a variation of the Corsi tapping test.

2.30 Jens K. Apel*, Gavin F. Revie*, Angelo Cangelosi*, Rob Ellis*, Jeremy Goslin* and Martin H. Fischer (University of Dundee, University of Plymouth)
Attention deployment during memorizing and executing complex instructions.

3.00 Christopher Jarrold, Helen Tam*, Alan D. Baddeley and Caroline E. Harvey* (University of Bristol, University of York)
Estimates of primary and secondary memory predict different aspects of intelligence: Evidence from both children and adults.

3.30 TEA

4.00 Susan Gathercole, Ahmet Fuat*, Jerry Murphy*, Elizabeth Littlewood* and Barbara Conway* (University of York, University of Durham, Darlington PCT)
Working memory deficits in untreated and treated hypertension.

4.30 Catherine Molesworth*, Francesca Happé and Coralie Chevallier* (Institute of Psychiatry)
Adolescents on the autism spectrum show a category contrast effect.

5.00 Elizabeth Milne (University of Sheffield)
Increased intra-participant variability in adolescents with autistic spectrum disorder: Evidence from single trial analyses of evoked EEG.

End of parallel sessions

End of meeting

Reserve List

1. Diana Omigie*, Daniel Mullensiefen* and Lauren Stewart (Goldsmiths University of London)
Evidence for dissociation of music perception and appreciation in congenital amusia.

2. Luna Muñoz* (University of Central Lancashire) (Sponsor Jeannie Judge)
Risk taking with peers and the moderating role of callous-unemotional traits.

3. Nicolas Dumay and Jeffrey F. Bowers (Basque Center on Cognition, Univeristy of Kent, University of Bristol)
Do voice details survive lexical consolidation?
1. Laurent Cleret de Langavant*, Philippe Remy*, Iris Trinkler*, Joseph McIntyre*, Emmanuel Dupoux*, Alain Berthoz* and Anne-Catherine Bachoud-Lévi* (Institut National pour la Santé Et la Recherche Médicale, Ecole Normale Supérieure, Université Paris-Est, Henri Mondor Hospital, Centre National de la Recherche Scientifique, Collège de France, Université Paris-Descartes) (Sponsor Heather van der Lely)
Communication with an addressee during pointing spatially shapes the gesture and activates a social brain network.

2. Elisa Raffaella Ferrè*, Gabriella Bottini* and Patrick Haggard (University of Pavia, University College London)
A specific vestibular modulation of somatosensory perception.

3. Joshua Fry*, Daniel Müllensiefen*, Sagar Jilka*, Rhiannon Jones*, Victoria Williamson* and Lauren Stewart (Goldsmiths University of London)
The Earwormery: Learning more about involuntary musical imagery and how it relates to personality and musical experience.

4. James A. Grange* and George Houghton* (Keele University, Bangor University) (Sponsor John Wearden)
Heightened conflict during cue encoding increases backward inhibition in set switching.

5. Neil Harrison* (Liverpool Hope University) (Sponsor Dana Samson)
Auditory motion in depth is preferentially ‘captured’ by visual looming signals.

6. Becky I. Haynes*, Kevin A. Davies* and Jenny Rusted (Brighton and Sussex Medical School, University of Sussex)
Intra-individual variability in reaction time on a computerised Stroop test. Does variability distinguish between lupus patients with and without central nervous system involvement?

7. Louise J. Head* and Peter J. Hills (Anglia Ruskin University)
Facial features of the other-race: Their effect on the own-race bias in face recognition.

8. Jessica Louise Holt* and Jean-Francois Delvenne (University of Leeds)
A bilateral advantage in controlling access to visual short-term memory.

9. Halina Kalaga*, Tim Hodgson and Simone Schnall (Exeter University, Cambridge University)
The influence of social context and embodied affect on moral judgements.

10. Marjolein Kammers*, Katy Rose* and Patrick Haggard (University College London)
Feeling numb: Thermosensation, but not thermal pain, modulates feeling of body ownership.

11. Surinder Kaur*, Elley Wakui*, Dean Petters*, Jules Davidoff and Martin Jüttner (Aston University, Goldsmiths University of London)
Trajectories of part-based and configural object recognition in adolescence.
12. **Sook-Lei Liew*, Tong Sheng* and Lisa Aziz-Zadeh* (University of Southern California) (Sponsor Jules Davidoff)**
Action observation of a physically dissimilar individual: An fMRI study.

13. **Stergios Makris* and Kielan Yarrow** (City University London)
Viewing objects and planning actions: On the potentiation of grasping behaviours by visual objects.

14. **Flavia Mancini*, Matthew R. Longo*, Marjolein P. M. Kammers* and Patrick Haggard** (University College London, University of Milano-Bicocca)
Visual distortion of body size modulates pain.

15. **Samantha F. McCormick*, Kathy Rastle and Colin J. Davis** (Royal Holloway University of London)
Investigating orthographic effects on speech processing: A word learning approach.

16. **Luna Muñoz** (University of Central Lancashire) (Sponsor Jeannie Judge)
Risk taking with peers and the moderating role of callous-unemotional traits.

17. **Diana Omigie*, Daniel Mullensiefen* and Lauren Stewart** (Goldsmiths University of London)
Evidence for dissoication of music perception and appreciation in congenital amusia.

18. **Jessica Strozyk* and Ines Jentzsch** (University of St Andrews)
Effects of conflict strength and age on error processing in the flanker task

19. **Valeria Tretyak*, Fanny Chatel* and Kielan Yarrow** (City University London)
Response speeding via trial-to-trial persistence of motor plans in dorsal pre-motor cortex.

20. **Lee D. Walsh*, Nobuyuki Inui*, Janet L. Taylor* and Simon C. Gandevia**
(Neuroscience Research Australia, University of New South Wales, Naruto University of Education) (Sponsor Patrick Haggard)
Factors affecting body representation of the hand.

21. **Kielan Yarrow, Warrick Roseboom* and Derek H. Arnold** (City University, University of Queensland)
Spatial grouping resolves ambiguity to drive temporal recalibration.

22. **Olga Zubko*, David Wilkinson, Joe DeGutis* and Robert Johnston**
(University of Kent, Veterans Affairs Boston Healthcare System, Harvard Medical School)
The effect of target-distracter similarity relations on face matching.
Humans don’t time intervals like a stopwatch

Kielan Yarrow\textsuperscript{1}, Frederik Eichelbaum\textsuperscript{1} and Anna Lambrechts\textsuperscript{1,2}
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Many activities require the ability to estimate intervals of time in an accurate and flexible manner. A traditional and popular account suggests that humans possess a kind of internal stopwatch that can be started and stopped at will. Here we test this idea by measuring variable performance errors in two experiments. Participants had to compare the total time accumulated during one to three comparison intervals with a single standard interval. With two or more comparison intervals, participants had to pause, but not reset, their putative internal stopwatches. By establishing baseline performance at two different standard durations and extrapolating based on Weber’s law, we were able to estimate how much performance should have deteriorated when comparison segments contained breaks. The decrement in performance we observed far exceeded the stopwatch prediction, and thus favours alternative models of interval duration discrimination which do not posit a linear metric for time.

The relationship between delayed discounting, executive functioning and timing.

Catharine Montgomery\textsuperscript{1}, John E. Fisk\textsuperscript{2} and Ruth S. Ogden\textsuperscript{1}
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2. University of Central Lancashire
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In addictive behaviours, drugs with a higher addictive potential usually have a shorter period of time between drug administration and the desired drug effect, and in addition, the drug effect may be short lived. Consequently it seems reasonable to expect that one’s ability to accurately judge the passage of time between drug administration and drug effect, and also the length of drug effect would affect an individual’s drug seeking and drug taking. Similarly in a delayed discounting task, one’s ability to accurately judge the time periods displayed would likely affect the reward chosen. However, little research has investigated the link between delayed discounting of rewards and other aspects of human timing. Given the relationship between executive control of inhibition and timing, a secondary aim was to investigate the mediating effects of executive functioning on the delayed discounting of rewards. Method: Forty participants completed measures of human temporal perception (temporal generalization, time estimation, time reproduction), measures of executive functioning (computation span, random letter generation, word fluency, number-letter task), and impulsive decision making (delayed discounting). Regression analysis was used to predict discounting of delayed rewards at different time periods. Results: Time Estimation and reproduction significantly predicted delayed discounting of rewards. In addition, the number of alphabetical sequences on Random Letter Generation significantly predicted discounting at all time periods. Total lifetime dose of cannabis and average dose of ecstasy were also related to delayed discounting.
Language discrimination is based on sensitivity to durational cues, not rhythm class

Laurence White¹, Sven L. Mattys² and Lukas Wiget²
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Studies of listeners’ ability to distinguish languages – even when segmental information is impoverished or eliminated – have been taken as evidence for categorical rhythmic distinctions between language groups (“rhythm classes”). Furthermore, it has been suggested that sensitivity to rhythm class is present at birth and that infants must establish the rhythm class of their native language as a precursor to language acquisition. We tested the hypothesis that adult listeners are sensitive not to putative rhythm classes, but to specific durational effects. We examined the categorisation of language pairs, using utterances in which only durational characteristics were preserved. We found that English listeners could distinguish between not only English and Spanish (from different rhythm classes), but also between different accents of British English. Furthermore, patterns of categorisation between and within languages highlighted the contribution of speech rate, durational contrast and utterance-final lengthening, suggesting that such cues may also be exploited in infant language acquisition.

Tone and intonation processing in Chinese-speaking congenital amusics

Fang Liu¹, Cunmei Jiang² ³, Yi Xu¹, Yufang Yang² and Lauren Stewart⁴
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Congenital amusia is primarily a deficit in music perception. Recent research has indicated that this disorder impacts upon one’s language abilities in subtle ways for speakers of both tone and non-tonal languages. This study investigated whether, and to what extent, congenital amusia affects Chinese amusics’ tone and intonation processing abilities. Thirteen Chinese amusics and thirteen matched controls participated in a set of tone and intonation perception tasks and two pitch threshold tasks. Compared with controls, amusics showed impaired performance on word discrimination in both natural speech and gliding tones. They also performed worse than controls on discriminating gliding tones derived from statements and questions, and showed elevated thresholds for both pitch-change detection and pitch-direction discrimination. However, they performed as well as controls on word identification, and statement-question identification/discrimination in natural speech. Overall, amusia does not appear to affect Chinese amusics’ performance on tasks that involved multiple acoustic cues to communicative meaning. Only when the tasks contained purely pitch differences between stimuli, which seldom occur in everyday speech, did amusics show impaired performance compared to controls. These findings provide insight into why amusics rarely report language problems in daily life, and help understanding of the non-domain-specificity of congenital amusia.
The relationship between pitch and space in congenital amusia

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Congenital amusia manifests as a lifelong difficulty in making sense of musical sound. The extent to which this disorder is accompanied by deficits in visuo-spatial processing is an important question, bearing on the issue of whether pitch processing draws on supramodal spatial representations. The present study assessed different aspects of visuo-spatial processing with a range of tasks (Shepard-Metzler Mental Rotation, Corsi Blocks Task, Visual Patterns Test) in 14 amusics and matched controls. The absence of a group difference on any of these tasks fails to support a previous claim that congenital amusia is strongly related to deficits in spatial processing (Douglas & Bilkey, 2007). However, a subgroup of amusics, with significantly elevated thresholds on a pitch direction discrimination task relative to the rest of the group, were slower, but equally accurate, at Mental Rotation. This finding is discussed in relation to the nature of supramodal mental representations of contour and strategies for dynamic mental transformation.


Given that perception of an object increases subsequent estimates of its recency of occurrence, does associative activation of an object's representation in the mind also augment its apparent recency?

Ian McLaren1, Mike Le Pelley2, Rossy McLaren1, Chris Longmore3 and Stephen Monsell1
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How do we know whether we recently saw a familiar object? We assume that an encounter with it transiently strengthens associations among its attributes. When asked to decide whether a object was seen recently (as in old/new recognition) or how long ago (recency judgement), we compute the current overall associative strength of the probe, and derive an index of recency. This supplies the substrate for "trace strength" accounts of recency effects in immediate probe recognition (e.g. Monsell, 1978). Here we tested the consequence of activating an object's elements not directly, via perception, but indirectly, through associative activation. Some learning theories suggest that this might increase the apparent recency (Dickinson & Burke, 1996), others that it should have the opposite effect (McLaren & Mackintosh, 2000). We presented five chequerboards followed by a recognition probe. The list contained chequerboards which shared half their pattern e.g.: AB, BC, CD. We found that when pattern CD followed pattern AB (which it indirectly activates via the inter-elemental associations of the previously seen BC) in the list, this reduced AB's apparent recency when it was presented as the probe. Our result, then, is that associative activation decreases apparent recency.
Stimulus-Response contributions to repetition priming: Is attention necessary for the encoding and retrieval of S-R bindings?

Aidan J. Horner¹,² and Rik N. Henson³
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2. University College London
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Stimulus repetition results in changes to reaction times and response accuracy, a phenomenon called repetition priming. Such behavioural changes can occur due to the encoding of stimulus-response (S-R) bindings, the retrieval of which can facilitate response-selection processes when the retrieved response is congruent with the response to be generated (Horner & Henson, 2009). To what extent is attention necessary for the encoding and retrieval of S-R bindings? Research has shown that responses to attended stimuli can also be bound to simultaneously presented unattended stimuli using immediate repetition negative priming paradigms (Rothermund, Wentura & De Houwer, 2005), suggesting that attention may not be a prerequisite for the encoding of S-R bindings. Here we used a long-lag object classification priming paradigm that manipulated attention to simultaneously presented objects at encoding and retrieval. Experiments 1-3 failed to provide evidence for responses being bound to stimuli that were unattended at encoding (but attended at retrieval) and Experiment 4 failed to provide evidence for the retrieval of S-R bindings when a stimulus was unattended at retrieval (but attended at encoding). Although caution should be taken when interpreting null results, the present experiments suggest that attentional manipulations can affect the encoding and retrieval of S-R bindings.


Source judgments are speeded by the recollective experience accompanying them but judgments of recollective experience are not.

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Judgments of source are often taken as reflecting recollection of source information but typical paradigms comparing recollective experience and source tend to combine the two types of judgment or conflate one of the judgments with recognition. Concerns have been raised that multiple judgments may influence each other (e.g. Bruno & Rutherford, 2010). In the current experiment, both source and recollective experience judgments were made post-recognition, with order of judgments counterbalanced across items. Response distributions and reaction time (RT) data demonstrated that order of judgments had no effect on source or recollective experience responses. Overall, source judgments were found to be reliably faster than recollective experience judgments. However, in line with previous research, RTs to make recognition decisions were found to be faster when the subsequent judgment was one of correct source or Remembering. Additionally, in a novel analysis, RT to make actual judgments was compared. Recollective experience judgments demonstrated no difference in RTs associated with response category while accurate source judgments were shown to be faster when accompanied by a Remember or Know judgment as opposed to a Familiar judgment. Taken together, these results suggest evaluations of subjective state capture more than mere source judgments.


The Event Horizon Model: The influence of event boundaries on retrieval

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Event segmentation of text, film, virtual environment, and autobiographical experiences results in multiple traces being stored in memory. This segmentation results in both memory retrieval costs and benefits. A cost is observed in the updating of event models during language comprehension (e.g., Zwaan, 1996), mental updating during the navigation of virtual environments (e.g., Radvansky & Copeland, 2006), fan effects (e.g., Radvansky, 1999), and reduced repetition priming across event boundaries (e.g., Oliphant, 1983). A benefit is observed in reduced retroactive interference across events (e.g., Nagge, 1935), the acquisition of words lists across rooms (Tamplin, Krawietz, & Radvansky, 2010), context shifts during massed practice (Verkoeijen, Rikers, & Schmidt, 2004), and improved performance on an AX-CPT task when there are event shifts between primes and targets (Reimer, Lorsbach, & Radvansky, 2010). The Event Horizon model attempts to account for this pattern of findings and to provide a basis for making predictions for future studies. The five basic components of the model involve (a) the segmentation of events, (b) the foregrounding of current event information, (c) recall confluence of information stored across multiple events, (d) recognition interference for
information stored across multiple events, and (e) the influence of causal relations among various events.


**Adaptive design for model discrimination**

Maarten Speekenbrink, Nick Chater and David R. Shanks  
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Psychology is rich in formal models of learning, categorization and decision making, to name but a few areas. While competing models differ in their substantive assumptions, they often make highly similar predictions. For this reason, model comparison based on empirical data is often inconclusive. Optimizing the design of an experiment for model discrimination is difficult, especially when individual participants differ widely in terms of model parameters. To resolve this problem, we present a method to design experiments adaptively whilst running them, at each trial choosing the stimulus which is expected to minimize the entropy of the posterior probability distribution over a set of competing models. We show the advantages of adaptive design in a simulation study. We then present data from an experiment in which the method was applied to discriminate between competing models of category learning, including an exemplar model (the Generalized Context Model) and a decision bound model.
Symposium: The cognitive functions of rostral prefrontal cortex
Organiser: Professor Paul W. Burgess

A beginner’s guide to the functions of the rostral prefrontal cortex

Paul W. Burgess
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Rostral PFC (approximating Brodmann Area 10) is a huge brain region in humans, about which virtually nothing was known until the last few years. The advent of functional imaging presented a conundrum: Activations in rostral PFC were found during just about any kind of paradigm. This led to a proliferation of theories about the role of rostral PFC in cognition, many of which invoked constructs which would be tapped by a wide range of tasks. But lesions to rostral PFC do not necessarily cause deficits on these tasks, or a wide range of them. Instead, the problems are largely restricted to relatively “new areas of cognition” which until recently have received little attention from experimental psychologists. These include multitasking and prospective memory, certain poorly understood executive functions (such as dealing with open-ended situations, some forms of abstract reasoning), time perception, metamemory, and a range of abilities relevant to social behaviour, such as mentalizing and humour appreciation. Some theories (e.g. the “gateway hypothesis”) have been proposed to try to reconcile the lesion and neuroimaging evidence. This talk will outline the brief history of this emerging field so as to provide an introduction to the talks that follow. Special emphasis will be placed upon the need for concordant evidence from different methods so as to avoid errors of inference.

Lesion evidence for critical functions of rostral prefrontal cortex

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The clinical observation of patients with rostral prefrontal damage indicates that specific aspects of behavioural adaptation may depend particularly on rostral rather than other regions of the prefrontal cortex (PFC). These aspects are typically solicited in ‘multitasking’ situations, such as everyday life. By contrast, functional neuroimaging shows that signal changes in rostral PFC can be associated with various cognitive tasks, such as ‘multitasking’ tests, but also with simple ones. Although activation studies have yielded influential theories on rostral prefrontal functioning, they could not demonstrate what is the critical role of rostral PFC. Human lesion studies, that indicate the necessary regions for a given task, are thus a crucial complement of activation approaches. Recently, the development of “voxel-based” lesion-deficit mapping techniques allows better integration of lesion studies with functional imaging ones. We performed several studies using a voxel-based lesion method, combined with specific cognitive tests, and compared them to functional imaging results. The findings suggest specific aspects of behavioural adaptation for which an intact rostral PFC is necessary. In particular, the
results are consistent with the view that the everyday-life problems of rostral patients could at least in part be explained by a deficit in prospective memory.

**How the human prefrontal function drives the pursuit of concurrent goals simultaneously?**

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The rostral prefrontal cortex confers humans the ability to pursue several goals at one time. Little is known, however, how the brain motivational system including the medial frontal cortex drives the pursuit of concurrent goals. In this talk, I will present recent fMRI data showing that the left and right medial frontal regions which jointly drive single-task performance according to expected rewards, divide under dual-task condition: while the left anterior cingulate cortex encodes the rewards driving one task, the right anterior cingulate cortex concurrently encodes those driving the other task. By contrast, rostral prefrontal activations were found to bilaterally vary as the integration of rewards driving both tasks simultaneously. Consistent with computational models describing anterior prefrontal function as processing cognitive branching, the results further reveal that the two frontal lobes divide for disentangling and representing simultaneously two concurrent goals coordinated by the rostral prefrontal cortex. Overall, I will discuss neurological and behavioral evidence suggesting that the human prefrontal executive function is limited to accurately drive the pursuit of two concurrent goals at one time.

**Rostral prefrontal cortex: Future thinking**

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Rostromedial prefrontal cortex (rmPFC) has been implicated in many forms of future thinking. For example, this region seems to mediate attention between current goals and future intentions. Moreover, greater rmPFC BOLD signal whilst appraising one’s future self is linked to more farsighted economic decisions. Here, we focus on rmPFC involvement in episodic prospection, i.e. the human faculty of envisaging future episodes. Participants either imagined specific events of spending money (e.g., £35 in 180 days at a Pub), or merely estimated what the money could purchase in the scenario. Imagining the future biased subsequent monetary decisions towards choices associated with a higher long-term pay-off. Using functional MRI, we linked rmPFC with this effect. BOLD signal in this region predicted future-oriented choices on a trial-by-trial basis. Activation reflected the reward value of imagined episodes, and greater reward sensitivity was related to less discounting. This effect was also associated with increased rmPFC – hippocampal coupling. The data suggest that rmPFC utilises information conveyed by the hippocampus to represent the utility of envisaged events. The immediate experience of the delayed reward value might then bias towards farsighted decisions.
Development of abilities associated with rostral prefrontal cortex function during adolescence

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The rostrolateral prefrontal cortex (RLPFC) is involved in the elaboration, evaluation and maintenance of abstract rules and information. The present study combined behavioural, functional and structural data to investigate the development of abilities associated with RLPFC function during adolescence. Two tasks were adapted for use in a younger population. The Shape task tests relational reasoning, which requires the simultaneous integration of multiple relations. The Alphabet task tests the ability to select and manipulate self-generated, as opposed to stimulus-oriented, information, in a controlled and flexible way. We investigated (1) the development of these abilities behaviourally, (2) the associated functional brain development, and (3) the link between functional and structural maturation. 179 (7–27 years old) and 37 participants (11-30 years old) took part in the behavioural and neuroimaging study respectively. Improvements in performance extended into late adolescence. The overall pattern of brain activation during the tasks was similar across ages, however developmental changes were observed in specific prefrontal regions. By integrating structural and functional data, we demonstrated that some of the functional changes with age were linked to differences in performance or local grey and white matter structure, while others were not and may instead reflect the maturation of neurocognitive strategies.

Comparing mental representations

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Reflect for a moment on what each of these evaluative judgments have in common: a) whether an item is identical, or merely similar, to a previously studied item; b) which of two choices is likely to result in the larger reward; c) whether the product of a mental operation matches an answer that has been provided. Each of these judgments, and many more, rely on the ability to compare distinct mental representations. Such comparisons may hinge on retrieval from semantic or episodic memory, or attention to stimuli that are present at the time the judgment is required. In this talk, I will make the case that rostrolateral prefrontal cortex (RLPFC) supports the performance of a wide variety of cognitive tasks because it plays a general role in the comparison of distinct mental representations. In addition to providing an overview of our fMRI findings in adults, I will discuss our research examining developmental and training-related changes in RLPFC function.

End of symposium
Cumulative and non-cumulative semantic context effects in lexical retrieval arise from long-lasting facilitation at the conceptual level

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In recent years, a variety of semantic blocking paradigms have been devised to assess the effects of the semantic context on object naming. The results suggest that the repeated access to identical semantic categories induces long-lasting semantic interference effects that survive up to eight intervening trials. Interestingly, this effect cumulates over time in some but not all variants of the semantic blocking paradigm. In two semantic blocking experiments, I tested the hypothesis that despite these different outcomes, the mechanisms underlying the semantic context effects seen across the variants of the semantic blocking paradigm are identical. The results suggest that inhibitory semantic context effects in object naming result from parallel facilitatory context effects at the conceptual level (as assessed in a semantic classification task) and are necessarily conceptually mediated. If possible, speakers modulate the patterns of activation of co-activated lexical-semantic representations top-down in order to render response selection at the conceptual and the lexical level more efficient (Belke, 2008). The implications of these findings are discussed with respect to current accounts of semantic context effects on object naming (Howard, Nickels, Cole-Virtue & Coltheart, 2006; Oppenheim, Dell & Schwartz, 2010).


Sandwich priming effects in picture naming

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Studies of lexical access in speech planning often use priming or interference paradigms, where a target picture is combined with a written prime or distracter word. A difficulty in interpreting the results of studies using interference paradigms with clearly visible distracters is that effects arising during lexical access cannot be distinguished from effects arising during self-monitoring. A difficulty with using masked priming paradigms is that the effects tend to be small and fragile. We report a series of picture naming experiments using both the conventional masked priming procedure and the sandwich priming procedure first used in lexical decision experiments by Lupker and
Davis (2009). The critical feature of the sandwich priming procedure is that prior to each masked prime the participants are briefly (i.e., 33 ms) presented the name of the target picture. Although neither categorically nor phonologically related primes significantly affected picture naming in the traditional masked priming experiments, in the sandwich priming experiments: (a) categorically related primes (e.g. “dog-cat”) interfered more than unrelated distracters with picture naming and (b) phonologically related primes (“mat-cat”) facilitated picture naming. The theoretical implications of these findings will be discussed.


**Sentence repetition as a diagnostic marker of Specific Language Impairment**

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Background: Children with Specific Language Impairment (SLI) have unexplained language difficulties. The most reliable clinical marker is Sentence Repetition (SR), whereby children repeat sentences and errors are counted. However, the origins of SR difficulties are disputed. Possible candidates include underlying linguistic representations, limitations in short-term memory (STM), and the central executive (CE). This study evaluates competing explanations. Methodology: 25 children with SLI, 19 age-matched and 21 language-matched children (mean ages 6;7, 6;4 and 4;8 respectively) repeated 100 sentences. Errors were counted using a novel algorithm, the Levenshtein Distance-in-words. Concurrent cognitive assessments were conducted. Results: CE assessments were better predictors of SR performance than Phonological STM assessments, uniquely accounting for greater variance. Measures of overall expressive abilities were better predictors than receptive measures. Specific syntactic errors found in spontaneous production were also observed during repetition. Discussion: SR is a good measure of expressive abilities, and qualitative errors during SR are also likely in more spontaneous contexts. These findings are important both for clinicians using SR as a diagnostic tool, and researchers using SR to assess expressive language. The data support the hypothesis that SR involves reconstruction from linguistic representations in long-term memory, with the CE also playing an important role.

**Enantiomorphy through the looking-glass: Literacy acquisition and the processing of mirror images.**

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To examine whether enantiomorphy, i.e. the ability to discriminate lateral mirror images, is influenced by the acquisition of a written system that incorporates mirrored letters such as b and d (e.g., Bornstein, Gross, & Wolf, 1978; Gibson, 1969), unschooled illiterate adults were compared to people reading the Latin alphabet, namely both schooled literates and unschooled adults alphabetized in adulthood. In various sorting and same-different comparison tasks using non-linguistic materials, illiterate participants displayed some sensitivity to enantiomorphic contrasts but performed far worse than all the other participant groups when the task required paying attention to such contrasts. Their difficulties were more severe with enantiomorphs than with rotations in the plane or shape contrasts. Learning a written system that incorporates enantiomorphic letters thus pushes the beginning reader to break the mirror invariance characteristic of our visual system, and this process generalizes beyond the realm of symbolic characters. Implications of these data are discussed in the framework of the neural recycling hypothesis (e.g., Dehaene & Cohen, 2007), according to which new cultural abilities linked to literacy may compete with evolutionary older functions of visual object recognition.


**Phonological vs. visual deficits in developmental dyslexia: Insights from a population of French children**

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In the context of a genetic study, 127 dyslexic and 84 control children aged 8 to 12 underwent a large battery comprising psychometric, literacy, phonological and visual tests. Visual tests focused on two specific hypothesis: the visual attention span (Bosse, Tainturier, & Valdois, 2007) and visual stress (Wilkins, Huang, & Cao, 2004). We investigated the prevalence of the various types of deficits (defined as -1.5 SD), and the respective contributions of phonological and visual abilities to dyslexia and to literacy skills, using logistic and linear regression. We found that visual stress affects very few dyslexic children if any. A visual attention span deficit affects a minority of dyslexic children, and largely co-occurs with a phonological deficit. A phonological deficit affects a large majority of the dyslexic children and explains most of the variance in literacy skills. The respective contributions of phonological awareness, rapid naming and verbal short-term memory to the phonological deficit are also discussed.
Orthographic influences on L2 auditory speech processing

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An increasing number of studies demonstrate that learning to read and write influences the way spoken language is processed. The present study investigated to what extent non-native speakers recruit orthographic knowledge strategically and automatically during auditory language processing in a foreign language. Sixty Danish and sixty German proficient non-native speakers of English and sixty native English speakers completed three auditory tasks on orthographically consistent and inconsistent English stimuli or pairs of stimuli (rhyme judgement, phoneme deletion and lexical decision; see Seidenberg & Tanenhaus 1979; Tyler & Burnham 2006; Ziegler & Ferrand 1998). The non-native speakers responded more slowly than the native speakers throughout. In the rhyme judgment and phoneme deletion tasks, which arguably tap strategic orthographic influences on auditory processing, we found a stronger impact of orthography in the non-native than in the native participants. In the lexical decision task, the German but not the Danish speakers displayed significantly stronger orthographic consistency effects than the English native speakers, indicating that the two groups of non-native speakers differed in how much orthographic information they activated automatically. We suggest that this may be due to differences in the sound-spelling regularities in the L1s of the Danish and the German speakers.


Sir Frederick Bartlett Lecture

The specificity of processing in prefrontal cortex: from reaction times to problem-solving

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There is a general consensus both that the human prefrontal cortex contains systems that modulate relatively routine processing, carried out in systems localised in more posterior cortical regions, and also that lateral, medial and orbital regions have to a considerable extent qualitatively different functions. There is also a widespread but somewhat less solidly agreed view that the anterior/posterior axis within prefrontal cortex relates to functional differences in some way linked to degrees of abstraction of process. However whether lateralisation within prefrontal cortex relates to functional differences other than those linked to the nature of the stimulus material or of the more basic processes being modulated, remains an open question. The lecture will address these last two issues with reference to two processing domains – the simple, namely reaction times – and the complex, namely problem-solving – and with respect to the compatibility between findings coming from two methodologies – those of the neuropsychological group study and of functional imaging.
Touching and feeling – two states/two systems: A neuroimaging and psychophysical study

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Previous fMRI studies in a rare patient population with no large diameter somatosensory afferents, together with microneurography and psychophysical observations in healthy subjects, have demonstrated a system of highly sensitive C-tactile afferents that are particularly sensitive to slowly moving stimuli. They project to insular and orbitofrontal cortices, and signal pleasant aspects of touch. Importantly, these nerves are not found in the glabrous skin of the hand, yet touch is also perceived as pleasant at this site. We asked if the brain processing of pleasant tactile stimuli differs between hairy and glabrous skin, and used a robotic tactile stimulation device that delivered high-precision (force and velocity) brush stroking to the forearm and glabrous skin of healthy subjects during PET neuroimaging. Psychophysical ratings showed no differences in intensity or pleasantness for the two sites. However, PET data showed that when contrasting brush stroking on the forearm skin with brush stroking on the palm we found a significant activation of the lateral orbitofrontal cortex (OFC). The opposite contrast, i.e. brush stroking on the palm minus brush stroking on the forearm showed a significant activation of somatosensory and medial OFC. Using a newly developed touch-lexicon, language descriptors also differentiated touch experience.

Multisensory modulation of pain

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The level of experienced pain does not depend only on the intensity of a painful stimulus, but also on a wide range of situational and cognitive-contextual factors: the placebo effect is perhaps the best known of these. However, pain physiologists have struggled to provide a principled account of how these factors work, while pain psychologists have generally focussed on particular treatments for pain. Therefore, there are few good psychological models of top-down modulation of pain. This talk reports recent work which shows, perhaps surprisingly, that acute pain can be modulated by processing in other sensory modalities: visual, tactile, and vestibular. These provide a useful laboratory model for top-down pain modulation, because the source of modulation is an experimentally-controlled stimulus. In a general sense, these modulations all work by linking the pain processing to the multisensory representation of one’s own body. This talk will discuss the evidence that multisensory conditions can modulate pain perception (as opposed to postperceptual appraisal of pain), and will consider underlying neural mechanisms, and prospects for multisensory therapies.
TMS reveals two functionally distinct time periods for early face and body perception

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The human visual system perceives faces and bodies in a series of hierarchical stages in which stimulus features of increasing complexity are extracted and analyzed. In this talk I will discuss how the temporal specificity of TMS can be exploited to demonstrate this hierarchy by revealing two early and functionally distinct time periods for face and body perception. TMS was delivered over the face-selective right occipital face area (OFA) and the body-selective right extrastriate body area (EBA) at different latencies while subjects performed a range of different face and body discrimination tasks. Results demonstrated that TMS disrupted task performance during two temporally distinct time periods, the first at 40-50ms and the second at 100-110ms. A follow up experiment revealed that these two time periods exhibited functionally distinct patterns of discrimination impairments. TMS delivered during the first time period (at 40-50ms) disrupted both preferred (faces at OFA and bodies at EBA) and non-preferred (bodies at OFA and faces at EBA) task performance. By contrast TMS delivered during the second time period (at 100-110ms) disrupted preferred task performance only. These results are consistent with hierarchical models of face and body perception and further illustrate how and when faces and bodies are discriminated in extrastriate cortex.

The role of verbal and non-verbal communication in collective decision making

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Joint decision-making is a ubiquitous feature of human social interaction, and most often uses verbal communication. How does verbal communication contribute to the outcome of joint decisions? We recently developed a novel quantitative framework relating individual and joint decision making in a Bayesian framework (Bahrami et al 2010). This paradigm measures the collective benefit of cooperation compared to isolated individuals as well as compared to an ideal Bayesian integrator of individuals’ information. Using this paradigm we determined whether verbal or non-verbal interaction altered the effectiveness of joint decision-making. Dyads made isolated and joint decisions in a perceptual task after sharing their confidence via (1) verbal communication (2) non-verbal communication (using visual graphics) (3) both verbal and non-verbal means and (4) without any communication. Both verbal and non-verbal communication resulted in robust collective benefit compared to non-communicating dyads but the benefit was significantly greater for verbal communication. Surprisingly, the benefits of combining verbal and non-verbal communication were subadditive. Finally, only verbal communication produced near optimal Bayesian integration of decisions. We conclude that success of collective decision-making under uncertainty depends critically on the channel by which information is communicated.

Sleep promotes insight for verbal and spatial problems

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There are numerous anecdotal reports of discoveries and insights occurring as a consequence of sleep, for instance Kekule's discovery of the structure of Benzene. A renaissance of interest into the cognitive effects of sleep has provided laboratory tests of such effects of sleep. Cai et al. (2009), for instance, found that implicit exposure to verbal insight problem answers facilitated their solution only after a nap. We tested whether implicit exposure to the solution was necessary in order for sleep to facilitate problem solution. We also tested whether effects of sleep on insight were restricted to verbal tasks, or whether they were domain general across spatial tasks. Participants attempted verbal insight (remote associates) and spatial insight (rebus) problems. After a period of 12 or 24 hours including sleep, or 12 hours not including sleep, the participants returned to solve problems that were previously unsolved as well as novel problems. Both sleep and non-sleep groups solved the novel problems with equal accuracy, but the sleep group solved more previously unsolved problems than the non-sleep group. Sleep facilitates insight for verbal and spatial problems, and with overnight sleep - rather than a nap - implicit exposure to answers is not required.


Can negative evidence raise argument strength in category-based property induction?

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In most cases encountering a piece of negative evidence intuitively lowers one’s credence in a hypothesis. The influence of negative evidence in models of induction hence ranges from no effect to an effect of reducing credence in the conclusion. Two experiments test the hypothesis that argument strength can actually increase when encountering negative evidence. Participants made forced choice judgments (Experiment 1) or sequentially evaluated (Experiment 2) single positive (e.g., Mozart’s music causes alpha waves in the brain, therefore Bach’s music causes alpha waves in the brain) and double mixed premise arguments (e.g., Mozart’s music causes alpha waves in the brain, X’s music DOES NOT, therefore Bach’s music causes alpha waves in the brain) where the second premise (i.e., X) was either from the same subcategory as the 1st premise and the conclusion (e.g., Hayden) or from a different subcategory (e.g., ACDC). Negative evidence lowered credence when it was instantiated by the same group and rose when it
was instantiated by a different subgroup. The results constitute a constraint on models of induction.

**Does young children's understanding of aspectuality depend on the phrasing of the question?**

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Aspectuality understanding requires an appreciation that an object is made up of many different properties, some of which can best be determined by a specific perceptual action (e.g., O'Neill, Astington & Flavell, 1992; Perner, 1991). In three experiments we investigated whether 4- to 5-year-old children’s ability to demonstrate aspectuality understanding was influenced by how the test question was phrased. In the first experiment 60 children chose whether to look or feel to gain information about a hidden object (identifiable by sight or touch). Test questions either referred to the perceptual aspect of the hidden object (e.g., whether it was red or blue), the modality dimension (e.g. what color it was) or the object’s identity (e.g. which one it was). Children who heard the identity question had more difficulty with the task. Further investigations in Experiment 2 (N=30) and Experiment 3 (N=23) demonstrated that children’s difficulty with the identity question was not related to their recall of pre-trial experience of the objects (as suggested by Perner & Ruffman, 1995). Children had difficulty identifying the property that differentiated the objects. We discuss how these results impact on researchers’ assessment of the development of aspectuality understanding.


**Selective conjunctive suppression in visual search**

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The probe-dot procedure (Klein, 1988) was used to explore, the distribution of attentional priority, in efficient search for conjunctions of motion and form (McLeod, Driver, & Crisp, 1988). Participants searched for a target amongst distractors, before locating a probe-dot. In Experiment 1 targets were defined by a conjunction of features (moving X target amongst moving Os and static Xs), or by a single feature (X amongst
Following conjunction search there was a RT cost for probe-dots appearing on static X distractors relative to either moving O distractors or the blank background, which was much larger than any cost in the feature conditions, and did not apply when participants passively viewed the search displays. Experiment 2 tested whether this suppression applied to all static items regardless of form by adding static Os to the conjunction displays. Suppression did not apply to all static items but applied only to a conjunctively defined subset: static Xs (sharing target form), but not static Os (without target form). Experiment 3 investigated the time-course of selective suppression, and revealed that durations of 100ms were sufficient for selective suppression. Selective suppression is likely a mechanism for the active modulation of competition between potent competitors for selection.


Contrasting effects of different types of processing load on visual awareness

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Previous research established that distractor processing critically depends on the level and type of load involved in a task. Distractor processing is reduced in tasks of high perceptual load that exhaust perceptual capacity in task-relevant processing; in contrast, distractor processing is increased in tasks carried under high WM load, because of the reduced capacity for cognitive control over task prioritization (see Lavie, 2005; 2010 for reviews). We report experiments examining whether these contrasting effects extend to signal-detection measures of visual awareness, while also comparing different types of working memory load. Participants performed a search plus detection task during the delay of a short-term memory task under varying levels and types of load. Results showed that detection sensitivity for a peripheral search-irrelevant stimulus was reduced with high perceptual load and high visual-short-term memory load but enhanced with high WM load. The results are discussed in relation to the Load Theory of Attention and Cognitive Control (e.g. Lavie et al., 2004) and the neuroscientific research establishing the different neural correlates of different types of working memory.


Subliminally presented and stored objects capture spatial attention

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When objects disappear from view we can still bring them to mind, at least for brief periods of time, because we can represent those objects in visual short-term memory (Sperling, 1960; Cowan, 2001). A defining characteristic of this representation is that it is topographic, that is, it preserves a spatial organisation based on the original visual percept (Astle et al. 2009; Kuo et al. 2009). Recent research has also shown that features or locations of visual items that match those being maintained in conscious visual short-term memory automatically capture our attention (Soto et al. 2008). But do objects leave some trace that can guide spatial attention, even without participants intentionally remembering them? Furthermore, could subliminally presented objects leave a topographically arranged representation that can capture attention? We presented objects either supraliminally or subliminally, and then a second later re-presented one of those objects in a new location, as a ‘probe’ shape. As participants made an arbitrary perceptual judgment on the probe shape, their covert spatial attention was drawn to that shape’s original location, regardless of whether its initial presentation had been supraliminal or subliminal. We demonstrate this with neural and behavioural measures of memory-driven attentional capture. These findings reveal the existence of a topographically arranged store of ‘visual’ objects, the content of which is beyond our explicit awareness, but which nonetheless guides spatial attention.


Gaze capture by a task irrelevant visual item in a visual search stimulus even when normal observers have a limited awareness of its presence

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If some items in an image are shown to one eye and other items to the other eye, humans have difficulty telling which eye sees which items, perhaps because the
information about the eye of origin of visual input is barely represented explicitly in the brain beyond the primary visual cortex (V1), whose activities are dissociable with visual perception or awareness. This work reports that, in a visual search to find a salient, uniquely oriented, target bar among many uniformly oriented background bars, an eye of origin singleton, e.g., a bar shown to the left eye among other bars shown to the right eye, could nevertheless capture gaze even when it was a background bar far from the target. Furthermore, after the observers completed a search, they had difficulty recalling whether there had been an eye of origin singleton in the display even if their gaze was captured by this singleton distractor. These observations suggest that bottom-up visual attentional guidance can be dissociated from perception and awareness even when it leads to motor actions, and support the idea (Li 2002) that a bottom-up saliency map is created in V1, which drives the sub-cortical superior colliculus for gaze control.


**Increased gaze following for fearful faces. It depends on what you're looking for!**

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An oculomotor visual search task was used to investigate how participants follow the gaze of a non-predictive and task irrelevant distractor gaze, and the way in which this gaze following is influenced by the emotional expression (fearful vs. happy) as well as participants’ goal. Previous research has suggested that fearful emotions should result in stronger cueing effects than happy faces. Our results demonstrated that the degree to which the emotional expression influenced this gaze following varied as a function of the search target. When searching for a threatening target, participants were more likely to look in the direction of eye gaze on a fearful compared to a happy face. However, when searching for a pleasant target, this stronger cueing effect for fearful faces disappeared. Therefore, gaze following is influenced by contextual factors such as the emotional expression, as well as the participant’s goal.

**Attentional capture by irrelevant emotional faces in children with conduct problems**

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Previous research has suggested that children with high levels of conduct problems (CP) are a heterogeneous group that can be delineated based on the presence or absence of Callous-Unemotional (CU) traits (e.g. Frick & Viding, 2009) and that these differences may, in part, lie in their perceptual processing of affective information. To date, no research exists that investigates attention to emotional faces in children with CP. We tested 51 boys (15 CP with CU; 16 CP without CU; 20 typically developing matched control) using an emotional attentional capture paradigm in which the emotional content of the faces was task-irrelevant. Participants searched for a male target face among female faces and indicated whether the target face was tilted to the left or right. The
presence (vs. absence) of an irrelevant emotional singleton expression (fearful, angry; but not happy) in one of the non-target faces slowed down the search RTs in typically developing children and in those with CP but without CU. However, in children with CP and CU, the presence of a negative emotional face did not affect search times. These results provide the first demonstration that high levels of CU traits are associated with reduced attentional capture by negative emotional faces.


A change of tasks delays and modulates early processes in lexical tasks: Evidence from ERPs.

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RTs are prolonged by a task switch, even when time is available to prepare for it. It is widely assumed that this ‘residual’ switch cost is due to competition at the stage of response selection. Elchlepp et al. (2009) presented a word with letters displayed in two colours, following a cue to perform semantic categorisation or to judge the symmetry of the colour pattern (tasks requiring similar distributions of spatial attention). The onset (~300 ms) of the effect of word frequency on semantic categorisation ERPs was delayed by a switch, suggesting that the change of task prolongs processes preceding response selection. In the present experiment, subjects were cued to perform lexical decision or the colour symmetry task. On lexical decision trials, ERPs for words and non-words began to diverge at ~200 ms, and a switch delayed the onset of this lexicality effect, confirming an early locus of a substantial fraction of the residual switch cost. Effects of bigram frequency were also modulated in ways suggesting an impact on pre-lexical/lexical processing. ERPs from the symmetry task showed modulations of the degree of involuntary lexical access consistent with “task-set inertia” as a source of the switch cost.


Semantic and phonological fluency in Deaf adult users of British Sign Language (BSL)

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Verbal fluency tasks are widely used in experimental psychology and neuropsychology. We report the first ever study of semantic and phonological fluency in a signed language. 30 Deaf adult users of BSL were given 1 minute to produce as many signs as they could in each of the following categories: “animals”, “food”, and a variety of phonological categories based on different handshapes, locations and movements. We predicted that fluency in BSL would share many of the same features as spoken language fluency, including clustering within semantic and phonological categories, and a slowing down of the response rate over the course of the minute. We present results to show that
this is indeed the case. We also found some features that could be unique to the signed modality. Certain handshapes and locations carry meaning, and for the “above the shoulders” location, for example, many signers produced a cluster of signs located on the forehead with meanings related to thought (e.g. THINK, KNOW, UNDERSTAND, CLEVER). One older signer produced fingerspelt responses for the semantic categories, but produced signs for the phonological categories. We discuss how these results shed light on the organisation of the BSL lexicon.

Symposium: Neuroplasticity in the language system after stroke
Organiser: Dr Jenny T. Crinion (University College London)

Spontaneous language recovery in acute stroke, using neuroimaging as an early prediction of outcome

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This talk presents data of various ongoing multimodal MRI studies investigating the spontaneous course of language reorganisation from the early to the chronic stage after stroke. Combining functional imaging with diffusion tensor imaging, we study the mechanisms underlying language recovery on a systems level, taking lesion site and disconnection of major language pathways into account. We described a three-phase model of language reorganisation, which is further specified by taking subgroups of patients with different infarct locations into account. In addition we use the advancing method of machine learning techniques to predict language recovery in the very early period after stroke by analysing fMRI data with a support vector machine (SVM). SVMs are capable to learn the categorization of complex, high-dimensional training data and generalize the learned classification rules to unseen data. This allows us distinguishing aphasic stroke patients with good from those with bad language recovery with high accuracy (86% correct classifications). The presented data demonstrate the great potential of this novel method to predict system specific outcome even in a disease as heterogeneous as stroke.


Chronic stroke and long term prediction of aphasia outcome (PLORAS)

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Predicting the long term consequences of brain damage is notoriously challenging. I will discuss how we are attempting to overcome some of these challenges. The first challenge is that similar lesion sites can have inconsistent effects in different patients. These consistencies might relate to many different factors including the age of the patient, their ability and motivation to re-learn, differences in interventions or the time course of natural recovery processes. To investigate the impact of these variables, we need to investigate lesion-symptom relationships in large populations of patients and this requires an easily accessible database. The second challenge is to consider how the effect of damage to one region depends on the set of other regions that have also been damaged. This has driven us away from region or voxel specific statistics; and moved us towards the investigation of sets of regions that are critical or not for a particular task. The third challenge is that clinically useful predictions must be at the level of individual patients. These can be provided, probabilistically, on the basis of data from other patients on the database who had damage to the same set of regions. I will illustrate how our database has been used to identify lesion sites in the left superior longitudinal fasciculus where damage results in long term amodal speech production difficulties in more than 90% of patients. Conversely, we have found that when this area is preserved, less than 10% of patients have amodal speech production difficulties.


Price, C.J., Crinion, J.T., Leff, A.P., Richardson, F.M., Schofield, T., Prejawa, S., Ramsden, S., Gazarian, K., Lawrence, M., Ambridge, L., Andric, M., Small, S.L., & Seghier, M.L. (2010). Lesion sites that predict the ability to gesture how an object is used. Archives Italiennes de biologie In press

Phonological therapy changes connection strengths between lower levels of the auditory network in patients with severely impaired speech perception

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We studied the effects of a behavioural therapy on the auditory network of patients with Wernicke's aphasia, using Dynamic Causal Modelling of fMRI data. We identified different levels of the auditory hierarchy from the thalamus (lowest level) to the superior temporal sulcus. Phonological therapy significantly improved all patients comprehension of speech of single words, sentences and paragraphs, \( F(1, 20) = 4.81, p = .04 \). There was a trend \( (p = 0.85) \) with the more severely affected patients benefiting more. In the severe group, pre-therapy, we identified a predominantly feed-forward
model between the earliest three levels of the auditory system. After therapy, two connections were significantly strengthened in the right hemisphere: the backwards connection from Heschl's gyrus to the thalamus, and the thalamic self-connection. Two connections were significantly reduced: the forward connection from Heschl's Gyrus to planum temporale, and the lateral connection between right and left planum temporale. This suggests that the effects of phonological therapy are primarily on the lower levels of the auditory system, leading to smaller prediction errors being passed on to higher levels. This demonstrates that therapy effects may be expressed as changes in connectivity between existing nodes of the brain network supporting auditory perception.

tDCS-enhanced language training – proof-of-principle studies in the healthy brain and in aphasia

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Efficacy and effectiveness of language training in chronic aphasia remain moderate only. Electrical brain stimulation over the left hemisphere has been shown to enhance language learning in healthy individuals (de Vries M.H., et al 2009; Floel A., et al 2008) and patients with mild word-retrieval problems (anomia) (Baker J. M., Rorden C. and Fridriksson J., 2010). However, in patients with moderate to severe anomia, right temporo-parietal brain areas have been implicated with naming improvement after treatment. In a randomized, double-blind, sham-controlled cross-over trial, we assessed if anodal transcranial direct current stimulation (tDCS) compared to cathodal tDCS and sham stimulations over the right temporo-parietal cortex would improve the success of a three-day intensive anomia training (two hours/day) in 12 chronic aphasia patients after left-hemispheric stroke. All training conditions led to a significant increase in naming ability (mean 83±22 %), which was retained for at least two weeks after the end of the training. Application of anodal tDCS significantly enhanced the overall training effect compared to sham. Response to anodal tDCS was most pronounced in patients with severe naming deficits. Additional predictive variables were not identified. Intensive language training has a large and sustained effect in chronic aphasia. Anodal tDCS, applied over the non-language dominant hemisphere, has the potential to significantly improve language reacquisition in chronic anomia.


Phonological priming and concurrent tDCS effects on the picture naming network in healthy older controls, implications for the treatment of anomia.

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The most effective treatment for word-finding difficulties in aphasia is not clear. Speech and Language therapists use phonological cueing, a variant of priming, to facilitate naming performance of patients with anomia. However, the behavioral profile of aphasic patients is not sufficient to identify who will benefit most from this cueing treatment approach. Recently, anodal transcranial direct current stimulation (tDCS) has been proposed as a facilitatory adjunct to behavioral interventions in aphasic stroke patients, yet the nature of the effects of tDCS on the brain are not known. To date, no functional magnetic resonance imaging studies (fMRI) studies have used a phonological priming paradigm with picture naming response times or indeed a language paradigm with concurrent tDCS. Here, I will present data from two fMRI studies that investigate the neural mechanisms underlying the facilitatory effects of 1) phonological cues on normal picture naming and 2) anodal tDCS (2mA for 20 mins) when applied to left inferior frontal cortex. The results demonstrate that both phonological priming and tDCS facilitate naming response times and may be expressed as neural priming of the brain network supporting a left dominant speech function.

End of symposium

A comparative study of serial spatial recall in monkeys (Papio papio) using a variation of the Corsi tapping test.

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Three experiments are presented, aimed at assessing if non-human primates can be meaningfully compared to humans in a variation of a widely used non-verbal test of serial recall. The results of Experiment 1 indicate that monkeys can master a simplified serial recall task where feedback is provided at the first occurrence of error during recall. The second experiment featured a procedure similar to some implementations of the Corsi test in humans, designed to test the effects of sequence structure and movement path length. Several attributes of human serial recall were observed in the baboons tested. However, monkeys’ accuracy and speed of processing did not always benefit from sequence organisation in conditions in which humans typically take advantage of serial-spatial structure. The third experiment aimed at testing humans in conditions very similar to those used with monkeys in experiment two. Apart from a quantitatively longer memory span observed in humans, some differences emerged in the relative benefits of imposing structure over the to-be-remembered material in humans and monkeys. The results are discussed in relation to other domains where differences in how human and non-human primates segment complex visual patterns have been observed.
Attention deployment during memorizing and executing complex instructions

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Previous research showed that rehearsal of spatial locations improves spatial working memory (e.g., Awh & Jonides, 2001; Fischer, 2001). The present study investigates this effect during memorising and executing multiple instructions in an assembly task. In particular, we examined whether eye movements towards relevant objects during the presentation of sequential verbal instructions predict their successful execution. Twelve participants were presented with between 3 and 8 instructions of the form “Move the [object] to [location]” that subsequently had to be executed on a monitor by manipulating objects in a numbered grid with a mouse. Eye movements towards objects during the presentation and execution of the instructions were recorded. We discovered that, as instruction complexity increased, attention was divided between all previously mentioned objects. This active rehearsal behaviour broke down after 4 instructions, coincident with participants’ instruction span. Our results indicate that eye movements during instruction presentation can predict their successful execution.


Estimates of primary and secondary memory predict different aspects of intelligence: Evidence from both children and adults.

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Measures of working memory have consistently been shown to be strong predictors of aspects of intelligence and academic attainment. Recently Unsworth and colleagues (e.g., Unsworth & Engle, 2007) have suggested that the strength of this relationship reflects the fact that working memory tasks measure both the active maintenance of information in primary memory and the effortful recall of information from secondary memory. Two experiments tested this suggestion among 52 undergraduate participants (Experiment 1) and a total of 132 6- and 8-year-old children (Experiment 2). In each, participants were presented with a series of working memory tasks that were modified to maximize their potential loading on either primary or secondary memory, as well as an immediate free recall task from which estimates of primary and secondary memory capacity were also extracted. Although determining these estimates from the developmental sample was not straightforward, in both experiments factor analysis produced two-factor solutions that were broadly consistent
with a primary/secondary memory distinction. In addition, these two factors showed differential associations with measures of fluid (non-verbal) and crystallized (verbal) intelligence in both adults and children.


**Working memory deficits in untreated and treated hypertension**

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The objectives of the study were to: i) investigate what aspects of working memory if any are impaired in untreated hypertension, and ii) establish if any impairments are resolved or persist after successful antihypertensive treatment. Working memory abilities were assessed in patients with a recent diagnosis of hypertension prior to and after successful anti-hypertensive treatment. A matched comparison group of normotensive individuals from the same GP surgery was also tested. Significant deficits in verbal working memory were found in the hypertensive group relative to the normotensive group both before and after antihypertensive treatment. Pre-treatment systolic blood pressure was highly correlated with working memory performance. These cognitive deficits may reflect permanent damage to the frontal regions of the brain that serve working memory, caused either by lengthy periods of untreated hypertension or blood pressure levels that although elevated, fail to meet current diagnostic criteria. The presence of impaired working memory may therefore identify the need to review thresholds for BP treatment, and the potential value of combining low working memory scores with elevated blood pressure values as markers for cardiovascular risk.

**Adolescents on the autism spectrum show a category contrast effect**

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In general, the pattern of categorisation abilities shown by individuals with an autism spectrum disorder (ASD) is not well characterised. This is exemplified by competing predictions concerning the influence of prior knowledge on categorisation decisions. To test these predictions we presented an ASD group and a typically developing group with a discrimination task preceded by a task designed to demonstrate a category contrast effect. Stewart, Brown, and Chater (2002) first demonstrated the effect using a sequential categorisation task. Response accuracy to each boundary item was greater if the preceding item was a member of the contrast category, than if it was from the same category as the target. The weak central coherence account (Happé, 1994), and Ropar and Mitchell’s (2002) observation of reduced influence of prior knowledge
predicted a reduced contrast effect in ASD. The “reduced perception of similarity” account (Plaisted, 2001) and the enhanced perceptual functioning model (Bonnel, Mottron, Peretz, et al., 2003; Mottron & Burack, 2001) predicted an enhanced effect. Contrary to predictions, the ASD group demonstrated a contrast effect and discrimination performance that was typical. The discussion focuses on the implications of these findings for theories of categorisation processes in ASD and typical populations.


*Increased intra-participant variability in adolescents with autistic spectrum disorder: Evidence from single trial analyses of evoked EEG.*

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Intra-participant variability is an important indicator of pathophysiological processing; response time variability may be an endophenotype of autistic spectrum disorder (Geurts et al. 2008). The data I will present here demonstrate, for the first time, that intra-participant variability can be measured reliably from EEG data, and that intra-participant EEG variability is significantly greater in individuals with ASD than in neurotypical controls. EEG was recorded from thirteen high functioning adolescents with ASD and twelve neuro-typical age- IQ- and gender-matched controls during a pattern onset task. Data were decomposed using Independent Component Analysis. For each participant, the co-efficient of variance (s.d. / mean) for the single trial P1 peak amplitudes and latency, and the inter-trial phase coherence (ITPC) of evoked alpha activity were computed. Group comparison indicated that the latency coefficient of variance was significantly greater (t[23] =2.35, p<.05) and ITPC was significantly lower (t[23] = -2.5, p<.05) in the participants with ASD compared with the neuro-typical
participants. There were no group differences in P1 amplitude or single-trial amplitude variability. The data provide further evidence for disturbances in the synchronisation of oscillatory networks in ASD, and may offer insight into the origin of frequently reported smaller ERP amplitudes in ASD.


Reserve List for Oral Presentations

Evidence for dissocation of music perception and appreciation in congenital amusia

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Individuals with congenital amusia have difficulties recognizing and discriminating melodies (Peretz et al., 2003). While much research has been concerned with identifying possible core perceptual deficits, the extent to which these impact upon appreciation of music is unknown. Using experience sampling methodology, we probed music-related behaviour in 17 amusic and 17 matched controls. We used hierarchical cluster analysis to identify distinct patterns of music-related behaviour in which the model was blind to the status of individuals (amusic or control). We found an uneven distribution of amusics and controls across a two-cluster solution. Evaluation of the variables discriminating these clusters revealed that the member individuals differed significantly on their levels of engagement with, and reported appreciation of music. Our results provide evidence that while the majority of individuals with amusia show little evidence of wanting to engage with music in their everyday life, a significant proportion show behaviour largely indistinguishable from controls. The dissociation between perception and appreciation in a subgroup of amusics could not be explained by severity of amusia and further investigation is warranted to elucidate the nature of this relationship.


Risk taking with peers and the moderating role of callous-unemotional traits

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Automobile accidents are the leading cause of death and injury among adolescents (e.g., The Times, 2009) and accident rates greatly increase when passengers are present. The present study will examine social factors that may increase accident rates among adolescents (Allen & Brown, 2008). In particular, young drivers may ‘show off’ in front of their peers and take risks to show that they are autonomous and ‘adult’ (Moffitt et al., 1996). Youths with callous-unemotional traits are known to take risks in
response to a reward (O'Brien & Frick, 1998) and to be thrill-seeking. These youths may be particularly vulnerable to peer influence. Three questions are posed in this study: (1) how do callous-unemotional (CU) traits relate to risky behaviour? (2) does the presence of peers influence the relation of CU traits and risk-taking? and (3) does age mediate relations among CU traits, presence of peers, and risk-taking? The present study uses novel methodology. Prior research on this topic has primarily relied on self-report or tasks that do not generalize very well to real life. The present study uses an objective measure of risk with a driving simulation in which “passengers” (peers) will be present or absent. Participants (N=200) are youths ages 16 to 19 years, recruited in groups of three. Findings will be discussed in relation to developmental reasons for risk-taking, as well as the possible identification of those youths most vulnerable to taking risks when pressured by peers.


Turner, J. (June 16, 2009). Learn to drive at the age of 11. The Times.

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Do voice details survive lexical consolidation?

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Newly learnt words enter a consolidation process such that after one night's sleep they engage in lexical competition (Dumay & Gaskell 2007). Thus, a test of whether lexical representations retain information about voices (Goldinger, 1998) is to look at whether voice details modulate delayed (post-sleep) competitor effects, amongst other consolidation phenomena. This is exactly what we did. Ninety-six participants learnt one set of novel competitors (such as "shadowks" for "shadow") seven days before the test, and another set immediately before the test. Each word was learnt in a male or a female voice, and was tested in either the same or the other voice. Cued recall ("shadow--?") and phoneme monitoring (Is there an /s/ in "shadowks"?) showed stronger memory (i.e., more accurate/faster responses) for the seven-day old items and an enhanced voice effect (better performance in the same voice condition) after seven days. Crucially, our most indirect measure (pause detection) showed that only the seven-day old items (as expected) engaged in lexical competition, but only when the input preserved the voice in which they were encoded. These findings argue that listeners are equipped to make the most of voice variability, and that voice details, when encoded, survive lexical consolidation.

Communication with an addressee during pointing spatially shapes the gesture and activates a social brain network

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Communicative pointing is a human specific gesture which sets up a three-way relationship between a subject who points, an addressee and an object. Yet psychophysical and neuroimaging studies on pointing have only taken into account two-way relationships between an agent and an object without exploring the communicative interaction with an addressee. Here, we address whether the communicative value of pointing modifies both its behavioral and neural correlates by comparing pointing with or without communication. We found that in healthy participants pointing repeatedly at the same object, the presence of a communicative interaction with an addressee induced a spatial reshaping of both the pointing trajectories and the endpoint variability. Therefore, a change in frames of reference might occur when pointing conveys a communicative intention. In a PET study, pointing when communicating with an addressee was associated with increased regional cerebral blood flow in the right posterior superior temporal sulcus and the right medial prefrontal cortex in contrast with pointing without communication. Such a right hemisphere network suggests that the communicative value of pointing relates to processes for taking another person’s perspective. This study brings to light the need for future studies on communicative pointing to take into account its three-way relationship.

A specific vestibular modulation of somatosensory perception

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Functional imaging studies show overlapping of vestibular and somatosensory projections in the human brain. However, it remains unclear whether and how vestibular inputs affect somatosensory function. To address this issue, we studied effects of left caloric vestibular stimulation (CVS) on detection of near-threshold somatosensory stimuli delivered to the left and right hands of healthy volunteers. We also tested CVS modulation of visual contrast detection to control for supramodal, non-specific effects. Signal detection analyses showed a clear increase in somatosensory perceptual sensitivity found immediately after CVS. This functional somatosensory improvement was similar ipsilateral and contralateral to vestibular stimulation. Effects on visual contrast sensitivity
were much less prominent, and not statistically reliable. These findings suggest that vestibular-somatosensory links are not merely an epiphenomenon of brain activation patterns found in neuroimaging studies, but rather a specific cross-modal perceptual enhancement. The vestibular system may play an important role in the weighting between processing of internal somatosensory information and exteroceptive information from the environment beyond the body.

The Earwormery: Learning more about involuntary musical imagery and how it relates to personality and musical experience

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The research presented addresses questions about the nature of musical imagery, with a focus on involuntary musical imagery (INMI). A questionnaire method was used to examine the nature of musical imagery and INMI, as well as musical experience and obsessive compulsive traits. Exploratory factor analysis found three meaningful components to people’s experiences of musical imagery, and factor scores were assessed for correlation with other measures. Musical experience was found to relate strongly to a first component, which seemed to measure the extent to which musical imagery is unconscious and complete. Obsessive compulsive traits were related most strongly to INMI through a second component, seemingly measuring the extent to which musical imagery is perceived as persistent and distracting. Both musical experience and obsessive compulsive traits were also related to the frequency of INMI experiences. The third component appeared to measure an unrelated aspect of musical imagery experiences, specifically the extent to which they are familiar and entertaining. This factor was not strongly related to musical experience or obsessive compulsive traits.

Heightened conflict during cue encoding increases backward inhibition in set switching

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Backward inhibition (BI) is a performance cost that occurs when an individual returns to a task after 1 (vs. more than 1) intervening trial, and it may reflect the inhibition of task-set components during switching. In 2 experiments, we support the theory that inhibition can target cue-based preparatory stages of a task. Participants performed a cued target-localization task that had been previously shown to produce BI. In Experiment 1, reassignment of arbitrary cue-target pairings midway through the experiment doubled the size of BI, though cue, target, and response sets remained unchanged. In Experiment 2, we demonstrated that the effect depends on re-pairing members of the same cue and target sets. The results are attributed to heightened conflict (and hence greater inhibition) during cue-target translation when a previously learned cue-target mapping is remapped.
Auditory motion in depth is preferentially ‘captured’ by visual looming signals

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Dynamic audiovisual capture’ occurs when the direction of motion of a visual cue causes a misperception of the trajectory of an auditory stimulus. Faster bimodal reaction times for motion in depth have recently been observed for looming cues compared to receding cues (Cappe, Thut, Romei, & Murray, 2009). The current study aimed to test whether visual looming cues are associated with greater dynamic capture of auditory motion in depth than receding signals. Participants judged the direction of an auditory motion cue presented with a visual looming cue (expanding disk), a visual receding cue (contracting disk), or visual stationary cues (static disks). Visual cues were presented either simultaneously with the auditory cue, or after 500 ms. Results showed greater dynamic capture for looming visual cues compared to receding visual cues, and no dynamic capture for asynchronous presentation. A second experiment tested whether a spatial mismatch between the visual and auditory cues would affect dynamic capture differently for looming and receding stimuli. It was found that spatial mismatch reduced the degree of dynamic capture compared to spatially aligned cues, but there was no differential effect. The results are discussed in relation to theories of multisensory integration of dynamic cues.


Intra-Individual Variability in reaction time on a computerised Stroop test. Does variability distinguish between lupus patients with and without central nervous system involvement?

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Intra-individual variability (IIV) has been proposed as a behavioural marker for central nervous system integrity (Hultsch, D.F., et al. 2000). Variability increases occur with age, mild cognitive impairment, traumatic brain injury, Parkinson’s disease and epilepsy (Bunce, D., et al. 2008). The present study compared 13 patients with Neuropsychiatric Systemic Lupus Erythematosus (NPSLE) (defined as SLE affecting the central nervous system) with 21 non-NPSLE patients and 28 age-matched healthy controls on IIV and behavioural scores on a computerised Stroop test. Within-person standard deviations (ISDs) and a coefficient of variation (CV) were calculated from a regression model of RT against trial, block, gender and age. In addition, the groups were compared on traditional cognitive measures of memory and fluency. Results indicate that for both congruent and incongruent trials, the NPSLE group were slower, with a higher ISD and CV. This form of analysis was also more successful at separating the groups than was behavioural data from traditional cognitive tasks including where the NPSLE and non-NPSLE groups separated from controls but not from each other. In conclusion it appears that inter-individual variability is increased in patients thought to have some
degree of damage to their brain and that this measure separated the groups with greater sensitivity than mean RT alone. Future work will compare this to analysis of RT distributions using ex-Gaussian measures (Matzke, D. and E.J. Wagenmakers, 2009) and correlating variability with quantitative brain imaging measures and clinical variables such as depression and anxiety.


**Facial features of the other-race: Their effect on the own-race bias in face recognition**

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The own-race bias proposes that own-race faces are recognised more accurately than other-race faces (Meissner & Brigham, 2001). This study investigated whether facial features have any effect on the own-race bias and face recognition. Fifty-one participants rated faces for their distinctiveness in a learning phase, then completed a recognition task in which they had to state if they had seen a particular face before. The stimuli shown to the participants consisted of Black and White faces that were either conventional Black and White faces or had eyes of the other race or mouth of the other race. An own-race bias was not found as Black faces were recognised more accurately than White faces. Moreover, findings show that the Black faces with eyes of the other race significantly aided participant’s recognition.


**A bilateral advantage in controlling access to visual short-term memory.**

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Recent research on visual short-term memory (VSTM) has revealed the existence of a bilateral field advantage (i.e., better performance when the items are distributed in the two visual fields than if they are presented in the same hemifield) for spatial location and bar orientation, but not for colour (Delvenne, 2005; Umemoto et al., in press). Here, we investigated whether a bilateral field advantage in VSTM is constrained by attentional
selective processes. It has indeed been previously suggested that the bilateral field advantage observed in a number of visual tasks may be a general feature of selective attention (Alvarez & Cavanagh, 2005; Delvenne, 2005). Therefore, we hypothesized that VSTM for colour might benefit from the bilateral presentation if attentional selective processes are particularly engaged. Participants completed a colour change detection task whereby target stimuli were presented either across both hemifields or within one single hemifield. In order to engage attentional selective processes, some trials contained irrelevant stimuli that needed to be ignored. The results revealed a bilateral field advantage only when irrelevant stimuli were presented amongst the targets. Those findings strongly suggest that attentional selective processes must be engaged in order for VSTM hemispheric independent processes to operate.


The influence of social context and embodied affect on moral judgements.

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The emotion of disgust is thought to increase the severity of moral judgements (Schnall et al., 2008a). However, research has found mixed effects with respect to cleanliness. Schnall, Benton, and Harvey (2008b) found that cleanliness decreases the severity of moral judgements, while Zhong, Strejcek, and Sivanathan (2010) demonstrated the reverse effect. The present research examined whether the context of cleanliness (Self vs. Others) moderates the effects of cleanliness on moral judgements, thereby accounting for the mixed results of past research. After engaging in a mood induction, participants (N = 2581) completed an online questionnaire that first manipulated cleanliness and its context, and subsequently measured moral judgements. Analyses revealed that the mood induction was successful in generating both positive and negative affective states, with participants in the two Clean conditions reporting greater positive emotions than those in the Dirty conditions. However, there were no significant differences in the severity of moral judgements between participants in the Clean versus Dirty experimental conditions, and the context manipulation (Self vs. Other) did not moderate the effects as expected. Thus, affect did not influence the severity of moral judgements in the present research.


**Feeling numb: Thermosensation, but not thermal pain, modulates feeling of body ownership**

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There is an important link between pain, regulation of body temperature, and body ownership. For example, altered body ownership due to chronic pain or “rubber-hand illusions” (RHI) is associated with reduced temperature of the affected limb. However, the causal relationships within this triad are not well understood. We have therefore investigated whether manipulating temperature can influence body ownership. We used a thermode to make the right hand of healthy participants either painfully cold, cool, neutral, warm or painfully hot. Next, we induced the RHI and investigated its strength by measuring perceived position of the hand (1), feeling of body ownership (2), and we also measured changes in hand temperature due to inducing the RHI (3). We replicate previous reports that inducing the RHI produces a decrease in limb temperature. Importantly, we demonstrate for the first time a causal effect in the opposite direction. External cooling increased the strength of the RHI, while warming decreased the strength of the RHI. Finally, we show that the painful extremes of these temperatures do not modulate the RHI. Hence, while thermosensation is an important driver of body ownership, pain seems to bypass the normal multisensory mechanisms of embodiment.

**Trajectories of part-based and configural object recognition in adolescence**

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Two experiments assessed the development of children’s part and configural (part-relational) processing in object recognition during adolescence. In total 280 school children aged 7-16 and 56 adults were tested in 3-AFC tasks to judge the correct appearance of upright and inverted presented familiar animals, artifacts, and newly learned multi-part objects, which had been manipulated either in terms of individual parts or part relations. Manipulation of part relations was constrained to either metric (animals and artifacts) or categorical (multi-part objects) changes. For animals and artifacts, even the youngest children were close to adult levels for the correct recognition of an individual part change. By contrast, it was not until 11-12 years that they achieved similar levels of performance with regard to altered metric part relations. For the newly-learned multi-part objects, performance for categorical part-specific and part-relational changes was equivalent throughout the tested age range for upright presented stimuli. The results
provide converging evidence, with studies of face recognition, for a surprisingly late consolidation of configural-metric relative to part-based object recognition.

Action observation of a physically dissimilar individual: An fMRI study

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The putative mirror neuron system (pMNS) is hypothesized to encode the goals of an action, even when the observer cannot physically complete the observed action in the same manner. Here we ask, how is this system modulated when observing individuals with unusual physical differences? Using functional magnetic resonance imaging, we scanned 11 typically developed participants as they observed the same goal-driven actions performed by a woman without limbs (individual with physical differences, IPD) and women with intact limbs (individuals with typical development, ITD). When observing IPD perform actions versus ITD, participants had no activity in pMNS regions. Instead, they had greater activity in the right amygdala and temporoparietal junction, regions associated with emotional processing and perspective taking. Furthermore, observations of IPD’s stump actions compared to a control condition did not significantly engage pMNS regions, while observation of ITD’s hand actions did. These results suggest, for the first time, that there may be a disruption of the goal-matching action understanding system in the pMNS when observing differently bodied individuals and that regions associated with emotional processing and effortful perspective taking are engaged instead. These novel findings comprise the first neuroimaging evidence of neural modulations when observing individuals with unusual physical differences.

Viewing objects and planning actions: On the potentiation of grasping behaviours by visual objects.

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How do humans interact with tools? Gibson (1979) suggested that humans do not perceive the abstract properties of tools, but rather what they afford in terms of meaningful actions. This “affordances” hypothesis implies that visual objects can potentiate motor responses even in the absence of an intention to act. Most previous studies have used as stimuli 2D pictures of objects and thus examined affordances while excluding stereo cues which may be important in the real world. In our study we used real objects with a strong significance for either a grasping or a pinching action. Our first experimental task required a timed motor response, simulating either a pinching or grasping behaviour, to an orthogonal (auditory) imperative stimulus. Participants observed the objects through shutter goggles, generating either monocular or binocular vision with precise timing. In a second experiment, participants viewed the objects binocularly while receiving stimulation of their primary motor cortex using TMS, and had muscular responses recorded from two intrinsic hand muscles (associated with either a precision or power grip). Both RTs and MEPs interacted with tool category in the
predicted manner, providing further support to the affordances hypothesis and also illustrating how affordances develop over time.


**Visual distortion of body size modulates pain**

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Pain is a complex subjective experience that can be shaped by several cognitive, psychological and even contextual variables. For example, simply viewing the body reduces the reported intensity of acute physical pain. We investigated whether this visually induced analgesia can be modulated by the visually depicted size of the stimulated body part. We measured contact heat-pain thresholds, while participants viewed either their own hand or a neutral object, at real size, enlarged, or reduced. Vision of the body was analgesic, increasing heat-pain thresholds by ~ 4°C. Importantly, enlargement of the viewed hand enhanced this analgesia, while looking at a reduced hand decreased it. These results demonstrate that visual distortions of body size modulate sensory components of pain, and reveal a clear functional relation between the perception of pain and the representation of the body.

**Investigating orthographic effects on speech processing: a word learning approach**

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The impact of orthographic learning on speech production and perception was examined in a 3-day training study. On Day 1, 12 adult participants were taught 20 novel spoken words paired with a picture. On Day 2, the participants were introduced to the spellings of the words. The taught spelling for a word was either regular or irregular with respect to grapheme to phoneme conversion rules (CHESK vs CESK for /tʃɛsk/). Spelling regularity was counterbalanced across groups. Prior to the introduction of written names there was no difference in picture naming times across groups of words but testing on Day 2 showed that while naming times for all pictures decreased, naming times for pictures with regular and irregularly spelled names decreased at different rates. This advantage for pictures with regularly spelled names was maintained on Day 3. In addition, on Day 3, reaction times to regularly spelled words were faster than those to irregularly spelled words in an auditory lexical decision task. We discuss the implications of these results with respect to those theories suggesting that orthography is automatically activated during tasks that do not explicitly require orthographic knowledge.
Risk taking with peers and the moderating role of callous-unemotional traits

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Automobile accidents are the leading cause of death and injury among adolescents (e.g., The Times, 2009) and accident rates greatly increase when passengers are present. The present study will examine social factors that may increase accident rates among adolescents (Allen & Brown, 2008). In particular, young drivers may ‘show off’ in front of their peers and take risks to show that they are autonomous and ‘adult’ (Moffitt et al., 1996). Youths with callous-unemotional traits are known to take risks in response to a reward (O’Brien & Frick, 1998) and to be thrill-seeking. These youths may be particularly vulnerable to peer influence. Three questions are posed in this study: (1) how do callous-unemotional (CU) traits relate to risky behaviour? (2) does the presence of peers influence the relation of CU traits and risk-taking? and (3) does age mediate relations among CU traits, presence of peers, and risk-taking? The present study uses novel methodology. Prior research on this topic has primarily relied on self-report or tasks that do not generalize very well to real life. The present study uses an objective measure of risk with a driving simulation in which “passengers” (peers) will be present or absent. Participants (N=200) are youths ages 16 to 19 years, recruited in groups of three. Findings will be discussed in relation to developmental reasons for risk-taking, as well as the possible identification of those youths most vulnerable to taking risks when pressured by peers.


Turner, J. (June 16, 2009). Learn to drive at the age of 11. The Times.

Evidence for dissociation of music perception and appreciation in congenital amusia

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Individuals with congenital amusia have difficulties recognizing and discriminating melodies (Peretz et al., 2003). While much research has been concerned with identifying possible core perceptual deficits, the extent to which these impact upon appreciation of music is unknown. Using experience sampling methodology, we probed music-related behaviour in 17 amusic and 17 matched controls. We used hierarchical cluster analysis to identify distinct patterns of music-related behaviour in which the
model was blind to the status of individuals (amusia or control). We found an uneven distribution of amusics and controls across a two-cluster solution. Evaluation of the variables discriminating these clusters revealed that the member individuals differed significantly on their levels of engagement with, and reported appreciation of music. Our results provide evidence that while the majority of individuals with amusia show little evidence of wanting to engage with music in their everyday life, a significant proportion show behaviour largely indistinguishable from controls. The dissociation between perception and appreciation in a subgroup of amusics could not be explained by severity of amusia and further investigation is warranted to elucidate the nature of this relationship.


**Effects of Conflict Strength and Age on Error Processing in the Flanker Task**

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According to the conflict monitoring theory of cognitive control (Botvinick, Braver, Barch, Carter, & Cohen, 2001), people monitor for the occurrence of conflict in information processing in order to establish the need for control adjustments. Conflict monitoring has previously been shown to be impaired in older adults (e.g., Zeef & Kok, 1993). In this study we investigated this effect in a middle-aged group using an adaptation of the flanker task in which conflict was additionally manipulated by independently varying the contrast of target and flanker letters. Effects of this manipulation on both behavioural and electrophysiological measures were analyzed. A significant effect of contrast on the compatibility effect confirmed that the conflict manipulation was successful. Control adjustments in form of the post-error slowing effect were also affected. Despite a general slowing for middle-aged adults, neither conflict size nor post-error slowing was affected by age. However, the amplitude of both the ERN and the Pe, two components of the event-related potential that have shown to be reduced in amplitude in older adults and that have previously been linked to post-error slowing, were reduced in the middle-aged group. These findings challenge previous interpretations of these components.


**Response speeding via trial-to-trial persistence of motor plans in dorsal pre-motor cortex**

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In choice RT tasks, RT decreases when the same stimulus appears twice in a row (the response repetition (RR) effect). When two or more stimuli are mapped onto the same response, we can seek a response-only (Ro) RR effect (i.e. the same response made twice in a row to different stimuli) which might reflect persistent motor activity for a specific action. However, when stimuli cannot be categorised via a simple rule, the RoRR effect is negligible, suggesting that motor activity does not persist. An alternative explanation is that with few potential movements, all plans persist, reflecting the brain’s capacity for parallel motor planning, but yielding no action-specific repetition advantage. Hence the RoRR effect might only emerge with more movement alternatives. Two behavioural experiments found support for this idea, revealing large RoRR effects with four or more response alternatives. A final TMS experiment found an enhanced RoRR effect following a virtual lesion to dorsal pre-motor cortex (dPMC). This suggests that persisting motor plans may in fact contribute to response repetition effects, and that this contribution may have been facilitated by TMS, perhaps reflecting a process similar to stochastic resonance.

Factors affecting body representation of the hand

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When sensory input from the hand is lost, people often report feeling a ‘phantom’ limb. The mechanisms underlying this phenomenon are poorly understood. We disrupted sensory inflow from the hand by applying an ischaemic block to the arm, which paralyses and anaesthetises the arm below the cuff, and tracked development of the experimental phantom hand. Detection threshold measurements showed that we blocked ‘large-fibre’ touch sensations. In contrast, some small fibres continued to signal heat pain. These sensory changes profoundly influenced how subjects experienced their hand. When invited to select a visual template to indicate the perceived size of their hand, sensory block increased the perceived hand size by a mean of 34%. The perceived posture of the hand and fingers also changed as the sensory block developed. However, there was no ‘default’ posture for the phantom. Rather, the final posture depended on the actual position of the hand before the block. These data suggest that the body representation for both size and posture of the hand can be altered by large-fibre somatosensory inputs, while signals from small-diameter pain fibres may be less important.

Spatial grouping resolves ambiguity to drive temporal recalibration

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Cross-modal temporal recalibration describes a shift in the point of subjective simultaneity (PSS) between two events following repeated exposure to asynchronous cross-modal inputs – the adaptors. Previous research suggests that audio-visual
recalibration is insensitive to the spatial relationship between the adapting events. Here we show that audio-visual temporal recalibration can be driven by cross-modal spatial grouping. Six participants adapted to alternating trains of lights and tones. Spatial position was also manipulated, with alternating sequences of a light then a tone, or a tone then a light, presented on either side of fixation. As the events were evenly spaced in time, in the absence of spatial-based grouping it would be unclear if tones were leading or lagging lights. However, any grouping of spatially co-localised cross-modal events would result in an unambiguous sense of temporal order. We found that adapting to these stimuli caused the PSS between subsequent lights and tones to be shifted toward the temporal relationship implied by spatial-based grouping. These data therefore show that the adaptive mechanism that generates temporal recalibration is sufficiently sophisticated to infer relatedness from spatial cues.

The effect of target-distracter similarity relations on face matching

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Zubko et al. (2010) described a task in which the ability to match unfamiliar faces was subject to distracter interference. Participants were presented with a target face for 2s, followed by 1, 3 or 5 'distracter' faces each for 0.5s, and then a probe face that remained on-screen until response. Participants were first required to indicate whether distracter faces were mostly male or female, and then whether the first and last faces were the same or different. While normal observers showed a drop in matching performance as the number of distracters increased, individuals with developmental prosopagnosia did not. The aim of the present study was to characterise the source of this unexpected interference. Across 5 experiments, we demonstrate that the interference effect persisted when differences between the superficial image properties of targets and distracters were increased, but disappeared when either non-face distracters were presented or the exposure duration of face distracters was restricted to 0.2s. We also found that the interference effect was not moderated by participants’ ability to remember, either implicitly or explicitly, the identity of distracters. We discuss these results with reference to how unfamiliar target faces are segregated from other stimuli in short-term memory.
