



E|P|S

Experimental
Psychology
Society

LONDON MEETING

6-7 JANUARY 2005

A scientific meeting will be held at the Department of Psychology, University College London on 6/7 January, 2005. The local organiser is Dr Sophie Scott.

EPS Prize Lecture

Thursday 6 January at 5.30 – 6.30

A Framework for Facial Expression Recognition: Better Late than Never
Dr Andy Calder, (MRC Cognition and Brain Sciences Unit, Cambridge)

Symposia

Thursday 6 January 9.30 – 1pm

Mechanisms of Imitation
Organiser: Professor Cecilia Heyes

Friday 7 January 10.00 – 1pm

“The Social Face”
Organiser: Dr Andy Calder

Poster Session

Will be held on Thursday 6 January at 4pm – 5.30pm in Room 305 (Third Floor Seminar Room) and the Third Floor Common Room. Assigned poster numbers can be found in the Poster Index of this programme. Delegates may put up posters from 9.00 and take them down by 5.30.

Platform Presentations

Sessions will be held in the Ground Floor and Lower Ground Floor Lecture Theatres of the Psychology Department (26 Bedford Way, WC1). Both theatres have data projectors available for Powerpoint presentations. Presenters may provide their own laptops and connector leads, or bring disks or CDs for the on-site computers which run Powerpoint 97 under Windows NT/2000. Any queries about facilities in the theatres should be sent to the local organiser, Sophie Scott (sophie.scott@ucl.ac.uk)

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

There will be a drinks reception on Thursday evening at 6.30 in the Old Refectory, on the main UCL campus. The conference dinner will be at 7.30 at Bertorelli's, 19-23 Charlotte Street, London WC1 – (020-7636 4174). A booking form is enclosed.

START OF PARALLEL SESSIONS*Session A***Lower Ground Floor Lecture Theatre**

- 9.00 **Geoffrey Bird* and Cecilia Heyes** (University College London)
Effector-dependent learning by observation of a finger movement sequence
- Symposium:** “Mechanisms of Imitation”
Organiser: Professor Cecilia Heyes
- 9.30 **Cecilia Heyes** (University College London)
Learning to solve the correspondence problem
- 10.00 **Stefan Vogt** (University of Lancaster)
Neural circuits underlying imitation of novel and practised hand actions
- 10.30 **Raffaella Rumiati*** (Scuola Internazionale Superiore di Studi Avanzati, Trieste)
Strategic control of multiple routes in imitation of actions in healthy and in brain-damaged individuals
- 11.00 COFFEE
- 11.30 **Ulf Dimberg*** (Uppsala University)
Facial reactions to facial expressions: Automatically and unconsciously evoked mimicking responses?
- 12.00 **Anna Saggerson* and Rob Honey** (Cardiff University)
Imitative learning in pigeons
- 12.30 **Marcel Brass*** (Max Planck Institute for Human Cognitive and Brain Sciences, Munich)
Why don't we imitate all the time?
- End of Symposium
- 1-2 LUNCH

START OF PARALLEL SESSIONS*Session B***Ground Floor Lecture Theatre**

- 9.00 **Mirjana Bozic***, **William Marslen-Wilson**, **Billi Randall***, and **Lorraine Tyler** (University of Cambridge and MRC Cognition and Brain Sciences Unit, Cambridge)
Morphology, form, and meaning in the decomposition of complex word-forms: An incremental masked priming study
- 9.30 **Michael Ford***, **William D Marslen-Wilson**, and **Matthew H Davis** (MRC Cognition and Brain Sciences Unit, Cambridge)
The time-course of morphemic frequency effects
- 10.00 **Andrew J Stewart and Judith Holler*** (University of Manchester)
Depth of processing influences pronoun resolution
- 10.30 **Andy Ellis**, **Joanne Brooks***, and **Michal Lavidor** (University of York and University of Hull)
Evaluating a split fovea model of visual word recognition: Effects of case alternation in the two visual fields and in the left and right halves of words presented at the fovea
- 11.00 COFFEE
- 11.30 **Eleni Orfanidou***, **Matthew H Davis**, and **William Marslen-Wilson** (MRC Cognition and Brain Sciences Unit, Cambridge)
Spoken word recognition: Lexicality and repetition priming in behavioral and fMRI studies
- 12.00 **Marc Brysbaert**, **Eva Belke***, **Antje S Meyer** and **Mandy Ghyselinck*** (University of London, University of Birmingham and Ghent University, Belgium)
Age of acquisition effects in picture naming: Evidence for a lexical-semantic competition hypothesis
- 12.30 **Laura R Shapiro*** and **Jonathan Solity*** (University of Warwick)
(Introduced by Nick Charter)
Is Dyslexia Preventable?
- 1- 2 LUNCH

*Session A***Lower Ground Floor Lecture Theatre**

- 2.00 **Anna Saggerson* and R C Honey** (Cardiff University)
Demonstrator familiarity modulates observational learning in rats:
Latent inhibition in the social domain?
- 2.30 **Rüdiger Flach*** (University College London) (Introduced by Cecilia Heyes)
Pseudo-synchronization – a tool for the investigation of agency?
- 3.00 **John H Wearden** (Manchester University)
Roberts and Church (1978) revisited: Starting, stopping, and running
an internal clock in humans
- 3.30 **Bert Reynvoet*, Wim Gevers*, and Bernie Caessens*** (University
of Leuven, Belgium, and Ghent University, Belgium) (Introduced by
Marc Brysbaert)
Unconscious primes activate motor codes through semantics
- 4.00 TEA (Room 308)

POSTER SESSION (Room 305 and third floor common room)
- 4.50 Annual General Meeting (Lower Ground Floor Theatre)
(Members only)
- 5.30 **EPS Prize Lecture – Andy Calder** (MRC Cognition and brain
Sciences Unit, Cambridge)
A framework for facial expression recognition: Better late than never
- 6.30 DRINKS RECEPTION (Old Refectory, on the main UCL campus)
- 7.30 CONFERENCE DINNER, BERTORELLI'S

*Session B***Ground Floor Lecture Theatre**

- 2.00 **Marko Nardini*** (University College London) (Introduced by Janette Atkinson)
Functional specialisation in children’s spatial memory: Do “modules” talk to each other?
- 2.30 **Dee Birtles*, Oliver Braddick, John Wattam-Bell, and Janette Atkinson** (Visual Development unit, University College London and University of Oxford)
Development of dorsal and ventral stream processing in infants: VERP responses to global motion and form
- 3.00 **Ian Apperly, Dana Samson*, Claudia Chiavarino*, and Glyn Humphreys** (University of Birmingham)
A strong test of the domain-specificity of “theory of mind” problems in brain-damaged adults: Evidence from a genuinely *false* photograph task
- 3.30 **Géry d'Ydewalle** (University of Leuven, Belgium)
Memory problems among Korsakoff patients: Not at encoding but at retrieval?
- 4.00 TEA (Room 308)

POSTER SESSION (Room 305 and third floor common room)
- 4.50 Annual General Meeting (Lower Ground Floor Theatre)
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- 5.30 **EPS Prize Lecture – Andy Calder** (MRC Cognition and brain Sciences Unit, Cambridge)
A framework for facial expression recognition: Better late than never
- 6.30 DRINKS RECEPTION (Old Refectory, on the main UCL campus)
- 7.30 CONFERENCE DINNER, BERTORELLI’S

*Session A***Lower Ground Floor Lecture Theatre**

9.30 **Louise H Phillips, Mary L Tunstall* and Shelley Channon**
(Aberdeen University and Clinical Health Psychology Dept, London)
The role of working memory (WM) in social cue decoding

Symposium: “The Social Face”
Organiser: Dr Andy Calder

10.00 **Teresa Farroni*** (University of London)
Development of the “social brain”

10.30 **Nathalie George*** (Laboratoire de Neurosciences Cognitives et
Imagerie Cerebrale, Paris)
Eye look at you: Psychological processes and brain responses related to
the processing of gaze contact

11.00 COFFEE

11.30 **Catherine Harmer*** (University of Oxford)
Monoamines and facial expression recognition

12.00 **Ruth Campbell, Cheryl Capek*, Mairead MacSweeney, and Mick
Brammer*** (University College London)
Cortical correlates of categorising speech from faces

12.30 **Ian Penton Voak*** (University of Stirling)
Personality dimensions in the social face

END OF PARALLEL SESSIONS

End of Meeting

Session B

Ground Floor Lecture Theatre

- 9.30 **Petroc Sumner, Parashkev Nachev*, Nina Vora*, and Christopher Kennard***
(Faculty of Medicine, Imperial College London)
Distinct cortical and collicular contributions to inhibition of return revealed using S cone stimuli
- 10.00 **Ellen Poliakoff*, Rachel Coward*, Christine Lowe, and Don O’Boyle*** (University of Manchester)
Inhibition of return and ageing: The role of non-ocular response inhibition?
- 10.30 **Sarah Brand* and Nilli Lavie** (University College London)
Effects of task switching on distractor interference
- 11.00 COFFEE
- 11.30 **M Jane Riddoch and Glyn W Humphreys** (University of Birmingham)
I can see what you’re doing: Action familiarity and affordance promote recovery from extinction
- 12.00 **Glyn W Humphreys, Nele Demeyere * and M Jane Riddoch**
(University of Birmingham, University of Leuven and University of Birmingham)
Separate modes of attention in simultanagnosia: Evidence from visual enumeration
- 12.30 **Geoffrey Underwood** (University of Nottingham)
Cognitive override of visual saliency: Eye movements and attention while inspecting natural scenes

END OF PARALLEL SESSIONS

End of Meeting

POSTERS (Abstracts see Pages 32-50)**Thursday 6 January – 4pm****Room 305 Third Floor Seminar Room and Third Floor Common Room**

1 Gerry Altmann, Anne Pier Salverda* and Silvia Gennari* (University of York and University of Wisconsin, Madison)

Competing event-based interpretations mediate anticipatory eye movements in visual world studies

2 Bahman Baluch and Maryam Danaye Toosi* (Middlesex University and Research Institute of Curriculum and Educational Innovations-Tehran-Iran)
Developmental dyslexia as a function of opacity and transparency of a word's spelling: Evidence from Persian

3 Luc Boutsen*, Glyn W Humphreys, and Peter Praamstra* (Aston University, Birmingham, Behavioural Brain Sciences Centre, University of Birmingham, and Queen Elizabeth Hospital, Birmingham)

Neural correlates of configural processing of faces and objects: An ERP study of the Thatcher illusion

4 Nino Bregadze* and Aureliu Lavric* (University of Exeter) (Introduced by Stephen Monsell)

ERP effects with vs. without concurrent fMRI: A validation

5 Suparna Choudhury*, Sarah-Jayne Blakemore*, and Tony Charman* (Behavioural & Brain Sciences Unit, Institute of Child Health, University College London and Institute of Cognitive Neuroscience, University College London) (Introduced by Sophie Scott)

Development of perspective taking during adolescence

6 Richard Cowan and Chris Frith (Institute of Education, University of London and Institute of Neurology, University College London)

The neural basis of calendrical calculation

7 M Belen Lopez Cutrin*, Sotaro Kita*, and Gabriella Vigliocco* (University College London and University of Bristol) (Introduced by Alan Johnston)

Which gestures occur during tip-of-the-tongue?

8 Eddy J Davelaar* and Marius Usher* (Birkbeck, University of London) (Introduced by Vernon H Gregg)

Do the conceptual and operation span tasks tap into the same or different resource(s)?

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- 9 Colin J Davis*, Jeffrey S Bowers, and Derek A Hanley*** (University of Bristol and Macquarie University, Sydney, Australia)
Interfering neighbours: The impact of novel word learning on the identification of orthographically similar words
- 10 F de Vignemont*, H H Ehrsson*, and P Haggard** (University College, London) Bodily illusions modulate tactile perception
- 11 Nicolas Dumay* and M Gareth Gaskell** (University of York)
Sleep and the acquisition of words: Evidence from direct and indirect measures
- 12 I Dumontheil*, S J Gilbert*, J S Simons*, C D Frith, and P W Burgess*** (Institute of Cognitive Neuroscience, University College London and Institute of Neurology, University College London)
Prefrontal brain regions involved in processing internal vs. perceptual information
- 13 Frank Eisner* and James M McQueen** (Institute of Cognitive Neuroscience, London and Max Planck Institute for Psycholinguistics, Nijmegen)
Talker-specific perceptual learning in response to idiosyncratic speech production
- 14 Alberto Gallace* and Charles Spence** (Oxford University and Universita' degli Studi di Milano Bicocca, Milano, Italy)
Visual capture of apparent limb position influences tactile temporal order judgments
- 15 Camilla Gilmore* and Peter Bryant** (University of Oxford)
Problem effects on children's use of the inverse relationship between addition and subtraction
- 16 Valérie Goffaux* and Bruno Rossion*** (Face categorization Lab, Université Catholique de Louvain, Belgique) (Introduced by Jules Davidoff)
Faces are "spatial"- Holistic perception of faces is subtended by low-spatial frequencies
- 17 Julie Goldstein*, Joel Fagot*, Jules Davidoff, and Alan Pickering*** (Goldsmiths University of London and Marseilles, CNRS-INCM France)
Monkeys and humans categorise colours differently
- 18 Antonia Hamilton*, Daniel Wolpert*, Uta Frith, and Scott Grafton*** (Institute of Cognitive Neuroscience, University College London, Sobell Department, Institute of Neurology, University College London and Department of Psychological and Brain Sciences, Dartmouth College, NH, USA)
Where does action influence perception in the brain?
- 19 Stephen Hamilton*, Robert Davies*, Robyn Holliday, Kate Lester*, Jane Oakhill, and Brendan Weekes** (University of Sussex, University College London, and University of Kent)
False memory effects among children with reading difficulties

20 Deirdre Hawkins* and Eddy J Davelaar* (Birkbeck, University of London)
(Introduced by Vernon H Gregg)

A closer look at presentation rate effects in free recall

21 Corentin Jacques* and Bruno Rossion* (Unité de Neurosciences Cognitives et
Laboratoire de Neurophysiologie and Université Catholique de Louvain, Belgium)
(Introduced by Jules Davidoff)

Concurrent processing reveals competition between visual representations of faces

22 Luke Jones* and Marco Bertamini (University of Liverpool)

Reflections and the world: Information about size and distance from reflections

23 Carolyn McGettigan*, Matthew H Davis, Ingrid S Johnsrude*, and Karen Taylor* (Institute of Cognitive Neuroscience, University College London, MRC Cognition and Brain Sciences, Cambridge, and Queen's University, Kingston, Ontario, Canada)

Lexical information drives perceptual learning of distorted speech: Evidence from the comprehension of noise-vocoded sentences

24 A S Meyer, E Belke*, G Humphreys, and S Hoque* (University of Birmingham and Aston University)

Effects of semantic and lexical knowledge on the deployment of visual attention

25 Caroline Michel*, Roberto Caldara*, Jaehyun Han*, Chan-Sup Chung*, and Bruno Rossion* (Université catholique de Louvain, Belgium, Yonsei University, Seoul, Korea and University of Glasgow) (Introduced by Jules Davidoff)

Is holistic perception of faces specific to our own-race?

26 Vicky Nanousi*, Jackie Masterson, Judit Druks*, and Martin Atkinson* (University of Essex, Department of Human Communication Sciences, University College London, and Department of Linguistics, University of Essex)

'Interpretable vs. uninterpretable features: Evidence from six Greek-speaking agrammatic patients'

27 Richard Plant*, Garry Turner*, and Nick Hammond* (University of York)
(Introduced by Gareth Gaskell)

In the nick of time

28 Disa Sauter*, Andy Calder, and Sophie Scott (University College, London, and MRC Cognition and Brain Sciences Unit, Cambridge)

An investigation of vocal expressions of emotion - are there different kinds of 'happiness'?

29 Christine Schiltz*, Bettina Sorger*, Fatima Ahmed*, Roberto Caldara*, Eugene Mayer*, Rainer Goebel*, and Bruno Rossion* (University of Louvain, Belgium, Maastricht University, The Netherlands, University of Glasgow and University Hospital Geneva, Switzerland) (Introduced by Jules Davidoff)

Anomalous response to facial identity in the right middle fusiform gyrus underlies impaired face identification in acquired prosopagnosia

30 Matt Twyman*, Nigel Harvey, and Clare Harries (University College London)

Using and assessing advice about risk

31 Sarah White*, Elisabeth Hill, Joel Winston*, John O'Doherty*, and Uta Frith (Institute of Cognitive Neuroscience, University College London, Goldsmith College London, and Wellcome Department of Imaging Neuroscience, University College London)

Social judgements from faces in autism

32 Andrew T Woods* and Fiona N Newell (Trinity College, Dublin 2, Ireland)

Spatial factors involved in the multisensory integration of objects

Effector-dependent learning by observation of a finger movement sequence

Geoffrey Bird and Cecilia Heyes
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Neurophysiological and behavioural evidence of motor activation during action observation raises the possibility that observational learning can be effector-dependent. In three experiments testing this hypothesis, observers watched a model responding to a six-item unique sequence in a serial reaction time (RT) task. Their sequence knowledge was then compared with that of controls who had performed an unrelated task or observed responding to random targets. Observational learning was indicated when the introduction of a new sequence was associated with more RT elevation in observers than in controls. We found evidence of observational learning only when observers used the finger movement sequence observed during training; not when they responded at the same sequence of locations using different digits. Free generation and recognition tests also detected observational learning. Consistent with the associative sequence learning model of imitation, these results imply that observation learning can be both explicit and effector-dependent.

Symposium: Mechanisms of Imitation
Organiser: Cecilia Heyes

Learning to solve the correspondence problem

Cecilia Heyes
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The recent development of behavioural techniques for the investigation of imitation in healthy adults, and the discovery of neurological ‘mirror’ systems, has fuelled rapid progress in research on mechanisms of imitation. Combining these approaches with more traditional neuropsychological and comparative work on imitation, this symposium addresses several key questions: How is visual input from observed movement translated into matching motor output? What are the phylogenetic / development origins of the mechanisms that solve this ‘correspondence problem’? How do (conditionally) automatic and strategic processes of imitation interact? How do we stop ourselves from imitating? Having introduced these questions, the first paper in the symposium will outline the associative sequence learning model of imitation (Heyes 2001), and present evidence supporting its claim that imitation mechanisms are developmental in origin. These studies suggest that imitative learning of complex movements can be effector-dependent, and that the spontaneous tendency to imitative simple movements can be modified by experience.

Heyes, C. M. (2001) Causes and consequences of imitation. *Trends in Cognitive Sciences*. 5. 253-261

Neural circuits underlying imitation of novel and practised hand actions

Stefan Vogt
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Until recently, brain imaging studies on the human mirror neuron system used rather simple action stimuli that are unlikely to confront the observer / imitator with the complexity encountered during imitation-based learning. Are the neural circuits underlying such ‘true imitation’ identical with those involved in simple imitative acts? We studied the delayed imitation of guitar chords using an event-related fMRI paradigm (Buccino et al., 2004). Musically naïve participants were scanned during (1) model observation, (2) motor preparation, and (3) imitative execution. Throughout these three phases, we found activations in the same parieto-premotor circuit (MNS) that is involved in pure action observation. Results also indicate that the MNS can not only be activated exogenously (by a visual or auditory model), but also endogenously, in the absence of a model display. During motor preparation in order to imitate, we also found the middle prefrontal cortex (area 46) strongly activated, possibly re-combining the motor elements into a complete finger configuration. This interpretation of area 46 as an ‘orchestrator’ of the MNS is currently being studied further in an fMRI experiment on practise effects in the guitar task, and results of both studies will be presented.

Buccino, G., Vogt, S., Ritzl, A., Fink, G. R., Zilles, K., Freund, H.-J., & Rizzolatti, G. (2004). Neural circuits underlying imitation learning of hand actions: an event-related fMRI study. *Neuron*, 42, 323-334.

Strategic control of multiple routes in imitation of actions in healthy and in brain-damaged individuals

Raffaella Rumiati
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The aim of the two studies I will discuss was to bring to the surface the strategic use of imitative processes in the context of a two-route model (Rumiati & Tessari, 2002): direct imitation, employed in reproducing new, meaningless actions, and imitation based on stored semantic knowledge of known, meaningful actions. In the first study (Tessari & Rumiati, in press), healthy participants reproduced meaningful (MF) and meaningless (ML) actions within an established time limit. Three factors were found to affect selection of imitation strategies: composition of the experimental list (blocked or mixed presentation), the presence / absence of instructions relating to list composition, and the relative proportions of MF and ML stimuli. These findings were corroborated by a second study (Rumiati, Tessari, and Zadini, in preparation) involving unilateral left- and right- brain damaged patients. When presentation of MF and ML is blocked, healthy participants under time pressure and brain-damaged patients with a limited cognitive resource system use the semantic route to imitate MF actions and the direct route to

imitate ML actions. However, when MF and ML actions are mixed, all participants tend to select the direct route because it allows the reproduction of both types of actions.

Rumiati, R.I., & Tessari, A. (2002) Imitation of novel and well-known actions: The role of short-term memory. *Experimental Brain Research*, 142, 425-433.

Facial reactions to facial expressions: Automatically and unconsciously evoked mimicking responses?

Ulf Dimberg
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The results from a long running research project will be summarised showing that distinct facial reactions can be rapidly and automatically evoked when people are exposed to facial expressions of emotion. In a number of studies subjects were exposed to pictures of angry and happy facial expressions while their electromyographic (EMG) responses were detected from different emotion relevant facial muscles. More specifically, the activity from the *Corrugator supercilii* muscle (wrinkle the eyebrows) and the *Zygomatic major* muscle (elevates the cheek to a smile) were detected. It was found that angry stimuli spontaneously evoked increased Corrugator activity whereas happy faces evoked increased Zygomatic activity. A second series of studies showed that these response patterns can be detectable after only 400-500 ms. Particularly, data from an experiment are presented in which the backward masking technique was used to unconsciously expose subjects to angry and happy facial stimuli. This experiment showed that, in spite of the fact that the subjects were unconsciously exposed to the different stimuli, they still reacted with distinct facial reactions that mirrored the facial stimuli. These data support the proposition that automatic and unconscious processes may play an important role in the imitation of facial expression of emotion.

Imitative learning in pigeons

Anna Saggerson and Rob Honey
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We used a novel automated procedure to study imitative learning in pigeons. In Experiments 1 and 2, observer pigeons witnessed a demonstrator pigeon successfully performing an instrumental discrimination in which different visual stimuli indicated which of two responses (pecking or stepping) resulted in the delivery of seed. The observers were then presented with the visual stimuli and were given access to the response panel. Observer pigeons' behaviour during the stimuli was influenced by how the demonstrator had responded during these stimuli. In Experiment 3, observers witnessed demonstrator pigeons performing one response (pecking) for one outcome (red seed) and another response (stepping) for a different outcome (green seed). Observers

then received a procedure designed to devalue one of the outcomes (red seed) relative to the other outcome (green seed). Subsequently pigeons were less likely to perform the response that they had observed paired with the devalued outcome (pecking in the example above) than the response that they had observed paired with the more valued outcome (stepping in the example above). The results of Experiments 1 and 2 indicate that pigeons can learn stimulus-response associations by observation and those of Experiment 3 suggest that they can also learn response-outcome associations by observation.

Why don't we imitate all the time?

Marcel Brass, Jan Derrfuss, and DYves von Cramon
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There is converging evidence from different fields of neuroscience that the mere observation of an action leads to a tendency to imitate that action. It was assumed that such tendencies are based on a direct matching of the observed action onto an internal motor representation. But if this assumption holds true, the question arises, how we are able to inhibit imitative response tendencies? We have investigated this question in a series of neuropsychological and brain imaging studies. The neuropsychological study indicated that prefrontal patients have problems to suppress imitative response tendencies. Furthermore, it showed that the inhibition of imitative and non-imitative prepotent responses involves different neuronal mechanisms. Our neuroimaging data supported this finding. The inhibition of imitative responses was found to be related to activation in the anterior fronto-median cortex and the temporo-parietal junction. These cortical areas are known to be involved in perspective taking and determining self-agency. Taken together, our findings suggest that the inhibition of imitative response tendencies involves cortical and functional mechanisms which enable us to distinguish between internally generated and externally triggered motor representations.

End of Symposium

Morphology, form, and meaning in the decomposition of complex word-forms: An incremental masked priming study

Mirjana Bozic¹, William Marslen-Wilson², Billi Randall¹, and Lorraine Tyler¹
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2. MRC Cognition and Brain Sciences Unit, Cambridge
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We investigated the role of morphological, semantic, and form-based factors at early stages of visual word recognition. In an incremental masked priming study, stimulus pairs co-varying in morphological, semantic, and orthographic relatedness were presented

interact with effects of morphological decomposability. Only morphological effects consistently came through at all SOAs. Equivalent priming at each SOA was observed for potentially morphologically related pairs, independent of whether they were semantically transparent (*bravely-brave*), semi-transparent (*barely-bare*), or opaque (*archer-arch*). These effects are interpreted as evidence for obligatory morphological decomposition at an early stage of the visual word recognition process, and not as reflecting the properties of central lexical representations.

The time-course of morphemic frequency effects

Michael Ford, William D Marslen-Wilson, and Matthew H Davis
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Morphemic frequency effects in visual lexical decision are taken as evidence that words are processed and represented in terms of morphemes, while surface frequency effects are seen as evidence that words are stored as whole forms. However, the pattern of results is mixed, with evidence in support of both approaches. This may reflect an over-reliance on factorial designs to address these questions. We report two lexical decision experiments that use a regression design to address the issue of morphemic frequency effects in singular nouns. In Experiment 1, surface frequency was a better predictor of response times than lemma frequency. Family size, cumulative morpheme frequency, and a semantic measure based on Latent Semantic Analysis were also significant predictors. Generally, the results show that response times are simultaneously predicted by multiple frequency counts. In Experiment 2, the time course of morphemic frequency effects was addressed by using lexical decision with a speeded response deadline. Lemma frequency was now found to be a better predictor of response times than word-form frequency. The two experiments together challenge models of language where the effects of frequency counts are viewed as categorical, with a word showing effects either of one but not the other count.

Depth of processing influences pronoun resolution

Andrew J Stewart and Judith Holler
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The unrestricted race model (van Gompel, Pickering & Traxler, 2001) accounts for effects in syntactic ambiguity resolution whereby the ambiguous version of a sentence is read more quickly than unambiguous versions. We report two reading time experiments examining pronoun resolution and show that a similar effect emerges under conditions where readers engage in ‘shallow’ processing. We also show that, when forced to engage in ‘deep’ processing, the unrestricted race model has problems accounting for our data and that some form of constraint based system is needed. The ambiguous and unambiguous versions of our sentences were read

at an equivalent speed under 'shallow'; processing conditions but the ambiguous versions more slowly under 'deep'; processing conditions. The same pattern emerges in the question reaction time data. We propose that task demands allow readers to strategically deploy processing mechanisms (cf. Ferreira, Bailey & Ferraro, 2002).

Ferreira, F., Bailey, K.G.D., & Ferraro, V. (2002). Good-enough representations in language comprehension. *Current Directions in Psychological Science*, 11, 11-15.

Van Gompel, R.P.G., Pickering, M.J., & Traxler, M.J. (2001). Reanalysis in Sentence Processing: Evidence against Current Constraint-Based and Two-Stage Models. *Journal of Memory and Language*, 45, 225-258.

Evaluating a split fovea model of visual word recognition: Effects of case alternation in the two visual fields and in the left and right halves of words presented at the fovea

Andy Ellis¹, Joanne Brooks¹, and Michal Lavidor²

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Two experiments are reported exploring the effect of cAsE aLtErNaTiOn on lexical decisions to words and nonwords presented laterally or centrally. In line with previous research, Experiment 1 found that case alternation slowed lexical decision responses to words more in the right visual field (RVF) than in the left visual field (LVF). In Experiment 2, the words and nonwords were all presented centrally. There were three conditions, a condition in which the word and nonwords were presented in lower case letters, a condition in which the letters to the left of the central fixation were case alternated (e.g., aMbItion, mOdLants) and a condition in which the letters to the right of fixation were case alternated (e.g., collApSe, pireNtOl). Alternating the case of letters to the right of fixation slowed lexical decision responses more than alternating letter case to the left of fixation. The results provide further support for a split fovea account of visual word recognition according to which those letters of a centrally-fixated word that fall to the left of fixation are processed initially by the right cerebral hemisphere while those letters that fall to the right of fixation are processed initially by the left cerebral hemisphere, with the characteristics of the left and right hemispheres being revealed in the processing of initial and final letters in centrally presented words.

Spoken word recognition: Lexicality and repetition priming in behavioral and fMRI studies

Eleni Orfanidou, Matthew H Davis, and William Marslen-Wilson
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Representations and processes in spoken word-recognition were probed using delayed repetition priming in separate behavioural and fMRI studies. Participants made lexical decisions to 120 words and 120 pseudowords spoken by a male or female voice. Each item was presented twice, separated by ~12 intervening items (50% fillers). Half of the repetitions were spoken in a different voice to the first presentation to test for effects of episodic details. Behavioural priming was observed for both words and pseudowords, consistent with an episodic account of priming, though priming effects were unaffected by voice changes, consistent with more abstract representations being involved. The fMRI data revealed an elevated response to words compared to pseudowords in several temporal lobe regions associated with word recognition. Reduced activation for second presentations (priming) was observed in left posterior inferior temporal regions and in bilateral frontal regions (inferior frontal gyrus, anterior cingulate). Increased responses to second presentations (repetition enhancement) were observed in frontal and parietal regions associated with episodic memory retrieval. No effect of voice change was observed. A correlational analysis showed that behavioural priming was correlated with repetition suppression in frontal regions. This may point to a significant response learning component in these repetition priming effects. Implications for episodic and abstractionist accounts of lexical representation and priming will be discussed.

Age of acquisition effects in picture naming: Evidence for a lexical-semantic competition hypothesis

Marc Brysbaert¹, Eva Belke², Antje S Meyer² and Mandy Ghyselinck³

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A review of the literature indicates that in most tasks, the effects of frequency and age of acquisition (AoA) on reaction latencies are of approximately the same size. However, in picture naming the AoA effect is significantly larger than what can be expected on the basis of the frequency effect. Previous explanations of the frequency-independent AoA effect have attributed it to the organization of the semantic system or to the way in which phonological word forms are stored. In a series of three experiments, we show that a homogeneous semantic context slows naming latencies more for late acquired than for early acquired words. This interaction between AoA and semantic context is likely to arise at the lemma level during lexical-semantic encoding. We discuss implications of our findings for computational implementations of picture naming processes.

Is Dyslexia preventable?

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We argue that improving instruction for all children can lead to a dramatic reduction in the incidence of reading difficulty. The Early Reading Research (ERR) intervention was developed using principles derived from instructional psychology and rational analysis. The ERR intervention was delivered to whole classes of children by their normal school teachers, and required no additional time or resources. The progress of the ERR group and a comparison group was monitored for the first 3 years of school. From the end of Reception onwards, the ERR children had significantly higher reading and comprehension ages than comparison children. This advantage was maintained a year after removing the ERR intervention. ERR children at all ability levels improved relative to the comparison children. By the end of the intervention, only 2% of the ERR children were classified as lower achieving readers, in contrast to 25% of comparison children. This research suggests that most cases of dyslexia could have been prevented by the use of better teaching methods for all children.

Demonstrator familiarity modulates observational learning in rats: Latent inhibition in the social domain?

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In two experiments observer rats were placed in a chamber from which they could watch a demonstrator rat performing an instrumental discrimination: The demonstrator might be pulling one chain during one auditory stimulus and a different chain during a second auditory stimulus. The demonstrator was either the same strain as the observer (and the observer's cage mate) or a different strain to the observer (and the observer's cage mate) and we assumed that the demonstrator would be more familiar to observers in the former than the latter condition. During testing, observer rats were placed in the operant chamber and their tendency to show behavior consistent with the demonstrator during the two auditory stimuli was assessed. In both experiments observers who witnessed a different-strain demonstrator were more likely to respond in a demonstrator-consistent manner than those who witnessed a same-strain demonstrator. These results indicate that instrumental discriminations can be acquired by observation and suggest that demonstrator familiarity modulates this process of observational learning. The effect of demonstrator familiarity is akin to one that is commonplace outside the social learning domain where exposure to a stimulus retards later learning about that stimulus – an effect known as latent inhibition.

Pseudo-synchronization – a tool for the investigation of agency?

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The present study addressed the interplay between agency – i.e., the knowledge that one is or is not generating a sensory event oneself – and the use of feedback in temporal motor control. For this purpose, a (pseudo-)synchronization tapping task was employed, in which the auditory pacing signal was replaced, without informing the participants, by an auditory feedback signal. This temporal control change led to an abrupt increase in response frequency. In a second experiment, participants were instructed about a temporal control change, which would be indicated by a change in pitch. The actual temporal control change occurred either before or after this signal. In either case, response frequency increased. In contrast, the expected temporal control change gave way to a temporary decrease in response frequency. This result suggests that the synchronization instruction is not crucial for the use of auditory feedback in temporal motor control, as long as participants do not know for sure whether or not they are generating the tones themselves.

Roberts and Church (1978) revisited: Starting, stopping, and running an internal clock in humans

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In 1978, Roberts and Church produced evidence that rats possessed a “stopwatch-like” internal clock. That is, the clock could be started and stopped “at will” and times measured from different timing episodes could be accumulated together more or less veridically. This paper presents three experiments investigating internal clock control in humans. In the first, a temporal generalization technique was used. A continuous tone (900 ms long) served as a standard, and people had to judge whether other auditory stimuli had the same duration as the standard. Some of these auditory stimuli were tones without gaps, but in other cases the tones had a 200-ms gap located in a random position within them. In different conditions, people had to “exclude” the gap, and in other cases “include” it, and performance was compared with that from the no-gap trials. There were no significant gap/no-gap differences in the “exclude” condition, but differences were found when the gap had to be included. A second experiment with random-length gaps replicated this result. The data could be explained by supposing (a) that people could start and stop their internal clock with little “loss of time” but (b) that the clock ran more slowly during the gap, so affecting judgements if the gap was “included”. These suggestions were tested in a third experiment where a verbal estimation technique was used. Gaps of different duration (75, 150, and 300 ms) were included or excluded, and resulting verbal estimates compared with those from no-gap trials. When the gap was “excluded” gap duration made no difference to estimates (although about 50-100 ms of “accumulated time” was lost by the presumed start/stop processes), whereas increasing gap duration systematically shortened duration estimates in the “include” conditions. The results suggest that humans have very precise control over starting and stopping their internal clock (although the control is not perfect), but cannot control the “speed” of the internal clock, which differs between gaps and tones.

Unconscious primes activate motor codes through semanticsBert Reynvoet¹, Wim Gevers², and Bernie Caessens²

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Today, it is generally accepted that unconscious stimuli can activate a response code, leading to a response congruency effect (RCE) on a subsequent target. However, it is not yet clear whether this is due to the semantic processing of the primes or to the formation of direct stimulus-response associations bypassing the semantic system. Recently, the semantic hypothesis was confirmed by showing that novel stimuli, not part of the target set, evoke an RCE. However, the fact that these studies were limited to numerical stimuli and not free of confounds between meaning and congruency, poses problems for the generalization of this hypothesis. In Experiment 1, novel letters or digits preceded another letter or digit that needed to be categorized as coming before or after a reference stimulus. A RCE was found within letters and digits but was also present between classes of stimuli (e.g. prime is a letter, target a digit). Experiment 2 and 3 indicated that the locus of the RCE was at a late, effector-specific response level, because it was still present when letters and digits needed to be classified into different semantic categories, but absent when a different response modality was used for both stimulus classes. In sum, these experiments provide strong additional support for the semantic processing hypothesis.

EPS Prize LectureA framework for facial expression recognition: Better late than never

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Twenty years ago, Bruce and Young (1986) presented a model of face recognition that posited separate functional routes for facial identity and facial expression recognition. Due to limited data available at the time, Bruce and Young (1986) were necessarily speculative in some areas where very little information was known. One area concerned the processing of facial expressions and its relation to facial identity. In recent years research in this area has increased significantly and we are now in a considerably better position to address this. I will discuss a potential framework for facial expression recognition based on research from a number of different sources, including image-based analysis of facial images (PCA), cognitive studies of healthy participants, cognitive neuropsychology, and functional imaging.

Bruce, V., & Young, A. W. (1986). Understanding face recognition. *British Journal of Psychology*, 77, 305-327.

Functional specialisation in children's spatial memory: Do "modules" talk to each other?

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According to current models, spatial memory and navigation depend on parietal and medial temporal networks specialised for representing different kinds of information, although the development of these is not well understood. In a spatial orientation task, children aged 18-24 months searched for objects hidden in locations defined by conjunctions of visual properties. These properties were spatial (geometry) and non-spatial (colour/pattern), associated with "dorsal" and "ventral" visual stream processing respectively. Young children showed an inability to search by integrating information from these two cortical streams. In a second task varying the availability of egocentric and allocentric cues, typically developing children (3-6 years) and individuals with Williams Syndrome (WS) searched for hidden objects. In typical development, performance was consistent with parallel use of these two sets of cues. In contrast, in WS information from these was less efficiently combined. Both studies provide evidence for early functional specialisations in spatial representation, but suggest that errors often result from the poor integration of different representations, *e.g.* across "dorsal" and "ventral" streams, and across networks for egocentric and allocentric representation. Visuospatial deficits in WS may result in part from a persistent processing anomaly in these integrative processes.

Development of dorsal and ventral stream processing in infants: VERP responses to global motion and form

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Visual processing of motion and static form are functions of dorsal and ventral cortical streams respectively. Differential development, and specific vulnerability of the dorsal stream in neurodevelopmental disorders (*e.g.* Williams syndrome, autism), have been demonstrated in middle childhood. (Atkinson et al, 1997; Gunn et al, 2002; Braddick et al, 2003). What is their relative developmental course in infancy? (Braddick, 2004). We have found that visual event-related potentials (VERP) are elicited earlier in infancy by orientation changes than by motion direction. (Braddick, 2003; Atkinson et al, 2003). However, these responses could arise from purely local processing. Global processing, including pattern integration and figure segmentation, is characteristic of extra-striate levels of the two streams. Here we examined VERPs in infants (8-16 weeks) and adults, evoked by global form and motion. A circular region of coherently organized

elements was surrounded by random elements. For global form coherence short arcs were concentrically arranged; for motion coherence dots moved through similar concentric arcs. Such patterns alternated at 1 Hz with patterns of randomly arranged elements. A 1 Hz VERP signal (F1) is a specific response to global organization, while a 2Hz signal (F2) may arise from local pattern changes. Infants in show a larger F1 for motion than form; this ratio declines with age and averages about 1 in adults. The ratio shows the opposite behaviour for F2, so the motion advantage is specific to global processing. This suggests that global form processing matures more slowly than motion, even though local processing develops earlier for form. This will be discussed in relation to infants' perceptual organization, and developmental vulnerability of the two streams.

Atkinson J et al, *NeuroReport*, 8: 1919 (1997); Gunn et al *NeuroReport*,13: 843 (2002); Braddick et al, *Neuropsychologia*, 13: 1769 (2003)

Braddick, EPS Oxford, April 2004

Braddick in K. Simons (Ed.), *Early visual development: Normal and abnormal*. OUP (1993); Atkinson et al, *Invest. Ophthalmol. Vis. Sci.* 43: E-Abstract 3992 (2003).

A strong test of the domain-specificity of “theory of mind” problems in brain-damaged adults: Evidence from a genuinely *false* photograph task

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In earlier work we investigated the ability of 12 brain damaged patients to reason about false beliefs using a false belief task with reduced processing demands and separate trials to control for remaining incidental demands on working memory and inhibitory control (Apperly et al, in press; Samson et al, 2004). Five patients passed false belief and control trials, four patients made errors on all trials, and three patients made errors *only* on false belief trials. It appears that these latter patients have a relatively specific difficulty with belief reasoning, but how specific? If these patients' problem is with some mechanism devoted to the task of reasoning about beliefs then they should not have difficulty on closely matched tasks with no belief reasoning. If these patients' problem is broader in scope, then the kind of tasks to which it extends may give us insights into the more general processes necessary for reasoning about beliefs. “False” photograph tasks have been used in previous research as a closely matched comparison task for false belief reasoning. However, the validity of this comparison has been called into question on practical and conceptual grounds (principally because the photographs were not actually *false*). We describe a novel, genuinely false photograph task, which overcomes these problems. Data from 11 of the original 12 patients show that all patients performed either consistently above chance on both false belief and false photograph tasks, or not above chance on either task. We discuss the implications of these findings for accounts of the functional and anatomical basis of “theory of mind”.

Apperly, I.A., Samson, D., Chiavarino, C. & Humphreys, G.W. (Under submission). Frontal and temporo-parietal lobe contribution to Theory of Mind: Neuropsychological evidence from a false belief task with reduced language and executive demands. *Journal of Cognitive Neuroscience*.

Samson, D., Apperly, I.A., Chiavarino, C. & Humphreys, G.W. (2004) The left temporo-parietal junction is necessary for representing someone else's belief. *Nature Neuroscience*, 7(5) 449-500.

Memory problems among Korsakoff patients: Not at encoding but at retrieval?

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It is still an open question whether the memory problems of Korsakoffs reflect encoding and/or retrieval deficits. At study, subjects generated an associate of the target word or counted enclosed spaces of the letters in the target words. At test, 3-letter stems were presented, corresponding to the target words. One group was instructed to use these stems as cues to retrieve the targets (direct test); another group was instructed to complete the stems with the first word that came to mind but to use another word if the first word was a target word (opposition test). In four experiments, Korsakoffs did not show an encoding deficit; however, despite the opposing instructions, they completed the stems with the target words almost at the level of control subjects with the direct (intentional) test. Korsakoffs do not show encoding problems. Retrieval is also not really a problem for them, provided they don't have to search intentionally (consciously).

The role of working memory (WM) in social cue decoding

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It has been argued that performance on social processing tasks such as facial emotion recognition or understanding interpersonal relationships depends on working memory resources. There is evidence that some clinical groups show deficits in both social processing and working memory tasks. However, it has also been suggested that social cue decoding and non-social working memory tasks may depend on different processing mechanisms located in separable brain regions. Relatively few studies have investigated the cognitive components of social cue decoding. We assessed the role of working memory in facial emotion processing (Experiment 1) and interpersonal perception (Experiment 2) using dual task methodology. Commonly used clinical tests of social cue decoding were carried out simultaneously with auditory *n*-back tasks

increasing in load. The results showed a substantial effect of the dual task on emotion recognition, regardless of intensity or type of emotion. Dual task effects on the

interpersonal perception tasks were more equivocal. These findings suggest that at least some tasks of social cue decoding may depend on working memory resources.

Symposium: “The Social Face”
Organiser Andy Calder

Development of the "social brain"

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The perception of faces, and the understanding that faces can reflect internal states of social partners, are vital skills for the typical development of humans. Of particular importance is processing information about eyes, and eye gaze direction. In adults the perception of averted gaze elicits an automatic shift of attention in the same direction, allowing the establishment of "joint attention". Mutual gaze provides the main mode of establishing a communicative context between face-to-face humans. The importance of eye-gaze perception has generated much controversy as to its developmental and neural basis. In fact, the major debate in social cognitive neuroscience concerns the origins of the "social brain" in humans, and theoretical arguments about the extent to which this is acquired through experience are raging. Here we will review evidence from recent neurophysiological and behavioural studies with both adult and infants on the processing of direct and averted gaze. Our results suggest that mechanisms underlying the use of averted gaze for shifting attention are present from early in life, but that those may differ between infants and adults. With regard to direct gaze, recent studies show that even newborns prefer to look at faces that engage their mutual gaze. Further, our electrophysiological evidence shows that at least from 4 months of age faces with direct gaze show enhanced processing as compared to those with averted gaze. We conclude by speculating on mechanisms that underlie those early abilities, and suggest they provide the foundation for later more complex social cognition.

Eye look at you: Psychological processes and brain responses related to the processing of gaze contact

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Within faces, gaze is a cue of particular importance for inter-individual interactions. The direction of gaze indicates the direction of attention of others in the

surrounding space and taken together with other facial cues it allows inferences on others' intentions. Among gaze directions, direct gaze or gaze contact convey special meaning. It is a crucial cue to reciprocal social attention and constitutes a frequent preliminary to inter-individual interaction. Therefore it may trigger specific psychological and cerebral processes associated with its detection and the allocation of resources to the processing of encountered faces. In this talk, I will review behavioural and electrophysiological data showing processing asymmetry favouring direct relative to averted gaze and the influence of gaze direction on the processing of seen faces.

Monoamines and facial expression recognition

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Facial expressions of emotion convey important information for social function. There has been increasing interest in the neural basis of facial expression processing and recognition and there is support for the hypothesis that dissociable processes underlie the recognition of different emotional states. We have used this model to assess the role of serotonin and noradrenaline in emotional processing. Serotonin and noradrenaline are common targets for antidepressant drug treatments and this approach may help explore how these treatments influence emotional function and ultimately the symptoms of depression and anxiety. Results from a number of studies suggest that acute administration of a number of different antidepressant drugs increases the perception of happy facial expressions in healthy volunteers. With repeated administration of these antidepressants, volunteers also showed reduced recognition of negative facial expressions of fear and anger. These results suggest that antidepressant drugs may directly modulate the processing of social and emotional information. In particular, antidepressants may facilitate positive emotional processing and reduce the perception of threat-relevant information. These differences are consistent with reduced positive bias and increased threat-relevant processing which has been reported in both depression and anxiety. The neural correlates of this decrease in threat-relevant processing were further examined using functional magnetic resonance imaging in healthy volunteers. Consistent with reductions in fear recognition, blood oxygen level dependent (BOLD) amygdala responses to subliminal presentations of fear were reduced in healthy volunteers randomised to receive the serotonergic antidepressant citalopram (20mg/day/7days) compared to placebo. Taken together, these results suggest a modulatory role for serotonin in amygdala function and in the processing of emotionally valenced information. This approach may help integrate cognitive and pharmacological theories of depression and anxiety.

Cortical correlates of categorising speech from faces

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Some speech patterns can be identified from snapshots of faces. In this fMRI study we explored the following questions: what are the cortical correlates of (off-line) categorisation of speech from facial images? Do these differ from those for categorising facial expression? How does changing the scale of the image (head vs head and body) affect these circuits (to what extent are inferior frontal regions recruited for images of speech from the face-alone)? The answers to these questions inform us about the relationships between seeing speech and hearing it (especially in relation to its dynamic properties), and the extent to which different face readings draw on common and on unique cortical substrates.

Personality dimensions in the social face

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Faces convey a vast amount of information of importance to social primates such as humans (e.g. sex, age, identity, emotional state). People also use facial characteristics to generate personality attributions. Typically, there is a high degree of consensus in these attributions – people agree on the personality they expect a person to have on the basis of their facial characteristics - but the accuracy and basis of such judgements is relatively unexplored. We investigated personality judgements (using the ‘Big Five’ model) elicited by real faces, and composite faces constructed from individuals from the extremes of the personality dimensions (determined from both self-report or stranger ratings). Composites extract the defining characteristics of a group, whilst losing the characteristics that make each face look individual (e.g. hairstyle, facial jewellery). As such, they are a useful technique to investigate whether certain features are reliably associated with self-reported personality and/or perceived personality. I will present data from these studies addressing two questions: 1) Is there any accuracy in personality judgements made to faces alone in the absence of any other cues? 2) Are positive personality judgements (accurate or not) simply the result of halo effects of attractiveness, or are such attributions linked to specific, dissociable facial characteristics?

End of Symposium

Distinct cortical and collicular contributions to inhibition of return revealed using S cone stimuli

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Visual orienting of attention and gaze are widely considered to be mediated largely by shared neural pathways, with automatic phenomena such as the bias against returning to recently visited locations - inhibition of return (IOR) - being generated via the direct pathway from retina to superior colliculus (SC). Here we show for the first time that IOR occurs without direct access to the SC, using a new technique that employs stimuli to which the SC is blind. We found that these stimuli, visible only to short-wave-sensitive (S) cones, do elicit traditional IOR, measured using manual responses. Critically, however, we also found that S cone stimuli do not cause IOR when saccadic eye movement responses are required, indicating that saccadic IOR is not the same as traditional IOR, and is mediated via the SC. These findings provide the first direct evidence for separate cortical and collicular mechanisms of IOR, revealing a clear dissociation between visual orienting of attention and gaze.

Inhibition of return and ageing: The role of non-ocular response inhibition?

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Inhibition of return (IOR) refers to the slowing of a response to a target stimulus presented in the same location as a previous stimulus. Increased IOR has been reported in older adults, despite a reduction in other 'inhibitory' processes. However, cue-target tasks have been used in all previous studies and because of this IOR may have been overestimated due to non-ocular response inhibition associated with withholding a response from the cue. Could increased levels of response inhibition account for the observations of increased IOR in older adults? This confound can be circumvented by using a target-target paradigm, in which a response is made to all stimuli. We tested 3 groups of 24 subjects: Young (mean 22.5 years), Young-Old (mean 61.9 years) and Old-Old (mean 74.8 years). Subjects completed both visual cue-target and target-target tasks with identical inter-stimulus intervals of 1400 and 1800 ms. IOR magnitude increased with age, even when individual differences in baseline response speed were taken into account. Furthermore, for the first time, IOR magnitude was found to increase with age in the more methodologically sound target-target task. Thus, there appears to be a genuine increase in IOR magnitude with age.

Effects of task switching on distractor interference

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Lavie (2000; Lavie et al. 2004) suggested that prevention of interference by irrelevant distractors critically depends on availability of cognitive control functions (such as working memory) that actively maintain stimulus-processing priorities between target and distractors throughout task performance. In support of this hypothesis Lavie et al. (2004) and De Fockert et al. (2001) found greater interference by irrelevant distractors on selective attention tasks combined with tasks of high versus low cognitive control load. Here we hypothesized that since task switching is known to draw on cognitive control, switching should also reduce the ability to control against distractor interference. We therefore predicted that distractor interference in a letter flanker task would be greater when subjects switch between this task and a shape-based visual search task, than when the flanker task is repeatedly performed throughout a block. In addition to a robust general task switching cost (on overall RTs) we found a specific effect of greater distractor interference during task switching than non-switching blocks, as predicted. These results support the role Lavie and colleagues suggested for cognitive control in distractor rejection and clearly demonstrate that a cost to switching between two different tasks (c.f. Allport et al., 1994; Rogers & Monsell, 1995).

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I can see what you're doing: Action familiarity and affordance promote recovery from extinction

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We assessed the effects of three factors on recovery from extinction in patients with lesions of the posterior parietal lobe: (i) whether objects were frequently used together in action vs. whether they could be used in action together; (ii) whether there was an effect of positioning objects for action; and (iii) whether the surface properties of objects mediated performance. There was greater recovery from extinction for objects used frequently together, along with effects produced by objects that could be used together. There were also positive effects of correctly positioning objects for action. There were no effects of surface information. The results provide positive evidence for an effect on attention of affordances based on objects falling in plausible co-locations for action. Such affordances may also be influenced by the frequency with which objects are used together, and can be generated from edge-based representations of objects.

Separate modes of attention in simultanagnosia: Evidence from visual enumeration

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We present evidence from visual enumeration tasks indicating that at least two modes of attention can operate in simultanagnosia. We examined visual enumeration in patient GK, who has severe impairments in serially scanning attention across a scene and is unable to count the numbers of items in visual displays. However, GK's ability to judge the relative magnitude of two displays was consistently above chance. In addition, several variables had a differential impact on GK's counting and magnitude estimation. Magnitude estimation but not counting was facilitated by using elements that grouped more easily and by presenting the elements in regular configurations. In contrast counting was facilitated by placing the elements in different colours whilst magnitude estimation was disrupted. Also GK's performance on magnitude estimation tasks was disrupted by asking him to count the elements present. The data suggest that GK can process visual stimuli in either a focused or distributed attention mode. When in a focused attention mode performance is limited by poor serial scanning of attention.

Cognitive override of visual saliency: Eye movements and attention while inspecting natural scenes

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Is attention invariably commanded by visual saliency when we inspect a scene? Two experiments recorded eye movements while viewers inspected pictures of natural office scenes in which two objects of interest were placed. According to the Itti and Koch algorithm one object had lower visual saliency (a piece of fruit) relative to another that was visually complex (for example, coffee mugs and commercial packages). Two experiments modified the task while the pictures were inspected, to determine whether visual saliency is invariably dominant in determining the pattern of fixations, or whether the purpose of inspection can provide a cognitive override that renders saliency secondary. In the first experiment viewers inspected the scene in preparation for a memory task, and the more complex objects were potent in attracting early fixations, in support of a saliency map model of scene inspection. In the second experiment viewers were set the task of detecting the presence of a lower-saliency target, and the effect of the distractor was negligible, supporting a model in which the saliency map is built with cognitive influences.

Competing event-based interpretations mediate anticipatory eye movements in visual world studies

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Two experiments investigated the role of event-based representations in the interpretation of visual scenes and the mapping of spoken language onto these interpretations. In Expt. 1, visual scenes primed spoken words referring to actions in which the objects in the scene could participate, suggesting that event-based representations were encoded when viewing the scenes. Expt. 2 examined whether scene-specific event relations mediate the mapping of spoken language onto a concurrent visual scene. We constructed two versions of each scene: e.g., a businessman, a pipe, and a cigarette and either a sailor (who was more likely to smoke the pipe), or a woman (who was more likely to smoke the cigarette). The sentences 'The businessman will smoke the cigarette/pipe' accompanied these scenes; 'cigarette' with the sailor present and 'pipe' with the woman present. We found that the likelihood that participants initiated an eye movement to the pipe versus the cigarette during the verb ('smoke') was influenced by the identity of the sailor/woman. This suggests that participants had established an event-based representation involving this other agent, even though he/she was not mentioned in the sentence. We argue that event-based representations underpin both visual and linguistic representations, as well as the mapping between the two.

Developmental dyslexia as a function of opaqueness and transparency of a word's spelling: Evidence from Persian

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Persian language with its unique orthography enables one to examine cognitive processes of reading incorporating extremes of opaque and transparent spellings within one writing system (see Baluch, in press). Twenty-nine Persian children 22 male and 7 female classified as being developmentally dyslexic (mean age 9.4, Sd = 1.4) with no known congenital or neurological deficits were compared with 49 normal male children (mean age 9, Sd = 1.3) on the following test: oral naming, spelling, short-term memory (auditory and verbal) and phonological awareness. The analysis of the results using a 2 Participant (normal-Dyslexic) by 2 Spelling (opaque-transparent) mixed ANOVA showed an expected main effect between normal and dyslexics on almost all of the above tasks. However, performance of both groups of participants showed greater impairments when the words spelling was opaque as opposed to transparent spellings. The implications of the findings for developmental models of reading are discussed.

Baluch, B. (in press) Persian Orthography and Literacy. In R. M. Joshi and P. G. Aaron. *Handbook of Orthographies and Literacy*. Lawrence Erlbaum Associates.

Neural correlates of configural processing of faces and objects: An ERP study of the Thatcher illusion

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In the Thatcher illusion, a face with the eyes and mouth inverted looks abnormal when viewed upright but not when viewed inverted. Behavioural studies have shown that “thatcherisation” of an upright face disrupts perceptual processing of the local face configuration. We used EEG to study neural correlates of the thatcher illusion during the perception of faces and non-face objects to investigate whether inversion and thatcherisation affect similar neural mechanisms. High-density EEG was recorded from normal observers during two oddball tasks, in which faces, houses, and chairs were presented. All stimuli appeared upright and inverted, and faces and houses were “thatcherised” by inverting their internal features. Event-related potentials (ERPs) were analysed as a function of type (normal / thatcher) and orientation (upright / inverted). Face thatcherisation increased the latency of the N170 over occipito-temporal electrode sites (PO7/8 and neighbours) for upright but not for inverted faces. This result resembles the finding that inversion affects perception of normal but not of thatcherised faces. Earlier and later components (P100 and P200) were not affected by face thatcherisation. Houses and chairs showed no effects of thatcherisation or inversion. Topographical analyses showed that face thatcherisation affected the N170 at right posterior occipito-temporal electrodes, while inversion affected activity equally in left and right occipito-temporal sites. These results highlight the sensitivity of the N170 to face configurations and they suggest that inversion and thatcherisation may affect different (although partially overlapping) neural mechanisms.

ERP effects with vs. without concurrent fMRI: A validation

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Event Related brain Potentials (ERPs) and functional Magnetic Resonance Imaging (fMRI) provide different kinds of information on brain activity. Due to their excellent temporal resolution, EEG-derived ERPs can provide an online representation of the time-course of neural activity, but are severely limited in determining the anatomical origins of scalp-recorded measurements. Conversely, fMRI is well suited for anatomical

localisation, but has low temporal resolution. It is tempting for cognitive neuroscientists to integrate the two techniques. However, simultaneous EEG/ERP-fMRI acquisition poses non-trivial challenges, primarily regarding the contamination of EEG signal by MR scanning artifact. Although methods have been developed for eliminating fMRI artifact from the EEG, it remains unclear how easy it is to detect ERP effects in the scanner and whether they are temporally or spatially distorted. We recorded ERPs in a single subject with and without concurrent fMRI (1.5T, standard EPI) during verbal and spatial working memory n-back tasks, known to elicit differences in P3 ERP components. Statistical analyses showed that the amplitude, time-course and scalp topography of a P3 difference was virtually the same in ERPs acquired with and without concurrent fMRI. It is particularly encouraging that the observed ERP difference could be replicated (even) at single-subject level.

Development of perspective taking during adolescence

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The development of emotional perspective-taking during adolescence was investigated using a computerised question-and-answer task that required children aged between 8 and 14 and adults to differentiate emotional perspectives of themselves and other people. Subjects were presented with stimuli that set up simple scenarios and were subsequently asked either how they themselves would feel or how another character would feel. Subjects answered by selecting from a choice of cartoon faces each depicting different emotions. Reaction times to answer first person perspective (1PP) questions were compared with reactions times to answer third person perspective (3PP) questions in the four age groups tested. All children took significantly longer to answer 3PP questions compared with 1PP questions. By contrast, adults, showed no significant difference in reaction time to answer 3PP and 1PP questions. The development of the ability to take other people's perspectives from childhood to adulthood is discussed in relation to brain maturation patterns specific to adolescence, namely, a reduction in synaptic density and a simultaneous increase in myelination particularly in the prefrontal and parietal cortices.

The neural basis of calendrical calculation

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Calendrical savants can name the weekdays corresponding to past and future dates with remarkable speed and accuracy despite pervasive developmental disorders. Retrieval from memory, normal mental calculation and abnormal access to unconscious

integer processing have each been suggested to underlie their skills. We describe an fMRI study that examined activation during mental arithmetic and calendrical calculation by two calendrical savants. Both savants showed activation during calendrical calculation and mental arithmetic in areas that corresponded to those previously associated with number processing and arithmetic in normal people. There was no evidence of activity in medial temporal areas associated with long-memory retrieval. We conclude that the process underlying calendrical calculation is not mysterious even if the skill is unusual and the motivation for developing it uncertain.

Which gestures occur during tip-of-the-tongue?

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Lexical retrieval is considered to occur in two stages: first, semantic representations that correspond to the speaker's intentions are retrieved, then, its corresponding word-form. It has been suggested that gestures accompanying speech may facilitate lexical retrieval. We assessed the relationship between gestures and the two stages by considering the types of gestures produced during tip-of-the-tongue (TOT) states. We focused on: iconic (expresses semantic features of the target via the hand shape and/or movement) and meta-cognitive gestures (non-representative of the target, but reflect the speaker's current cognitive state, namely frustration). We predicted that: (a) iconic gestures would be more prevalent during TOTs where retrieval problems arise at the semantic level (iconic gestures would enhance the activation of the semantic representation); (b) meta-cognitive gestures would be greater during the retrieval of a word-form. TOTs were induced in 76 native Spanish speakers following Brown & McNeill's (1966) methodology. There was no significant increase in iconic gestures for TOTs occurring during semantic retrieval, however, more meta-cognitive gestures were found for TOTs occurring during word-form retrieval. There was a significant tendency to produce more iconic than meta-cognitive gestures in all TOT states, suggesting that iconic gestures may play a general facilitatory role in retrieval.

Do the conceptual and operation span tasks tap into the same or different resource(s)?

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In this poster, we give a progress report on a correlational study that compares the abilities of the conceptual (Haarmann, Davelaar & Usher, 2003) and operation span tasks in predicting performance on complex cognitive tasks. Following up on our previous work on individual differences in semantic short-term memory, we were particularly interested in whether the two span tasks would show opposite correlations in tasks in

which semantic activation hinders correct performance. The tasks under consideration were free recall of Deese-Roediger-McDermott lists, random number generation, reasoning, and anomaly detection. Results will be discussed within an activation-based framework of working memory with separate mechanisms underlying short-term storage and executive control.

Haarmann, H. J., Davelaar, E. J., & Usher, M. (2003). Individual differences in semantic short-term memory capacity and reading comprehension. *Journal of Memory and Language*, 48, 320-345.

Interfering neighbours: The impact of novel word learning on the identification of orthographically similar words

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Competitive network models of visual word identification predict an inhibitory effect of an orthographically similar word on the identification of a target word, particularly when the orthographically similar word is of higher frequency than the target. Several experiments have tested this prediction, with mixed results: inhibition has typically been observed with French and Spanish stimuli, but not with English stimuli. We assessed the impact of orthographic similarity on written word identification by having participants learn new words (e.g., BANARA) that were neighbours of familiar words that previously had no neighbours (e.g., BANANA). Repeated exposure to these new words resulted in slower decision latencies to classify the familiar words in both semantic categorisation and lexical decision tasks. There was some evidence of interference following an initial training phase, and clear evidence of interference the following day (without any additional training); interference was larger still following more training on the second day. These findings lend support to models of reading that include lexical competition as a key process.

Bodily illusions modulate tactile perception

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The sense of touch appears to differ from other senses in that the body itself forms part of the content of tactile percepts. Proprioception and touch might thus be expected to interact, since proprioception is the sense of the body par excellence and the neural systems subserving proprioception and touch are closely linked. We therefore studied to what extent the proprioceptive representation of the body influences passive tactile perception. Here we generated the proprioceptive illusion that the left index was

elongating or shrinking by vibrating the biceps or triceps tendon of subjects' right arm while they gripped the tip of their left index. Subjects estimated the distance between two simultaneous tactile contacts on their index, either while experiencing these proprioceptive illusions, or in control condition. We found that a tactile distance feels bigger when the stimulated body part feels elongated due to altered proprioceptive input. That is, a proprioceptive representation of body configuration influences the tactile perception of distance. We propose that perception of tactile objects is referenced to an implicit body representation, and that proprioception contributes to this body representation. In addition, our study provides the first quantitative, implicit measure of distortions of body shape induced by altered proprioceptive inputs.

Sleep and the acquisition of words: Evidence from direct and indirect measures

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Learning a new word involves the acquisition of form and meaning, and at some point the integration of this information with existing knowledge in the learner's mental lexicon. In human speech recognition, this latter "lexicalization" stage is characterized by the engagement of the novel word in a competition process, in which it is able to inhibit identification of existing words (Gaskell & Dumay, 2003; Dumay et al. 2004). Here we show that although the simple acquisition of a spoken form is swift, the integration of this knowledge in long-term memory is slower and is associated with sleep. Words learnt at 8 pm do not induce inhibitory effects immediately after exposure, but do so after a 12-hour interval including a night's sleep, and still do after 24 hours. Conversely, words learnt at 8 am do not show such effects immediately or after 12 hours of wakefulness, but do so after 24 hours as sleep has now occurred. This dissociation is best accommodated by neural and connectionist models of learning in which sleep provides an opportunity for hippocampal information to be fed into long-term neocortical store.

Gaskell, M. G., & Dumay, N. (2003). Lexical competition and the acquisition of novel words. *Cognition*, 89, 105-132.

Dumay, N., Gaskell, M. G. & Feng, X. (2004). A day in the life of a spoken word. In K. Forbus, D. Gentner, T. Regier (Eds.), *Proceedings of the Twenty-Sixth Annual Conference of the Cognitive Science Society* (pp. 339-344). Mahwah, NJ: Erlbaum.

Prefrontal brain regions involved in processing internal vs. perceptual information

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The function of the rostral prefrontal cortex, or Brodmann area 10 (BA10) has been the subject of a number of theories which variously specify its involvement in episodic memory, metacognition, goals/subgoals or a “default mode” of functioning. This experiment was performed in order to test a synthetic hypothesis developed by Burgess et al. (in press). According to this theory, BA10 can be divided into lateral and medial regions, which play different roles in the novel biasing of attention towards stimulus-dependent or stimulus-independent thought. This fMRI experiment therefore aimed to dissociate the role of these regions using two tasks given in four conditions. The critical two conditions required either attending to external events or the processing of stimulus-independent information, and there were two additional conditions which were used to control for stimulus-dependent processing and for rehearsal. The two tasks themselves comprised analogous spatial and numerical tasks; the different task formats were used in order to be able to study common, task-independent processes. 16 subjects were scanned using a 3T MRI scanner and the results showed a significant dissociation between medial BA10 and lateral BA10 according, respectively to whether the processing required by the task was principally stimulus-oriented or stimulus-independent. Thus the “Gateway Hypothesis” of Area 10 function was supported.

Burgess, P. W., Simons, J. S., Dumontheil, I. & Gilbert, S. J. (in press). *Speed, control and age: In honour of Patrick Rabbitt*, Oxford University Press.

Talker-specific perceptual learning in response to idiosyncratic speech production

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The speech perception system has been shown to adjust dynamically and rapidly to unusual productions of speech sounds. We investigated the specificity of such adjustments in four experiments using an exposure--test paradigm. Dutch listeners heard a female talker utter an ambiguous fricative [ʔ] (between [f] and [s]) in either [f]- or [s]-biased lexical contexts. Listeners with [f]-biased exposure (stimuli such as [wItloʔ]; from *witlof*, `chicory'; *witlos* is meaningless) subsequently categorized more sounds on an [Ef]--[Es] continuum as [f] than listeners with [s]-biased exposure. This effect occurred when the test continuum was based on the exposure-talker's speech (Experiment 1), and when the same test fricatives appeared after vowels spoken by novel female and male talkers (Experiments 2 and 3). When the continuum was made entirely from a novel talker's speech there was no exposure effect (Experiment 4). In contrast, listeners did show a perceptual adjustment to this continuum when, during exposure, fricatives from the novel talker had been spliced into the exposure-talker's speech (Experiment 5). We conclude that perceptual learning about idiosyncratic speech is applied at a segmental level and is under these exposure conditions talker specific.

Visual capture of apparent limb position influences tactile temporal order judgmentsAlberto Gallace^{1,2} and Charles Spence²

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Shore, Spry, and Spence (submitted) recently demonstrated that people find it easier to judge which hand is touched first (in a tactile temporal order judgment task) when their hands are placed far apart rather than close together. In the present study, we used a mirror to manipulate the visually perceived distance between participants' hands, while holding the actual (i.e., proprioceptively-specified) distance between them constant. Participants were asked to determine which of two vibrotactile stimuli, one presented to either index finger using the method of constant stimuli, was presented first. Performance was significantly worse (i.e., the JND was larger) when the hands were perceived (due to the mirror reflection) as being close together rather than further apart. The lack of any significant difference between the conditions in a control experiment in which the mirror was covered by an opaque screen, ruled out the possibility that a spatial confound could have affected the reported results. These results highlight the critical role that vision plays in influencing the conscious perception of the temporal order of tactile stimuli.

Shore, D. I., Spry, E., & Spence, C. (submitted). Spatial modulation of tactile temporal order judgments. *Perception*.

Problem effects on children's use of the inverse relationship between addition and subtraction

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The inverse relationship between addition and subtraction is an important principle that children must understand when learning arithmetic. Children can make some use of this principle to aid problem solving, shown by faster and more accurate performance on inverse problems ($a+b-b=?$) than standard problems ($a+b-c=?$), but they don't apply it in all appropriate situations. To discover more about children's understanding of this principle we can vary the location of the missing number ($a+?-b=a$) and the order of elements within the problem ($b-b+a=a$). Fifty-one children aged 8 – 9 were given inverse problems in standard and reverse format with the missing number in different positions (e.g. standard: $15+7-7=?$; $12+8-?=12$; $11+?-5=11$; $?+8-8=13$, reverse: $7-7+15=?$; $8-8+?=12$; $5-?+11=11$; $?-8+13=13$). Children's accuracy on inverse problems was compared with control problems which required calculation to solve (e.g. $16+7-4=?$). Both the position of the missing number and the order of elements within the problem affected performance: children found inverse problems with the elements in reverse order easier to solve and problems with the missing number towards

the start of the sum more difficult, regardless of element order. The difficulties children face when solving inversion problems will be discussed.

Faces are “spatial”- Holistic perception of faces is subtended by low spatial frequencies

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We report a series of behavioral experiments testing the hypothesis that holistic processing of faces is supported by information conveyed in low-spatial frequencies of the stimulus (Sergent, 1986; Morrison & Schyns, 2001). First, we used a 2AFC matching task on unfamiliar spatially-filtered face stimuli. We show that the positive influence of the whole face stimulus on the recognition of individual face parts (whole/part face advantage) is larger for low-spatial frequency faces (<8 cycles/image) as compared to face stimuli containing only high-spatial information (>32 cycles/image). The second experiment used the face composite effect (Young et al., 1987) in a same/different matching task. Replicating the classical effect, subjects made significantly more errors in matching two identical top face stimuli when they were associated with bottom parts of different faces aligned with their top parts than when the top and bottom parts were misaligned. However, the composite effect was enhanced when the face stimuli contained only low spatial frequencies, and significantly reduced for face stimuli containing only high-spatial frequencies. Overall, these studies provide clear-cut evidence that holistic processing of a face is supported mostly by low spatial frequencies, suggesting that holistic perception of a face precedes part-by-part local analysis.

Sergent J, 1986 "Microgenesis of face perception", in *Aspects of face processing*. Eds H D Ellis, M A Jeeves, F Newcombe and A M Young (Dordrecht: Dordrecht).

Morrison D J, Schyns P G, 2001 "Usage of spatial scales for the categorization of faces, objects, and scenes" *Psychon Bull Rev* 8 454-69

Young A M, Hallowell D, Hay D C, 1987 "Configural information in face perception." *Perception* 10 747-759

Monkeys and humans categorise colours differently

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The debate about Universal colour categories is considered within a phylogenetic approach providing comparative data between humans and non-human primates (baboons/ *papio papio*). We used a matching to sample technique that can be

administered in equivalent procedures to the two species. Blue and green computerised Munsell stimuli were used in the identity matching training and consequent similarity matching phases. Our experiments could have enabled monkeys and humans to perceive categorically a boundary between blue and green. However, despite no overall performance differences (accuracy and latency), there were differences in the shape of the categorisation function between baboons and humans. Humans showed extended latencies and choice variability only around the category boundary at 5BG. Baboons showed relatively flat RT functions and a more linear accuracy function for probe matching from 5G to 7.5B. Modelling the data showed that humans were using a central boundary whereas monkey data were fitted by two boundaries located close to the training stimuli. Thus, the two species are doing something qualitatively different in colour categorisation. It is argued that human colour categories come about from colour terms rather than from our common visual apparatus.

Where does action influence perception in the brain?

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Many neuroimaging and neurophysiology studies have demonstrated that motor regions of the brain are activated when a subject observes an action. It has been proposed that these activations arise because the motor system is used to simulate and thus understand the observed action. This simulation hypothesis predicts that performing an action should influence the perception of an observed action. Recent psychophysical evidence supports the simulation hypothesis, and demonstrates that performing an action systematically biases the performer's judgment of the properties of another person's action (Hamilton, Wolpert, & Frith, 2004). The current study aims to determine if the psychophysical effect observed can be attributed to the interaction of perceptual and motor processing in motor regions of the brain, using fMRI. Subjects were scanned while they judged the weight of a box lifted by another person, and simultaneously lifted a light or heavy box themselves. The task of judging weight per se, and the visual effect of seeing a moving hand, were controlled in a factorial design. A brain-behaviour correlation analysis was used to identify areas where the psychophysical biasing effect of action on judgement correlated with fMRI signal change, and a network of areas including the extra-striate body area, the left cerebellum and the left inferior frontal gyrus were revealed. These results support the hypothesis that making judgments about other people's actions involves an interacting network of both perceptual and motor regions of the brain. The results will be discussed with reference to both computational models and the functional anatomy of human action understanding.

Hamilton, A., Wolpert, D. M., & Frith, U. (2004). Your own action influences how you perceive another person's action. *Current Biology*. 14. 493-498.

False memory effects among children with reading difficulties

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Recall of information from prose passages can be biased towards false remembering of words that are not present in the text but consistent with the overall meaning or 'gist' of the passage. Similarly, recall and recognition of words in the DRM paradigm (Deese, 1959; Roediger and McDermot, 1995) normally results in false remembering of words that are consistent with the gist meaning of the study list or of words that are phonologically confusable with words in the study list. Reading comprehension difficulties are related to problems drawing inferences from text, which may be due to problems constructing a gist based memory trace. By contrast, dyslexia is believed to be related to problems constructing an implicit memory trace for the sounds of words. The aim of this study was to test the hypothesis that children with reading difficulties (poor comprehenders and dyslexics) will show different patterns of false memory in comparison to normal readers. Poor comprehenders should show reduced false memories for lure words that are associatively related in meaning (e.g. SLEEP-BED) but will show normal false memory effects for words that are associatively related in sound (e.g., SLEEP-WEEP), whereas dyslexics should show the opposite pattern. As predicted, poor comprehenders recalled fewer semantically related lures than did normal readers. Surprisingly, dyslexic children showed near-identical false memory patterns for phonologically related lures, whereas target (verbatim) recognition was significantly impaired. We interpret this as evidence of preserved implicit knowledge of phonological representations in dyslexia. The results have implications for theories of children's memory development such as Fuzzy Trace Theory (Brainerd & Reyna, 1998).

Deese J. On the prediction of occurrence of particular verbal intrusions in immediate recall. *J Exp Psychol* 1959; 58: 17–22.

Roediger HL, McDermott KB. Creating false memories: remembering words not presented in lists. *J Exp Psychol Learn Mem Cogn* 1995; 21: 803–14.

Brainerd CJ, Reyna VF. Fuzzy-trace theory and children's false memories. *J Exp Child Psychol*. 1998;71:81-129.

A closer look at presentation rate effects in free recall

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A recent computational model of memory with an activation-based short-term memory system correctly predicted that recency effects in category cued recall would make way for primacy effects when presentation rate was increased. Here, we take a closer look at presentation rate effects in free recall of 8-word lists. Three groups of 12 participants received 48 lists of words at a rate of 200ms, 1600ms or 3000ms. A detailed analysis of recall distributions, output order and recency/primacy-index provide further support the view that items in short-term memory are the first to be reported and that this is independent of whether these items were presented at the beginning or end of a list.

Concurrent processing reveals competition between visual representations of faces

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Scalp electrophysiological recordings in humans indicate that the processing of faces differs from other categories between 100 and 200 ms after stimulus onset, peaking at the N170. To test the effect of the addition of a second face stimulus in the visual field on the face-related N170, we measured this component in response to a laterally presented face stimulus while subjects were processing either a central face or a control stimulus. As early as 130 ms following the lateralized face stimulus, there was a strong (~40% of signal) and specific reduction of the N170 amplitude when subjects were concurrently processing a central face. This observation suggests that the early stages of the N170 reflect the activation of individual faces having overlapping and competing neural representations in the human occipito-temporal cortex.

Reflections and the world: Information about size and distance from reflections

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Some aspects of mirror reflections such as the left-right reversal (e.g. Gregory, 1997), and self-awareness (e.g. Gallup, 1998) are well known. However, the literature has not tested directly the sensitivity to spatial information provided by reflections. Even in naïve optics studies that examined reasoning of what is visible in mirrors typically no reflection was present visually, and when it was, it was not manipulated systematically (e.g. Bertamini, Spooner & Hecht, 2003; Bertamini, Latto & Spooner, 2003). The relative size of a target and its reflection is informative about the absolute distance of the target in units of the distance k between target and specular surface. For plane mirrors, the basic relationship is given by $d = 2k/r - 1$ where d is the distance of the viewpoint from the target object, and r is the ratio of the apparent sizes of target and virtual target. We presented observers with images of 2 target objects in front of a mirror and they made relative size and distance judgements (in separate experiments). All other visual cues to size and

distance were eliminated from the stimuli. Results showed orderly psychophysical functions for both size and distance judgements with steeper slope functions for distance judgements. Further experiments controlled for horizontal offset of target and virtual images, presence of the observer in virtual image, and the inclusion of feedback.

Bertamini, M., Spooner, A. & Hecht, H. (2003). Naive optics: Predicting and perceiving reflections in mirrors. *Journal of Experimental Psychology: Human Perception and Performance*, 29, 982-1002.

Bertamini M., Latto, R., Spooner, A. (2003). The Venus effect: people's understanding of mirror reflections in paintings. *Perception*, 32, 593-599.

Gallup, G.G., Jr. (1998). Can animals empathise? *Scientific American Presents*, 9, 66–71.

Gregory R. (1997). *Mirrors in mind*. London: Penguin.

Lexical information drives perceptual learning of distorted speech: Evidence from the comprehension of noise-vocoded sentences

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Native English-speaking listeners presented with spectrally impoverished, noise-vocoded (NV) sentences initially comprehend very little, but after a short exposure period can report nearly all words correctly, thus exhibiting perceptual learning. Learning can be achieved by prior training with English NV sentences but not by training with nonword NV sentences (Davis et al., 2004). The current study aimed to establish whether the crucial information that drives learning in English NV sentences is lexical, syntactic or semantic. Eighty listeners were either tested naïve, or received pre-test training with one of four NV sentence types that preserved different kinds of linguistic information; nonword, Jabberwocky, syntactic prose and real English. The test phase comprised 20 English NV sentences. Syntactic prose sentences, which lack semantic coherence, were as effective during training as real English, suggesting that sentence-level meaning is not critical for learning. Jabberwocky sentences have grammatical structure but no real content words, and were of intermediate effectiveness, suggesting that grammatical structure alone is not sufficient for effective learning. These results suggest that lexical information, not syntactic or sentence-level semantic information, drives perceptual learning with NV speech. This kind of lexically driven learning may be important for adaptation to an unfamiliar accent, or after cochlear-implantation.

Davis, M.H., Hervais-Adelman, A., Brent, L. & Johnsrude, I.S. Learning to understand noise-vocoded speech. *Paper presented at the EPS Meeting, University College London, January 2004.*

Effects of semantic and lexical knowledge on the deployment of visual attention

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We report a visual search experiment in which participants decided as fast as possible whether or not a target (e.g., a hammer) was present in a display of four objects. The experiment consisted of two sub-experiments. In the semantic sub-experiment, the target was either presented along with three unrelated objects or with two unrelated objects and a semantically related object (e.g., a screw driver). On target-absent trials an unrelated object was shown instead of the target. In the homophone sub-experiment, the target (e.g., a baseball bat) was presented along with three unrelated objects or with two unrelated objects and a conceptually and visually unrelated object with the same name as the target (e.g., (animal) bat). On target-absent trials the target was replaced by an unrelated object. We recorded the participants' response latencies and their eye gaze patterns. For the semantic sub-experiment, we obtained results similar to those recently reported by Moores, Laiti, and Chelazzi (2003, *Nature Neuroscience*). The latencies for positive and negative responses were longer in the presence than in the absence of a related distracter. In addition, the participants' first saccade after picture onset was more likely to be directed at a related than at an unrelated distracter. Importantly, parallel results were found for the homophone sub-experiment: The response latencies were longer when the homophonous distracter was present than when it was absent; and the first saccade was more likely to be directed towards homophonous than unrelated distracters. These results show in an object search task not requiring overt naming semantic and lexical information associated with the objects becomes readily available and affects the deployment of visual attention.

Moores, E., Laiti, L, & Chelazzi, L. (2003). Associative knowledge controls deployment of visual selective attention. *Nature neuroscience*, 6 (2), 182-189.

Is holistic perception of faces specific to our own-race?

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Humans are experts at recognizing faces across a wide range of viewing conditions. A notable exception to this rule is that of recognizing faces of a different race, the so-called ‘other-race face effect’. This striking phenomenon has prompted researchers to debate about the role of visual experience in our advantage at processing same-race faces. Yet, it remains to be clarified whether there are qualitative processing differences between same- and other-race faces. Here, we tested the hypothesis that same-race faces are perceived more holistically than other-race faces. We recruited Caucasian and Asian people without life experience among other-race faces, and presenting a large other-race effect as measured empirically. To test the differential holistic perception hypothesis, we obtained a measure of the extent to which the recognition performance of the upper part of a face is influenced by the – to be ignored - lower part of the face (Young, Hallowell & Hay, 1987). Both Caucasian and Asian participants showed a larger interference (‘composite effect’) for same-race faces relative to other-race faces. These results suggest that same-race and other-race faces processing differs qualitatively; relationships between features being extracted more efficiently from same-race faces, most likely as a by-product of visual experience.

Young, A.W.; Hallowell, D.; & Hay, D. (1987). Configural information in face perception. *Perception*, 16, 747-759.

‘Interpretable vs. uninterpretable features: Evidence from six Greek-speaking agrammatic patients’

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We report the performance of six Greek-speaking agrammatic patients in repetition, production and grammaticality judgment tasks on stimuli that require attention to verbal inflectional morphology. The aim of the study was to investigate the validity of syntactic accounts of the agrammatic deficit, such as the tree-pruning hypothesis (TPH) put forward by Friedmann & Grodzinsky (1997). The TPH postulates that agrammatics cannot construct syntactic trees higher than an impaired node, while nodes located lower than the pruning site (the impaired node) are relatively intact. The experiments, investigated patients’ ability to produce tense, agreement and aspect in single word and sentential tasks and patients’ ability to correctly judge the same inflectional markers within sentences. The results from the single word tasks revealed problems in all inflectional markers to almost the same degree, while within the sentential tasks (in production and in grammaticality judgment) aspect and tense were found to be more impaired than agreement. With respect to the sentential tasks, in the syntactic clause in Greek, agreement is thought to be located higher than tense and aspect, and aspect is located lower than tense. These results do not support predictions of the TPH insofar as tense and aspect that are lower in the syntactic tree were found to be more impaired than

agreement. Instead the results are interpreted within recent formulations of Minimalism that distinguish between interpretable (tense and aspect) and uninterpretable (agreement) features and the morphophonological evaluation operations associated with them.

Friedmann, N., & Grodzinsky, Y. (1997). Tense and agreement in agrammatic production: Pruning the syntactic tree. *Brain and Language*, 56, 397-425

In the nick of time

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Within many areas of experimental psychology researchers regularly make use of commercial experiment generators and custom written software to administer paradigms. Increasingly such paradigms make use of complex multimodal stimuli interacting with hardware which would have been unimaginable just five years hence. As an adjunct to such in-built complexity, some studies have gone to great lengths in order to seek out ever smaller effect sizes. Widespread use of modern technologies within the field has left some assuming they no longer need be concerned with the intricacies of millisecond presentation, synchronisation and response timing. However, through empirical investigation, we have discovered numerous sources of timing error within live studies (Plant et al, 2002 & 2003). Timing errors can have many causes and are not wholly predictable in the sense there are no ground rules for what may, or may not, affect timing within certain types of paradigm. To more practically aid the researcher, we have developed a method for benchmarking timing in the majority of paradigms whilst running in-situ and without modification on the researchers own hardware. Armed with specific information about a paradigm this gives them the opportunity to correct timing errors where practicable. In this paper we outline our methodology, stress the importance of such independent validation, and highlight typical areas that can be subject to error.

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Plant, R.R., Hammond, N.V. & Whitehouse T. (2003), How choice of mouse may effect response timing in psychological studies, *Behavior Research Methods, Instruments and Computers* 35(2), 276-284.

An investigation of vocal expressions of emotion - are there different kinds of 'happiness'?

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To date, the investigation of basic emotions (sad, anger, fear, disgust, surprise and happiness) has focused mainly on negative affect, and research typically utilises facial expressions. Recent work has established that these facial expressions have vocal equivalents (Scherer et al, 2001; Scott et al, 1997). It has been suggested (Ekman, 1992) that the emotion 'happiness' could be fractionated into a set of positive basic emotions, primarily expressed vocally. This hypothesis was investigated using a forced-choice paradigm. Twenty participants categorised paralinguistic sounds of negative and positive emotions, and rated them on scales of each of the emotions as well as for arousal and valence. Subjects successfully identified emotional sounds at a level that far exceed chance, and also rated each class of emotion sounds highest when rated for itself. The results support Ekman's proposal that triumph, amusement, pleasure and relief and distinct emotional categories. A second study replicated aspects of these results in the preliterate Himba culture in Namibia, confirming that vocal expressions of these emotions can be recognized across cultures. These findings suggest that there are positive basic emotions (Ekman, 1992) and that there may be functional differences in the expressions of emotions across different communicative channels (facial, vocal, postural, etc.).

Ekman, P. (1992). An Argument for Basic Emotions. *Cognition and Emotion*, 6, 169-200.

Scherer, K. R., Banse, R., & Wallbott, H. G. (2001). Emotion inferences from vocal expression correlate across languages and cultures. *Journal of Cross Cultural Psychology*, 32, 76-92.

Scott, S. K., Young, A. W., Calder, A. J., Hellawell, D. J., Aggleton, J. P., & Johnson, M. (1997). Impaired auditory recognition of fear and anger following bilateral amygdala lesions. *Nature*, 385, 254-257.

Anomalous response to facial identity in the right middle fusiform gyrus underlies impaired face identification in acquired prosopagnosia

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The middle fusiform gyrus and the inferior occipital gyrus of the right hemisphere are activated by both face detection and identification. Paradoxically, patients with acquired prosopagnosia following lesions to either of these regions cannot identify individual faces. but are generally still able to detect faces. Here we acquired functional

magnetic resonance imaging (fMRI) data in a single-case brain-damaged prosopagnosic patient, PS to test the hypothesis that neurons in the structurally intact right middle fusiform gyrus (rMFG) of PS no longer code facial identity, whereas they still subserve face detection. PS presents a deficit purely restricted to the identification of faces following lesions of the visual system encompassing the inferior occipital but sparing the middle fusiform gyrus in the right hemisphere. Using an fMRI-adaptation paradigm we show that neurons in the rMFG of PS do not respond differentially to conditions with identical and distinct faces, contrary to the larger response to different than identical faces systematically observed in the corresponding area in normal control subjects. The present results suggest that the identification of a face critically depends on the integrity of both the rMFG and the right inferior occipital gyrus (rIOG), which may interact functionally through reentrant cortical connections.

Using and assessing advice about risk

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People often learn about the levels of risk associated with different activities through advice, and their use and assessment of such advice may depend on factors such as the identity of the advisor, and the perceived quality of that advice. Earle & Cvetkovich (1999) demonstrated that explicit verbal estimates of trust in advisors correlate with perceived shared values between advisor and advisee. Here we apply that finding to a risk communication paradigm. Earle & Cvetkovich's findings were replicated in two experiments, in which participants were given advice about a range of risky activities. However, declared trust in advice sources did not correlate with how much those sources were used in making risk judgments. Relative measures of use and assessment of advisors were also found to bear different relationships to the accuracy of advice. Use of advisors was not reflected in explicit verbal estimates of trust in those advisors.

Earle, T.C., & Cvetkovich, G. (1999). "Social trust and culture in risk management". In G. Cvetkovich and R. Löfstedt (Eds), *Social Trust and the Management of Risk*. London: Earthscan.

Social judgements from faces in autism

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The judgement of social attributes from faces is likely to draw on social knowledge and understanding. The extent of such knowledge that may be available to people with autistic disorder is unknown. We tested 16 adults with Asperger Syndrome (AS), 24 control adults, 14 children with autism spectrum disorder (ASD) and 18 control children with several sets of faces and asked them to judge these faces on the following social attributes: trustworthiness, attractiveness and social status. Adults rated attributes on a 7 point scale whilst children responded either 'yes' or 'no' to only the most extreme stimuli. We also used control conditions where judgments of age and of price of objects were required. All children found the social judgments so difficult that they were at chance level on the majority of judgments. The AS adults performed as well as control adults on all dimensions except attractiveness judgments. Further analysis revealed that this impairment was shown only when judging the attractiveness of a face of the same sex. This class of judgments may well depend on the ability to take another person's perspective while all other social judgments could be made from an egocentric perspective. We conclude that individuals with ASD are able to acquire sufficient social knowledge to judge a number of stereotypic social attributes from photographs, supporting the specificity of the mentalising deficit.

Spatial factors involved in the multisensory integration of objects

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We investigated whether multisensory integration is affected by a difference in spatial location between visual and haptic objects. Previously (Woods, O'Modhrain & Newell, 2004), we reported that temporal synchrony did not result in less efficient crossmodal matching performance. However, visual and tactile objects were presented in spatially disparate locations which may have prevented integration of the percepts. In a series of experiments we tested the role of spatial location on the integration of objects across vision and touch. In Experiment 1 we found that matching performance was efficient when the visual and haptic object were located in the same position. Furthermore, a difference in location between these objects along the vertical dimension did not affect performance. However, a difference along the horizontal dimension caused a decrease in performance. In experiment 2, we tested the role of haptic object location in relation to the distance and lateral position from the body and found that haptic objects were over-estimated along their horizontal dimensions with deviations from the body midline. Our findings suggest that the modalities maintain discrete object representations during integration, and that matching performance over horizontal spatial disparity seems to be attributable to haptic object distortion.

Woods, A.T., O'Modhrain, S. & Newell, F.N. (2004). The Effect of Temporal Delay and Spatial Differences on Cross-Modal Object Recognition. *Cognitive, Affective & Behavioral Neuroscience*, 4, 260–269.

