

E|P|S

Experimental
Psychology
Society

LANCASTER MEETING

30 June – 2 July 2004

A scientific meeting will be held at the Conference Centre, University of Lancaster on 30 June – 2 July, 2004, at the invitation of the Department of Psychology. The local organiser is Dr John Towse.

First EPS Mid-Career Award Lecture
Dr John Duncan (MRC-CBU Cambridge)
“Attention in the brain”

The Mid-Career Award Lecture will take place at 6.00pm Thursday 1 July, in the Conference Centre, room 3

Symposia:

Wednesday 30 June 9.30 – 12.30

“Pathways to understanding cognitive development”
Organiser: Dr J Towse

Friday 2 July 9.30 – 12.30

“Attention in the brain”
Organiser: Dr N Lavie

Presentations

Sessions will be held in the conference centre rooms 3 and 4. Both rooms have OHPs and data projectors for PowerPoint presentations. Presenters may provide their own laptops or CDs for the on-site computers. Any queries about facilities in the theatres should be sent to Dr John Towse, Dept. of Psychology, Fylde College, University of Lancaster, Bailrigg, Lancaster, LA1 4YF. Tel: +44 (0)1524 593705, email: j.towse@lancs.ac.uk

Coffee will be served in the conference centre.

Receptions and Conference Dinner

Those who arrive on the 29 June are invited to come to the Graduate Bar from 8.00pm onwards to meet other members before the meeting starts. The Department of Psychology welcomes EPS delegates to a drinks reception from 6.00pm on Wednesday evening, 30 June, meeting in the Fylde Coffee Bar. On Thursday 1 July, there will be a conference dinner and transport will leave from the Conference Centre at 7.30pm. A booking form for the dinner is enclosed.

Tel: +44 (0) 1524 593705, email: j.towse@lancs.ac.uk

*Session A***Conference Centre Room 3**

9.00 **Karen R Brandt***, **J M Gardiner**, **F Vargha-Khadem**, **A Baddeley and M Mishkin*** (Lancaster University, University of Sussex, University College London & Great Ormond Street Hospital, University of York, National Institute of Mental Health, USA)
The role of subjective experience in a case of developmental amnesia

Symposium: “Pathways to understanding cognitive development”
Organiser: Dr John Towse

9.30 **John Towse** (Lancaster University)
Pathways to understanding cognitive development: Introduction

10.00 **Robert Siegler*** (Carnegie Mellon University, USA)
Relations between short-term and long-term change

10.30 COFFEE

11.00 **Karen Shimmon***, **Charlie Lewis***, **Brian Francis***, **Azman Shahadan*** and **Damon Berridge*** (Lancaster University)
Can we discern causal influences in data on ‘executive function’ and ‘theory of mind’ skills? A longitudinal analysis

11.30 **Susan E Gathercole** (University of Durham)
Cross-sectional, experimental, longitudinal and observational perspectives on the role of working memory in learning

12.00 **Elaine Funnell and Nikki Pitchford*** (Royal Holloway University of London, University of Nottingham)
A study of group and sub-group differences in literacy and IQ in children with left or right-hemisphere lesions

12.30 **Dr Denis Mareschal*** (University of London)
Connectionist modelling of development in childhood

End of Symposium

1-2 LUNCH

*Session B***Conference Centre Room 4**

- 9.00 **Katie Alcock*** (University of Lancaster) (Introduced by Mary Smyth)
Input, processing, and acquisition of grammatical structures: Pilot data
from two East African Bantu languages
- 9.30 **Padraic Monaghan, Luca Onnis*, Morten H. Christiansen* and
Nick Chater**
(University of York, Cornell University and University of Warwick)
The importance of variety in language acquisition: Segmentation and
generalisation in artificial language learning
- 10.00 **Gareth Gaskell, Nicolas Dumay* and Xiaojia Feng*** (University of
York)
A day in the life of a spoken word
- 10.30 COFFEE
- 11.00 **Aureliu Lavric* and Caroline Crentsill*** (University of Exeter)
(Introduced by Andy J.Wills)
ERP evidence on regular vs. irregular past-tense distinguishes between
phonological and morphological contributions
- 11.30 **Jelena Havelka*** (University of Kent) (Introduced by Marc
Brysbaert)
The assembly of Phonology from print is serial and subject to strategic
control: Evidence from Serbian
- 12.00 **Isabel M. Santos*** (University of York) (Introduced by Andy Young)
Perceptual bases of social inferences from faces
- 12.30 **Naomi Carroll*** (University of York) (Introduced by Andy Young)
Priming of emotion recognition
- 1-2 LUNCH

*Session A***Conference Centre Room 3**

- 2.00 **Andy Wills, Tom Beesley* and Gareth Croft*** (Exeter University)
Processes of polymorphous category acquisition
- 2.30 **Guy Mizon* and Stephen Monsell** (University of Exeter)
Task-set control processes can be measured with a task-cueing
paradigm only if $p(\text{task-switch})$ is low
- 3.00 **Peter A Bibby** (University of Nottingham)
Goal specificity, implicit learning and task-goal conflicts
- 3.30 TEA
- 4.00 **K Yarrow, L Whiteley*, P Haggard and J C E Rothwell*** (Institute
of Neurology London and Institute of Cognitive Neuroscience
London)
Dissociable temporal and spatial perceptions following saccadic eye
movements
- 4.30 **Marco Bertamini and Rebecca Lawson** (University of Liverpool)
Visual search asymmetry and contour curvature polarity
- 5.00 **Dr Jason Braithwaite*** (University of Birmingham) (Introduced by
Glyn W Humphreys)
Group-based and feature-based inhibition: Further evidence from a
probe-detection analysis of preview search
- 5.30 **Rebecca Lawson** (University of Liverpool)
Depth rotation and mirror-image reflection reduce affective preference
as well as recognition memory for pictures of novel objects
- 6.00 DRINKS RECEPTION (Fylde Coffee Bar)

*Session B***Conference Centre Room 4**

- 2.00 **Andy J Calder, Jill Keane*, Andrew W Lawrence*, Andrew W Young, and Roger Barker*** (MRC Cognition and Brain Sciences Unit, Cambridge, University of York, University of Cambridge)
Emotion processing in Huntington's disease
- 2.30 **Rob Jenkins, John Beaver* and Andy Calder** (University of Glasgow, University of Cambridge and MRC Cognition and Brain Sciences Unit, Cambridge)
“Are you lookin’ at me?” In search of the DeNiro effect
- 3.00 **Mike Burton and Ahmed Megreya*** (University of Glasgow)
Unfamiliar faces aren't faces
- 3.30 TEA
- 4.00 **Eva Belke*** (University of Birmingham) (Introduced by Antje Meyer)
Multiple object naming in the elderly
- 4.30 **Femke F. van der Meulen* and Linda R. Wheeldon** (University of Birmingham)
Serial order errors in practiced object naming
- 5.00 **Ilhan Raman** (Middlesex University)
Age-of-acquisition effects in word and object naming in Turkish
- 5.30 **Cristina Izura*** (University of York) (Introduced by Andrew W. Ellis)
Gender priming effects in Spanish picture naming
- 6.00 DRINKS RECEPTION (Fylde Coffee Bar)

*Session A***Conference Centre Room 3**

- 9.00 **Barbara J Juhasz*** (Massachusetts University) (Introduced by Simon P Liversedge)
The influence of non-foveal length information on eye fixations during reading
- 9.30 **Jeannie Judge* Marketa Caravolas and Paul C. Knox*** (University of Liverpool) (Introduced by Rebecca Lawson)
Fixation stability and phonological processing skills in adults with developmental dyslexia: Implications for reading
- 10.00 **Michal Lavidor, Tzu-Ching Chiang* and Vincent Walsh**
Lateralized cueing effects in the left and right segments of centrally presented words
- 10.30 COFFEE
- 11.00 **Hui-Ya Chen*, Mihalis Doulas* and Alan M. Wing** (University of Birmingham)
Metronome phase shift effects on bilateral alternate responding: One timer or two?
- 11.30 **Alan M Wing and Paul Pope*** (University of Birmingham)
The effect of alternating force on the reproduction of alternating time intervals in rhythmic tapping
- 12.00 **Paul Pope*, Alan M Wing and Peter Praamstra*** (University of Birmingham)
Force and time control in Parkinson's disease patients and elderly controls: the role of the basal ganglia in rhythmic motor production
- 12.30 **Ramesh Balasubramaniam* and Alan M. Wing** (University of Birmingham)
Trajectory formation in timed repetitive movements
- 1 - 2 LUNCH

*Session B***Conference Centre Room 4**

- 9.00 **Sandra Sünram-Lea*, Jonathan Foster* and Elizabeth Morton***
(Lancaster University, Neurosciences Unit, Edith Cowan University
Western Australia, McCusker Unit for Alzheimer's Disease Research,
Hollywood Hospital, School of Psychology, University of Western
Australia) (Introduced by Tom Ormerod)
Memory and metabolism: the effects of glucose and oxygen
administration on cognitive performance
- 9.30 **Donna Bayliss*, Christopher Jarrold*, Eleanor Leigh* and Alan
D Baddeley**
(University of Bristol and University of York)
Predicting working memory span and its relation to educational
achievement in individuals with moderate learning difficulties
- 10.00 **Satoru Saito and Hisao Ishii*** (Kyoto University, Japan, Shinshu
University, Japan)
Cued recall tests can behave like the reading span test in predicting
individual's language comprehension scores
- 10.30 COFFEE
- 11.00 **C Philip Beaman** (University of Reading)
"Working Memory" constraints on attentional capture
- 11.30 **Geoff Ward*, Parveen Bhatarah* and Lydia Tan*** (University of
Essex) (Introduced by Rick Hanley)
Examining the relationship between free recall and immediate serial
recall
- 12.00 **Chris Moulin & Akira O'Connor*** (University of Leeds)
Jamais vu: inappropriate sensations of unfamiliarity
- 12.30 **Stephen A Dewhurst*, Christopher Barry* and Selina J Holmes***
(Lancaster University) (Introduced by Tom Ormerod)
Testing the "associative responses" account of false recall and false
recognition
- 1 - 2 LUNCH

*Session A***Conference Centre Room 3**

- 2.00 **Thomas C Ormerod and Harriet Gross*** (Lancaster University and Loughborough University)
Domain-specific expertise in solving insight puzzles
- 2.30 **Edward P Chronicle, Tom Ormerod and Jim MacGregor**
(University of Hawaii at Manoa, USA, Lancaster University and University of Victoria, Canada)
Predicting performance from a model of insight in a suite of novel ball-weighing problems
- 3.00 **Gary Jones*** (University of Derby) (Introduced by Edward P Chronicle)
Examining insight in Children
- 3.30 TEA
- 4.00 **Evriliki Fioratou*** (Lancaster University) (Introduced by Tom Ormerod)
Insights from the cheap necklace problem
- 4.30 **Günther Knoblich* and Michael Öllinger*** (Max Planck Institute for Human Cognitive and Brain Sciences, Munich) (Introduced by Tom Ormerod)
Why do problem solvers get stuck? Inappropriate heuristics vs. inappropriate representations
- 5.00 **Ken J Gilhooly** (Brunel University, West London)
Differentiating insight from non-insight problems
- 5.30 BUSINESS MEETING (Conference Centre, room 4)
- 6.00 **First EPS Mid-Career Award Lecture** – Dr John Duncan (MRC-CBU Cambridge) (Conference Centre, room 3)
“Attention in the brain”
- 7.30 CONFERENCE DINNER
(Coach will leave from the Conference Centre at 7.30pm)

*Session B***Conference Centre Room 4**

- 2.00 **Catriona Morrison***, **Laura Keyse***, and **Michael Lewis**
(University of Leeds and Cardiff University)
Lexical predictors of word association
- 2.30 **Kevin Paterson, Ruth Filik* and Simon Liversedge** (University of
Leicester University of Derby and University of Durham)
Further investigations of the on-line processing of relative quantifier
scope during reading
- 3.00 **Eddy J Davelaar*** (University of London) (Introduced by Michal
Lavidor)
Retention of words suppresses semantic associates: the prime-
retention effect
- 3.30 TEA
- 4.00 **Juliet Conlin* and John W Adams*** (University of Durham)
(Introduced by Sue Gathercole)
Similarity effects in children's working memory span
- 4.30 **Dr. Karen J. Pine* & Hannah Bird*** (University of Hertfordshire)
(Introduced by John Towse)
The Tip-of-the-Tongue effect in children: Do their gestures facilitate
lexical access?
- 5.00 **Kevin Muldoon* and Brian Francis*** (Lancaster University)
Introduced by John Towse)
How analysing microgenetic data can reveal predictors of conceptual
insight: Findings from a study of early numeracy
- 5.30 BUSINESS MEETING (Conference Centre, room 4)
- 6.00 **First EPS Mid-Career Award Lecture** – Dr John Duncan (MRC-
CBU Cambridge) (Conference Centre, room 3)
“Attention in the brain”
- 7.30 CONFERENCE DINNER
(Coach will leave from the Conference Centre at 7.30pm)

*Session A***Conference Centre Room 3**

9.00 **Ula Cartwright-Finch* and Nilli Lavie** (University College London)
Perceptual load determines the extent of “inattention blindness”

Symposium: “Attention in the brain”
Organiser: Dr Nilli Lavie

9.30 – 10.30 **Sabine Kastner*** (Princeton University)
Attentional response modulation in the human visual system

10.30 COFFEE

11.00 **Nilli Lavie** (University College London)
Frontal cognitive control of visual selective attention

11.30 **Geraint Rees** (University College London)
Biased competition in Binocular rivalry

12.00 **Kimron Shapiro** (University of Wales, Bangor)
The functional architecture of divided visual attention

12.30 **Bob Rafal*** (University of Wales, Bangor)
Consciousness is gated by attending for action: Evidence from
Hemispatial neglect

End of Symposium

End of Meeting

The role of subjective experience in a case of developmental amnesia

Karen Brandt¹, J M Gardiner², F Vargha-Khadem³, A Baddeley⁴, and M Mishkin⁵

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2. University of Sussex

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Past research has indicated that there might be a selective role of the hippocampus in the subjective experience of ‘remembering’ (Eldridge et al. 2000). The present research further explored this possibility by investigating the subjective experiences of a developmental amnesiac (Jon) who has confined bilateral hippocampal damage. The results of Exp. 1 demonstrated that compared to matched controls, Jon did not show enhanced ‘remembering’ for enacted compared to just read phrases (known as the enactment effect). Further investigation revealed that Jon’s ‘remember’ responses were qualitatively different to those of the controls and were in fact more akin to the subjective experience of ‘knowing’ (Exp. 2). Finally, the results of Exp. 3 revealed that in conditions where ‘remembering’ is needed in order to correctly exclude study items, Jon’s performance was significantly lower than that of the controls. These results demonstrate Jon’s impairment in being able to have the rich episodic memories associated with ‘remember’ responses and lend further support to a selective role of the hippocampus in the subjective experience of ‘remembering’.

Symposium: “Pathways to understanding cognitive development”

Organiser John Towse

Pathways to understanding cognitive development: Introduction

John Towse

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For the experimental psychologist, is there really anything worthwhile to gain from the study of developmental issues? Almost certainly there is! The present symposium will showcase a variety of approaches to the study of children’s development, and sample current theoretical debates relevant to these topics. Moreover, through the consideration of different domains, the richness of the developmental phenomena will be explored, along with both the commonalities and idiosyncrasies of children’s cognition.

Relations between short-term and long-term change

Robert Siegler,
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Microgenetic methods involve dense sampling of changing behavior while the changes are occurring. Among the issues that this approach can address is the relation between short-term and long-term cognitive change (also known as the relation between learning and development.) In this talk, I first present the key characteristics of microgenetic designs, then describe the range of tasks and age groups to which the designs have proven applicable, and then discuss how the approach can be used to illuminate relations between learning and development.

Can we discern causal influences in data on ‘executive function’ and ‘theory of mind’ skills? A longitudinal analysis

Karen Shimmon¹, Charlie Lewis¹, Brian Francis², Azman Shahadan² and Damon Berridge²
1. Department of Psychology, Lancaster University
2. Centre for Applied Statistics, Lancaster University
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Debate on children’s understanding of mental states has shifted in recent years to explore the relationship between performance on tests of false belief and of domain general skills involving executive control. Notwithstanding many theoretical speculations about this relationship, there are surprisingly few longitudinal data that might tease apart any causal pattern to support one or other perspective. We report a three-stage longitudinal study involving over 16,000 test trials, across the time at which children come to pass the crucial tests of mental state understanding. Analysis shows that: [1] small modifications of executive tests give rise to large within-participant variations in performance, but [2] confirmatory factor analysis strongly suggests the ‘unity with diversity’ account of the executive system provided by Miyake and his colleagues. Longitudinal analyses found that [3] structural equation models of the relationship between latent variables designating groups of executive skills and ‘theory of mind’ suggest a complex relationship between them, not the simple causal pathways suggested in the literature, and [4] logistic models based upon trial by trial performance on individual executive tests show the strength of such interrelationship and the need to explore minute changes in executive task performance within and between sessions. It will be argued that longitudinal data like these are essential in testing models of causal change.

Cross-sectional, experimental, longitudinal and observational perspectives on the role of working memory in learning

Susan E. Gathercole
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It is argued that understanding of complex developmental relations can only be advanced by judicious combination of complementary research methodologies. This case will be presented using examples from studies of the contributions of both short-term and working memory to learning. Cross-sectional designs have provided useful ways of identifying significant relations between memory and learning, but elimination of some of the competing causal hypotheses has required both experimental investigation (in adults and in children) and longitudinal analysis. However, detailed theoretical understanding of the cognitive processes underlying links between working memory and learning has not been substantially advanced by correlational studies with either cross-sectional or longitudinal designs. Some findings from classroom observation of children are illustrated. It is argued that such qualitative approaches can provide novel theoretical insights provide the basis for subsequent investigation using quantitative methods.

A study of group and sub-group differences in literacy and IQ in children with left or right-hemisphere lesions

Elaine Funnell¹ and Nikki Pitchford²
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2. University of Nottingham
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This study, which investigates the effects of unilateral stroke on IQ and the development of literacy, demonstrates the importance of investigating performance at both group and sub-group level. Twenty-four children with acute postnatal stroke occurring between 8 months and 12 years of age took part in this study: Fifteen children suffered strokes to the left cerebral hemisphere, and nine to the right. Full scale IQ scores were equivalent across left and right hemisphere groups and slightly below average, suggesting no effect of side of stroke on IQ, but further investigation revealed significant impairments to performance IQ in the right hemisphere group and some marked individual differences between verbal and performance IQ (in both directions) in the left hemisphere group; although this group of children showed no difference between performance and verbal IQ overall. Children with left and right hemisphere lesions read, spelled and comprehended text to equivalent levels, but left hemisphere children showed significant correlations between literacy skills and verbal IQ, and were also more likely to perform at lower levels than predicted. There was no significant relationship between age at stroke and literacy levels in either hemisphere, but reading accuracy and spelling fell behind in the left hemisphere group as time since stroke increased. We conclude that there is a complex relationship between literacy attainment, IQ and side of lesion that is not apparent when overall group differences are assessed.

Connectionist modelling of development in childhood

Dr Denis Mareschal
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The real question in developmental psychology is to understand how behaviours emerge. This requires some kind of process or mechanistic account of how information is processed and how a system undergoes change during development. Connectionist models are cognitive models loosely based on neural information processing. Learning occurs by adjusting connection weights that gradually internalise the distribution statistics of features in the environment. In this talk I will discuss three examples: (1) a model of perceptual category learning in early infancy, (2) a model of the development of seriation (sorting) in child, and (3) a model of analogy completion in young children. In all three cases, the models capture the coarse as well as the fine-grained detail of infant and children's performance.

End of Symposium

Input, processing, and acquisition of grammatical structures: Pilot data from two East African Bantu languages

Katie Alcock
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Whether a child's acquisition of grammatical morphemes is dependent on their syntactic knowledge, or on processing and input limitations, is a subject of debate. Data from East African languages which have high frequencies of grammatical morphemes for subject, tense, and passive marking enable comparison of children's levels of use of particular markings with their exposure to those markings. Differences between languages and children can be accounted for by the frequency in the input which each child hears, without recourse to syntactic knowledge explanations. Passive verbs in particular are used at an early age, much earlier than maturational accounts allow, again suggesting that frequency in the input is the most important characteristic.

The importance of variety in language acquisition: Segmentation and generalisation in artificial language learning

Padraic Monaghan¹, Luca Onnis², Morten H. Christiansen², and Nick Chater³
1. University of York
2. Cornell University
3. University of Warwick
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In order to acquire language, the child must learn to segment speech into its constituent words, and derive the structural relations between words. Learning to segment

and learning to generalise language structure have been proposed as separate and sequential processes (Peña et al., 2002). We suggest that both can be learned simultaneously but only if there is sufficient variety in the speech input. We constructed stimuli similar to those of Peña et al., but controlled for phonological preferences among the syllables. Participants listened to continuous speech comprised of three trisyllabic words, where the first and third syllable of each word always co-occurred but the intervening syllable varied (A1_X_B1, A2_X_B2, and A3_X_B3, where X is the varying syllable). After training, segmentation was tested by comparing preference for words over part-words (A1_X_B1 versus X_B1_A2), and generalisation was tested by comparing ‘rule-words’ to part-words (A1_B2_B1 versus X_B1_A2). We found that, in Peña et al.’s original formulation where X varied over just three syllables, then neither segmentation ($p = .83$) nor generalization (marginal preference for part-words, $p = .08$) was found. When the X syllable varied over 24 syllables, however, we found both segmentation and generalisation (both $p < .05$).

Peña, M., Bonatti, L., Nespor, M., Mehler, J. (2002). Signal-driven computations in speech processing. *Science*, 298, 604-607.

A day in the life of a spoken word

Gareth Gaskell, Nicolas Dumay and Xiaojia Feng
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Recently, we demonstrated the delayed emergence of lexical competition effects for newly learnt spoken words (Gaskell & Dumay, 2003). For example, learning “cathedruke” leads (several days later) to slower recognition of “cathedral” because the novel item becomes a competitor to the existing word in the spoken word recognition process. Experiment 1 tested whether the previously reported delay in lexicalization was an artefact of a nonsemantic learning regime (repeated phoneme monitoring). We compared learning in these conditions with learning using sentence context and a clearly associated meaning. There was no evidence of swifter lexicalization for the richer context, and some evidence of the opposite result. Experiment 2 examined the time course of learning in more detail, with new stimuli in which the existing word was embedded in the novel item (e.g., “bellow” in “bellowst”). Experiment 2 used pause detection (Mattys & Clark, 2002) to detect the presence of a novel competitor, and showed no evidence of lexicalization immediately after exposure to the novel sequences. Instead, competition effects emerged without subsequent exposure when tested a day later. We interpret these results in terms of a consolidation process that integrates spoken words into the lexicon over a relatively protracted period of time.

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

Mattys, S.L.,m & Clark, J. H. (2002). Lexical activity in speech processing: evidence from pause detection. *Journal of Memory and Language*, 47,343-359.

ERP evidence on regular vs. irregular past-tense distinguishes between phonological and morphological contributions

Aureliu Lavric and Caroline Crentsill
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The status of regular morphological transformations (e.g. past-tense –ed suffixation: call-called, talk-talked) is central to the rekindled controversy between dual- and single-route models of morphological processing, which diverge in postulating (dual-route) or not (single-route) a default combinatorial process for regular items. Recently, the focus of the debate has been on the role of phonological differences between regular and irregular verbs in explaining selective deficits with regular items in brain damage (Tyler et al., 2002, Bird et al., 2003). ERP studies of morphology to date have relied on either the analysis of components of ERP waveform or cortical localisation of scalp potentials. In a new ERP past-tense production study, we integrated these analyses. An ERP component previously associated with syntactic processing (syntactic positive shift or P600) was more prominent in response to regular items. The localisation of this component revealed a double-dissociative pattern, with greater activity for regulars in the prefrontal cortex and greater activity for irregulars in temporal regions, consistent with previous localisation findings (Lavric et al., 2001). Importantly, the areas of surplus activity for regular items (e.g. dorso-lateral prefrontal) are not known for their intimate involvement in phonological processing. Our second ERP study directly manipulated phonological variables by using a same-different judgement task on past tense-stem pairs and by comparing the ERP response to regular and irregular pairs as well as pairs of words and non-words that sound like regular and irregular verbs. As above, our results are not consistent with a phonological account of the regular vs. irregular dissociation: we find an ERP difference between regular and irregular verbs that is not mirrored in the phonological control conditions.

Bird, H., Lambon Ralph, M.A., Seidenberg, M.S., McClelland, J.L., & Patterson, K. (2003). Deficits in phonology and past-tense morphology: what's the connection? *Journal of Memory and Language*, 48, 502–526.

Lavric, A., Pizzagalli, D., Forstmeier, S., & Rippon, G. (2001). A double-dissociation of regular and irregular English past-tense production revealed by Event-Related Potentials and Low Resolution Electromagnetic Tomography. *Clinical Neurophysiology*, 112, 1833–49.

Tyler, L.K., Randall, B., & Marslen-Wilson, W.D. (2002). Phonology and neuropsychology of the English past-tense. *Neuropsychologia*, 40, 1154–1166.

The assembly of phonology from print is serial and subject to strategic control: Evidence from Serbian

Jelena Havelka¹ and Kathleen Rastle²

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In this study, we used the special properties of the Serbian writing system to investigate two theoretical issues central to modeling skilled reading aloud: whether a serial procedure is implicated in print-to-sound translation, and whether particular components of the reading aloud system can be strategically controlled. In mixed-alphabet and pure-alphabet lists, participants read aloud phonologically-bivalent words (ie., words that have one pronunciation in Cyrillic and a different pronunciation in Roman, only one of which corresponds to a word) comprising bivalent (ie., ambiguous) letters in initial or final positions. Words with bivalent letters in initial positions were disadvantaged relative to non-bivalent controls to a greater degree than were words with bivalent letters in final positions, and the size of the bivalence effect was greater in the mixed-alphabet situations than in the pure-alphabet situations. Based on these data, we propose a dual-route theory of bi-alphabetic reading aloud in which the nonlexical procedure operates serially, and in which nonlexical spelling-sound correspondences for each script can be strategically emphasized or de-emphasized. Implications for models of bilingual reading aloud are also discussed.

Perceptual bases of social inferences from faces

Isabel M. Santos and Andrew W. Young

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Judgements about personality and other social characteristics based on facial appearance are remarkably consistent across individuals. However, the perceptual bases for such judgements are still not understood. A study examining reaction times to make social inferences based on the face showed that judgments of sex, age and attractiveness are relatively faster than approachability, intelligence and trustworthiness, suggesting different complexities of the various judgements. A second study with time-limited presentations of the facial stimuli also provided support for this hypothesis, indicating that the more complex social judgements require considerably more visual information than the judgements of age, sex and attractiveness. Given these observations, two further studies explored whether the various judgements rely on different perceptual representations. Inversion and photographic negation were used to investigate the visual processes underlying social inferences from the face. All characteristics were similarly impaired by inversion and negation, and an independent manipulation of hue and luminance showed that the effects of negation were mainly due to reversal of luminance values. These results suggest that both information about the spatial relations between features (whose processing is impaired by inversion) and information about the patterns of shape-from-shading (whose processing is impaired by brightness negation) are used in the perception of social characteristics from faces. Moreover, the fact that there was a

similar pattern of impairment across all judgements suggests that there is an initial common representation from which all characteristics are inferred.

Priming of emotion recognition

Naomi Carroll and Andrew W Young
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Priming techniques have been widely used to study visual recognition but have not been employed in investigating the recognition of emotion. Three experiments investigated priming of emotion recognition using a range of emotional stimuli including facial expressions, words, pictures and nonverbal sounds. In each experiment a prime-target paradigm was used with related, neutral and unrelated pairs. In experiment 1, facial expression primes preceded word targets in an emotion classification task. A pattern of priming of emotional word targets by related primes with no inhibition of unrelated primes was found. Experiment 2 reversed these primes and targets and found the same pattern of results, demonstrating bi-directional priming between facial expressions and words, and therefore showing that the priming effect can cross stimulus representations from nonverbal stimuli to verbal stimuli and vice versa. Experiment 2 also investigated priming of facial expression targets by picture primes and found a facilitation effect, and also inhibition. Experiment 3 extended the findings by demonstrating the same pattern of priming in an emotion classification task with facial expression and word targets, and nonverbal sound primes. This experiment demonstrates that the priming effect will cross sensory modalities. Experiment 3 also showed that priming does not just occur between pairs of stimuli that have a high co-occurrence in the environment (for example, nonverbal sounds and facial expressions), but with stimuli that co-occur less frequently and are linked mainly by their emotional category (nonverbal sounds and printed words).

Processes of polymorphous category acquisition

Andy Wills, Tom Beesley & Gareth Croft
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Polymorphous categories are those defined by m out of n rules. For example, one polymorphous category for stimuli varying in size, colour and shape would be "at least two of large, green and round". Undergraduates have considerable difficulty acquiring polymorphous categories - an intriguing result given the often-supposed prevalence of polymorphism in natural categories. Results presented at a previous EPS meeting (Cambridge, 2002) indicate that pre-training on individual dimensions can facilitate the acquisition of polymorphous categories compared to an equal number of trials on the polymorphous problem itself. In this presentation, we describe a series of experiments and numerical simulations designed to elucidate the processes that underlie this pre-training effect.

Task-set control processes can be measured with a task-cueing paradigm only if p(task-switch) is low

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The performance cost of a task-switch is typically reduced by advance knowledge of the task change and time to prepare. This preparation effect is usually taken to index executive control processes that reconfigure task-set. It is best studied using a paradigm in which the task is specified by a cue: the time available for preparation between cue and stimulus can be manipulated independently of other factors. However, recent studies have demonstrated the importance using of two cues per task to unconfound effects of cue change and task change. With cue change controlled, some have reported no task-switch cost and/or no preparation effect. We present data suggesting that the probability of a task switch is critical. With $p(\text{switch})=0.25$, a substantial and consistent task-switch cost and task-preparation effect were observed. With $p(\text{switch})=0.5$ (as in many cueing experiments) the effects were weaker and less consistent over subjects; they disappeared altogether at a higher switch probability. It seems that even a 50:50 chance of a task switch may encourage subjects to re-configure task-set prior to the cue. To measure task-set control with the cueing paradigm, one must keep $p(\text{switch})$ low enough to discourage task-set reconfiguration until a cue indicates a change of task.

Goal specificity, implicit learning and task-goal conflicts.

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The control of dynamic systems (Berry & Broadbent, 1984) has been presented as an example of implicit learning. In particular, it has been argued that either the underlying rule or previously correct instances have been learned implicitly rather than explicitly. Further, it has been argued that this situation arises as a product of the specificity of the goal of the task of maintaining a specific state. The current research argues that the reason for the failure to learn the rule explicitly is that there is a conflict between the task goal and the goal of learning the rule and that when this conflict is removed participants can learn the underlying rule explicitly. It is further argued, on the basis of verbal protocols collected during the task, that this task and rule learning conflict leads to the explicit referral to previous instances by participants. Overall, the results of this research suggest that the learning in the control of dynamic systems is explicit, independent of the specificity of the goal and depends on the relationship between the task and learning goals.

Berry, D. C., & Broadbent, D. E. (1984). On the relationship between task performance and associated verbalizable knowledge. *Quarterly Journal of Experimental Psychology*, *36A*, 209--231.

Dissociable temporal and spatial perceptions following saccadic eye movements

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The term saccadic chronostasis refers to the subjective temporal lengthening of a visual stimulus perceived following a saccadic eye movement. The perceived onset for such a stimulus appears to be antedated to a moment just prior to saccade initiation (Yarrow et al, 2001). If 1) such an illusion still arises when saccading to a moving stimulus, and 2) the brain constructs a unitary perceptual experience combining spatial and temporal stimulus qualities, we might predict that the initial position of a post-saccadic moving stimulus would be mislocalised backwards along its inferred trajectory. To test this prediction subjects either smoothly pursued moving stimuli initially presented at fixation (control condition) or saccaded to them prior to pursuit (saccade condition). They made both spatial (initial position) and temporal (duration) judgments in separate interleaved trials. Chronostasis was robust under these stimulus conditions, with post-saccadic targets perceived to have prolonged durations compared to constantly pursued targets. By contrast, mislocalisation judgments were similar in both conditions, with stimulus onset perceived ahead of its veridical position (c.f. the flash-lag effect). Hence perception of stimulus time is altered without a logically concomitant change in perceived stimulus position during saccadic chronostasis.

Yarrow et al (2001). *Nature*, 414, 302-305.

Visual search asymmetry and contour curvature polarity

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There has been great interest recently in curvature polarity (2D convexity and concavity) and perceived part structure. Visual search evidence suggests that concavities are easier to find among convexities than vice versa (Hulleman et al., 2000, Humphreys & Müller, 2000). However there are problems with this interpretation as the concave regions tested were more complex. There is also a problem of relating these findings to evidence of better performance for convexities (Bertamini & Croucher, 2003). We report here two visual search experiments that use simple regions: strictly convex and strictly concave (circular-holes). We use random dot stereograms to specify unambiguously what is figure. This is critical as curvature polarity reverses with figure/ground reversal. In Experiment 1 we found a concavity advantage but this was eliminated in Experiment 2 when there was no preview of the background. We suggest that, in Experiment 1, introducing holes caused the previewed background surface to change shape, and observers could detect this shape change efficiently. In contrast, introducing figures in front of the background does not alter its shape. In Experiment 2 the background appeared simultaneously with the targets and distractors, therefore there was no change in background shape with the presentation of holes.

Bertamini, M., & Croucher, C.J. (2003). The shape of holes. *Cognition*, 87, 1, 33-54.
Hulleman, J., te Winkel, W., & Boselie, F. (2000).

Concavities as basic features in visual search: Evidence from search asymmetries. *Perception & Psychophysics*, 62(1), 162-174. Humphreys, G. W., & Müller, H. (2000).

A search asymmetry reversed by figure-ground assignment. *Psychological Science*, 11(3), 196-201.

Group-based and feature-based inhibition: Further evidence from a probe-detection analysis of preview search

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Recent evidence suggests that observers can show an increased degree of inattentional-blindness to important new information if it carries critical feature attributes of other items being ignored: termed the ‘negative colour carryover’ effect (Braithwaite & Humphreys, 2003; Braithwaite, Humphreys, Hodsoll, 2003). The present findings extend this work by using a luminance probe-detection procedure embedded in a primary search task, to examine where attention is allocated. We presented participants with two separate preview search conditions. In both conditions the preview display contained items with an uneven colour bias (e.g., 66% red 33% green) – creating a ‘majority’ and ‘minority’ group. Added to this was a second search display containing a colour bias in the opposite direction (33% red, 66% green: equalling 50 / 50 overall at the time of search). In one condition the preview duration was a full 1000ms and in the other condition it was reduced to 150ms. We found that the negative colour carryover was abolished for new targets and probes at 150ms duration. However, probe detection in the old preview display was still influenced by which group it fell on. This suggest that ‘group-based’ and ‘feature-based’ mechanisms have a differing time course and may represented separate processes.

Braithwaite, J.J. & Humphreys, G.W. (2003) Inhibition and anticipation in visual search: Evidence from effects of color foreknowledge on preview search. *Perception & Psychophysics*, 65, 213-237.

Braithwaite, J.J., Humphreys, G.W., & Hodsoll, J. (2003) Color grouping in space and time: Evidence from negative color-based carry-over effects in preview search. *Journal of Experimental Psychology: Human Perception and Performance*, vol 29, No 4, 758-778.

Depth rotation and mirror-image reflection reduce affective preference as well as recognition memory for pictures of novel objects

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In two experiments, the identification of novel, 3D objects was worse for depth-rotated and mirror-reflected views compared to the study view in an implicit affective preference memory task as well as in an explicit recognition memory task. In Experiment 1, recognition was worse and preference was lower when depth-rotated views of an object were paired with an unstudied object relative to trials when the study view of that object was shown. There was a similar trend for mirror-reflected views. In Experiment 2, the study view of an object was both recognised and preferred above chance when it was paired with either depth-rotated or mirror-reflected views of that object. These results suggest that view-sensitive representations of objects mediate performance in implicit as well as explicit memory tasks. The findings do not support the claim that separate episodic and structural description representations underlie performance in implicit and explicit memory tasks respectively.

Emotion processing in Huntington's disease

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We present a detailed analysis of emotion processing in patients with manifest Huntington's disease (HD). In contrast to previous research showing a disproportionate impairment in recognising facial signals of disgust in HD patients, anger was most severely impaired in the current study. This was particularly evident in patients with unimpaired scores on the Benton unfamiliar face matching test; hence, the anger impairment for facial expressions cannot be attributed to deficits in basic face processing skills. A disproportionate anger impairment was also evident for recognition of vocal signals of emotion. Similarly, an anger deficit was observed on a test of conceptual knowledge of emotion, while performance on other emotions was intact. The close relationship between anger and disgust may explain the inconsistency between our current findings and earlier research. This interpretation is supported by the HD patients' performance on an adapted version of an experiment addressing the association among three disgust subcategories and each of three facial cues (Rozin et al., 1994, JPSP 66) - nose wrinkle (associated with offensive smells), mouth gap (associated with offensive tastes), and upper lip curl (associated with moral violations relating to disgust, e.g., sexual abuse), a form of disgust that is frequently accompanied by anger. While patients and controls could identify the association between subtype of disgust relating to nose wrinkle and mouth gap, their performance with the moral (anger-related) subtype was at chance. The relationship between these results and our recent work implicating the ventral striatum and dopamine system in anger processing will be discussed.

“Are you lookin’ at me?” In search of the DeNiro effect

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Adaptation effects are taken as evidence of cell populations that are tuned to the adapting stimulus. Given that cell recordings in macaques have identified cells in superior temporal sulcus (STS) that respond selectively to particular directions of gaze, we explored whether adaptation effects could be found for directed eye gaze stimuli. Before adaptation, observers were accurate at discerning the direction of seen gaze. However, adaptation to 25° leftward or rightward gaze (blocked) produced a powerful illusion that virtually eliminated subjects' ability to detect eye gaze on the adapted side; eye gaze averted 5° or 10° in the adapted direction was perceived as looking straight ahead, whereas direct gaze (0°) tended to be judged as averted in the unadapted direction. This pattern held even when retinotopic mapping between the adapting and test stimuli was disrupted by changes in identity and head orientation, demonstrating that our findings do not reflect low-level effects. A final experiment showed that adaptation to 25° averted gaze did not affect judgements of line bisection, illustrating that the adaptation effect we have observed does not reflect a general spatial bias. We interpret the results as evidence of human cell populations tuned to specific directions of seen gaze.

Unfamiliar faces aren't faces

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It is very hard to match two images of the same unfamiliar face, even under good lighting conditions. Here we use the line-up task introduced by Bruce et al (1999), and show that there are large individual differences on unfamiliar face matching. We try to predict these differences using a variety of tests, including visual short-term memory, perceptual style and perceptual speed. Some tests produce moderate correlations with face matching, and some do not. Furthermore, there is no correlation between unfamiliar face matching and measures of familiar face recognition. By far the best predictor of unfamiliar face matching is performance on the same task upside down, a correlation which is completely absent for familiar faces. We conclude that unfamiliar face matching is essentially image-matching, and does not engage any specialist ("expert") face processing skills.

Bruce, V., Henderson, Z., Greenwood, K., Hancock, P., Burton, A.M. & Miller, P. (1999). Verification of face identities from images captured on video. *Journal of Experimental Psychology: Applied*, 5, 339-360.

Multiple object naming in the elderly

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Object naming seems to become more effortful and error-prone with increasing age. Such age-related changes to word retrieval may result from general slowing of cognitive processes or from specific slowing of lexical retrieval processes. Alternatively, elderly speakers may find it increasingly difficult to inhibit irrelevant information. In utterance generation, this may affect the retrieval of individual words as well as their ordered insertion in an utterance plan. We assessed 16 elderly speakers (aged 52 to 88 years), in a single- and a multiple-object naming task and compared their performance to a control group of young speakers. We found no age-related differences in single-object naming. In multiple object naming, processing times for the objects (measured through the gaze durations for the objects) were longer in elderly than in young speakers. The coordination of eye gaze and speech, however, did not differ substantially between groups. When the difficulty of lexical-semantic and phonological encoding was varied, similar effects on processing times were observed in both age groups. Overall, our findings are most compatible with the general slowing hypothesis of age-related changes to word retrieval.

Serial order errors in practiced object naming

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In language production, serial ordering errors occur when previously spoken or upcoming words interfere with the current word. Dell et al. (1997) demonstrated that the proportion of ordering errors that is anticipatory (rather than perseveratory) increases as the overall error rate decreases. Thus, a well-functioning system is an anticipatory system. We tested whether 'Dell's law' would hold when participants named sequences of objects with phonologically related names (e.g., *shoe, chair, church, sheep, shell, cheese*). To allow us to examine the effects of practice, participants named the set of objects up to 20 times. In Experiment 1, the pictures remained on screen on all trials. In Experiment 2 they were removed on half the trials after a familiarisation phase and participants recited the object names from memory. The overall error rates were similar to those reported by Dell et al. and the error rates decreased with practice. However, the proportion of anticipatory errors did not increase with decreasing error rate but remained constant. We will compare our paradigm and results to those of related studies and discuss which variables may moderate the relationship between overall error rate and the rate of anticipatory errors.

Dell, G.S., Burger, L.K. & Svec, W.R. (1997). Language Production and Serial Order: A Functional Analysis and a Model. *Psychological Review*, 104, 123-147.

Age-of-Acquisition effects in word and object naming in Turkish

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Emerging evidence suggests that AoA plays an important role in word naming across a range of alphabetic writing systems with a varying degree of transparency between orthography to phonology mappings. This is contrary to the predictions of the arbitrary mapping hypothesis (Ellis & Lambon-Ralph, 2000) which argue that AoA effects should be stronger for tasks that involve arbitrary mappings between representations than for tasks that involve consistent mappings. Turkish orthography is characterised by totally predictable and context independent one-to-one representations between print and sound therefore an optimal medium to test the claims of the arbitrary mapping hypothesis. Turkish undergraduates named words and line drawings taken from the Snodgrass and Vanderwart (1980) set and rated for AoA, frequency, name agreement and object familiarity. The findings from the current experiments disagree with the claim that AoA effects should be reduced for transparent orthographies and are discussed with reference to the arbitrary mapping framework.

Ellis, A. W. & Lambon-Ralph, M. A. (2000). Age of acquisition effects in adult lexical processing reflect loss of plasticity in maturing systems: Insights from connectionist networks. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 26, 1103-1123.

Snodgrass, J.G. & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology: Human Learning and Memory*, 6, 174-215.

Gender priming effects in Spanish picture naming

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Grammatical gender is a widespread phenomenon in the languages around the world. Perhaps for this reason it has captured the attention of researchers from different scientific perspectives. In the domain of word production most studies have used the picture-word-interference paradigm which presents its own problems but two studies have explored gender priming effects on picture naming. They found contradictory results showing gender facilitation in one study (Jacobsen, 1999) but no significant effects in the other (Jeschaniak, 1999). We report 3 experiments designed to investigate gender priming effects on Spanish picture naming latencies. In Experiment 1 participants read masculine and feminine gender primes aloud then named pictures whose gender did or did not match the prime. Reliable facilitatory and inhibitory effects were found. In Experiment 2 gender information facilitated (congruent) or inhibited (incongruent) picture naming latencies across three word production blocks of trials. In Experiment 3 participants read the primes silently before naming the pictures. Congruent gender

priming facilitated naming reaction times but there was no inhibition from incongruent primes. The results help to clarify some of the contradictions in the Jescheniak (1999) and Jacobsen (1999) studies and suggest a role for grammatical gender in lexical retrieval.

Jacobsen, T. (1999). Effects of grammatical gender on picture and word naming: Evidence from German. *Journal of Psycholinguistic Research*, 28, 499-514.

Jescheniak, J. D. (1999). Gender priming in picture naming: Modality and baseline effects. *Journal of Psycholinguistic Research*, 28, 729-737.

The influence of non-foveal length information on eye fixations during reading

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In reading, information regarding the length of a word to the right of fixation (the parafoveal word) is a main determinant about where to move the eyes. Inhoff, Radach, Eiter & Juhasz (2003) manipulated this length information by presenting participants with either accurate or inaccurate length information parafoveally. However, the preview always consisted of a nonword and the target word, once fixated, was always a single word. The current study used a specific type of English compound word, where the deletion of the first letter of the second lexeme forms two short words (e.g. "backhand" and "back and"). Target words were embedded in identical neutral sentences up to the target word(s), as demonstrated below.

1a. Michael used his strong backhand many times during the long tennis match.

1b. Michael used his strong back and legs to lift the heavy couch for Suzy.

Eye movements were monitored either correct or incorrect parafoveal length information was provided. Results demonstrate that reading time on the target is significantly slowed by inaccurate length previews and that this slowing may be larger when the targets are two short words. The results will be discussed in terms of current models of eye movements.

Inhoff, A.W., Eiter, B.M., Radach, R. & Juhasz, B. (2003). Distinct subsystems for the parafoveal processing of spatial and linguistic information during eye fixations in reading. *Quarterly Journal of Experimental Psychology*, 56 (5), 803-827.

Fixation stability and phonological processing skills in adults with developmental dyslexia: Implications for reading

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Fixation stability and phonological processing skills are important for reading, and it has been proposed that children with dyslexia may perform less well on both measures concurrently, or have difficulties on one task independently of the other (Eden et al, 1994). Adults with dyslexia have been shown to have weak phonological skills (Ramas, et al, 2003), but their fixation stability has not yet been investigated. In Experiment 1, fixation stability was examined by measuring eye velocity in a task requiring stable fixation over a variable period. In Experiment 2, participants responded to visual targets without making eye movements. The number of trials in which eye movements or blinks were detected was measured. Phonological processing was assessed in both experiments using spoonerism and phoneme deletion tasks. In both studies, the group with dyslexia showed significantly lower accuracy on word and nonword reading than controls, and also demonstrated poorer phonological skills on both tasks. There was no difference between groups in eye velocity during “fixation” in Experiment 1. In Experiment 2, both groups moved their eyes on a similar proportion of trials. Our results suggest that in adulthood, poorer phonological skills, but not problems with fixation stability influence reading performance in dyslexia.

Eden, G, Stein, J, Wood, H, & Wood, F, 1994, Differences in eye movements and reading problems in dyslexic and normal children, *Vision Research*, 34 (10), 1345-58.
Ramas, F, Rosen, S, Dakin, S, Day, B, Castellote, J, White, S and Frith, U, 2003 *Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults*, *Brain*, 126, 841-865.

Lateralized cueing effects in the left and right segments of centrally presented words

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To address the extent to which the visual foveal representation is split (Lavidor & Walsh, 2003), we employed spatial cueing paradigm when cues were presented in the right or left visual fields (RVF and LVF respectively) preceding centrally presented words and pseudowords. We found a selective ipsilateral cueing effect on letter recognition, with better performance in the left segment of centrally presented targets following an LVF but not RVF cue. This pattern, however, was not obtained for letter recognition in the right segment, unless cueing was explicit. We compare our findings with previous spatial orienting studies (Auclair and Siéroff, 2002; Siéroff & Posner, 1988) and argue that our data and those of previous studies can be accommodated most parsimoniously by the split fovea theory.

Auclair, L. & Siéroff, E. (2002). Attentional cueing effect in the identification of words and pseudowords of different length. *The Quarterly Journal of Experimental Psychology*, 55A, 445-463.

Lavidor, M., & Walsh, V. (2003). A magnetic stimulation examination of orthographic neighbourhood effects in visual word recognition. *Journal of Cognitive Neuroscience*, 15, 354-363. Siéroff, E., & Posner, M. I. (1988). Cueing spatial attention during processing of words and letter strings in normals., *Cognitive Neuropsychology*, 5, 451-472.

Metronome phase shift effects on bilateral alternate responding: One timer or two?

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It is often assumed that the timing of bilateral cyclic arm movements involves two separate internal timers (oscillators) whose coupling varies with phase and frequency. In such studies frequency is usually set with a metronome. In studies of unilateral tapping, synchronisation with a metronome has been modelled as a first-order linear feedback correction process with timer phase adjusted in proportion to the discrepancy between response and metronome pulse. The correction factor may be estimated by the compensation seen following unpredictable phase shift in the metronome. We hypothesised that compensation for metronome phase error in alternate bilateral responding would show evidence of two lateralised timers. In separate experiments we investigated synchronisation with auditory pulses at 500 ms intervals when tapping with (Exp I) alternate hands and (Exp II) alternate feet. We predicted that a phase error introduced by a metronome shift (+/-50 ms) occurring with a response on the left or the right would not be compensated until the next response on that same side. Group average results (N=8) showed reliable phase compensation in both experiments (the compensation was more rapid in I than II). There was no evidence of compensation being delayed until the next response on the same side as the initial phase error. We conclude that bilateral alternate movements are regulated by a single timer.

The effect of alternating force on the reproduction of alternating time intervals in rhythmic tapping

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Motor variability increases with response amplitude on many dimensions including force and duration (signal dependent noise). In repetitive tapping, a sense of rhythm derives from patterning of response force as well as time. For instance, a binary grouping derives from alternating hard and soft responses, as well as from alternating long and short durations. We hypothesised that force and timing involve separate control systems and predicted additivity of variability effects when rhythm is defined by the conjunction of force and time. Participants ($N = 13$) reproduced five different rhythmic sequences defined by alternation of duration (with equal force), alternation of force (with equal duration) or alternation on both dimensions. Responses were made by squeezing a force transducer between finger and thumb. Each trial started with a brief phase of

synchronising with an auditory cue. Target intervals were either equal (600 ms) or alternated between two values (400-800 ms); target forces were similarly either equal (12 N) or alternating (8-16 N). In general it was found that variability (SD) was greater during alternation. SD was greater with alternation on the other dimension and there was a reliable interaction with alternation of both force and time. We conclude that control of force and time in rhythm production are not independent.

Force and time control in Parkinson's disease patients and elderly controls: the role of the basal ganglia in rhythmic motor production

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Separate studies have shown that Parkinson's disease, which is a disorder of the basal ganglia, results in impaired control of the force of motor responses and the timing of interresponse intervals. The present study investigated the relation between time and force control during the production of rhythmic motor sequences. Parkinsonian patients ($N = 8$) and elderly controls ($N = 8$) reproduced five different rhythmic sequences, with both the left and right hand, in the presence (*synchronization*) and absence (*continuation*) of an auditory pacing cue. Pacing tones were separated by either equal (600 ms) or unequal (400-800 ms) intervals, and could be produced with equal (12 N) or unequal (8-16 N) forces. Task difficulty was balanced across each condition. Both groups of participants practiced the production of target force levels in a repeating figure with each hand prior to experimentation. In general it was found that variability (SD) increased with the mean, and more so with alternation on two dimensions. Patients were more variable than controls in both force and time and showed greater deficits in performance of alternation tasks, especially when force and time alternated together. These results indicate the involvement of the basal ganglia in modulation of force and time in rhythmic actions and provide evidence of interdependence in the control of time and force.

Trajectory formation in timed repetitive movements

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Previous studies of repetitive movements have either looked at movement trajectories or the nature and variability of synchronisation errors. In the current study, we investigated the relationship between timing accuracy and movement trajectories. Eight musically trained right-handed adults performed rhythmic index finger movements with respect to auditory metronomic events at three intervals (1000ms, 750ms and 500ms). In a separate unpaced condition participants oscillated their index fingers in the absence of a metronome. We observed that the paced movement trajectories exhibited an asymmetry with respect to time and velocity in the out and return phases of the repeating movement cycle, while the unpaced ones did not. Paced movements were also less smooth in that they exhibited higher values of mean squared jerk. The degree of asymmetry in the flexion and extension movement times was positively correlated with

timing accuracy. Additionally, negative correlations were observed between timing error and the movement time of the following return phase suggesting that late arrival of the finger is compensated by a shorter return phase and conversely for early arrival. We conclude that the movement asymmetry is an important feature of timed movements that actively contributes to precision and accuracy. We illustrate this point further by presenting data from another experiment in which participants performed repetitive movements in a viscous force field, where the trajectory asymmetry is compromised by a velocity dependent perturbation.

Memory and metabolism: the effects of glucose and oxygen administration on cognitive performance

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The biochemical processes underpinning cognitive functioning have received considerable recent attention. The brain has a high metabolic rate relative to its mass and volume, and its metabolism is almost entirely restricted to oxidative utilization of glucose, with aerobic carbohydrate metabolism being essentially the only source of energy available for brain tissue. This paper will consider the extent to which fundamental metabolic processes - implicating glucose as the essential metabolic fuel, and oxygen as the essential reagent - impact upon cognitive status. We will report a series of findings which indicate that a) the ingestion of glucose prior to the learning episode may benefit long-term memory (LTM) up to one day later, b) ingestion of glucose appears to benefit LTM consolidation processes (yet this effect is reliably observed in our work only when cognitive processes are challenged via a dual task procedure at the time of encoding of the to-be-remembered materials), and c) some effects of oxygen administration on cognitive functioning have also been observed (although we have found that the effects of oxygen when administered in conjunction with glucose remain to be reliably determined).

Predicting working memory span and its relation to educational achievement in individuals with moderate learning difficulties

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Previous research has shown that individual differences in processing efficiency and storage ability are both important constraints on the working memory span of typically developing children (Bayliss, Jarrold, Gunn & Baddeley, 2003). The present study examined whether the same factors constrain the working memory performance of individuals with generalised learning difficulties. 60 individuals with moderate learning difficulties (MLD) and a comparison group of 60 typically developing individuals (TD) completed two working memory span tasks that combined verbal processing with either

verbal or visuo-spatial storage. Participants also completed independent measures of the processing and storage requirements involved in each task, and Raven's Coloured Matrices. The results showed that despite equivalent levels of working memory span, the relative importance of the factors constraining the working memory performance of the MLD and TD groups differed. In addition, working memory span itself predicted word recognition and sentence comprehension ability in the TD group only. These findings suggest that MLD and TD individuals achieve working memory span at different rates and in qualitatively different ways. Furthermore, these results emphasise the fact that working memory span is multiply determined, and consequently, that working memory span measures may tap different underlying processes in different populations.

Bayliss, D. M., Jarrold, C., Gunn, D. M., & Baddeley, A. D. (2003). The complexities of complex span: Explaining individual differences in working memory in children and adults. *Journal of Experimental Psychology: General*, 132, 71-92.

Cued recall tests can behave like the reading span test in predicting individual's language comprehension scores

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Many previous studies have shown that scores on the reading span test significantly predict individual's language comprehension abilities. In the present study, we examined an issue regarding this strong predictive power of the reading span test, an issue that is still unresolved in the field. Sixty-three participants were required to perform a language comprehension test, a reading span test, a word span test, and four cued recall tests. Two cued recall tests that have been developed by Haarmann, Davelaar, and Usher (2003) used a semantic category cue and the other two that have been newly developed in this study used a colour cue to recall a list of 9 or 12 words. Results showed that the reading span scores correlated with the language comprehension scores more strongly than did the word span scores, replicating findings from previous studies. Furthermore, recall scores on a category-cue test and those on a colour-cue test both significantly correlated with reading span and language comprehension scores. Partial correlation analyses revealed that a lot of variances were shared among the reading span, the category-cue test, and the colour-cue test scores and that these variances could predict the language comprehension scores.

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.

“Working Memory” constraints on attentional capture

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Three experiments examine the possibility that resistance to involuntary attentional capture (as indexed by the “irrelevant sound effect”; Beaman & Jones, 1997) is related to working memory capabilities. Research by Conway, Cowan & Bunting (2001) suggests that control of auditory attention is affected by working memory capacity, whereas other research (Ellermeier & Zimmer, 1997; Neath, Farley & Surprenant, 2003) failed to find any link between irrelevant sound effects and digit-span measures of immediate memory. Experiment One investigates the Operation Span (OSPAN) measure of Conway et al. (2001) and shows that the OSPAN measure is itself influenced by auditory distracters. Experiment Two fails to find an association between OSPAN and individual differences in susceptibility to irrelevant sound in serial recall. Experiment Three examines the effects of OSPAN on a free recall measure and shows that semantic effects of irrelevant speech are related to OSPAN. It is concluded that OSPAN measures a capacity to ignore semantically-mediated aspects of attentional capture but has little or no discernible impact upon the perceptually-based effects of irrelevant sound.

Beaman, C. P., & Jones, D. M. (1997). Role of serial order in the irrelevant speech effect: Tests of the changing-state hypothesis. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 23, 459-471

Conway, A. R. A., Cowan, N., & Bunting, M. F. (2001). The cocktail party phenomenon revisited: The importance of working memory capacity. *Psychonomic Bulletin and Review*, 8, 331-335.

Ellermeier, W., & Zimmer, K. (1997) Individual differences in susceptibility to the "irrelevant speech effect". *Journal of the Acoustical Society of America*, 102, 2191-2199.

Neath, I., Farley, L. A., & Surprenant, A. M. (2003). Directly assessing the relationship between irrelevant speech and articulatory suppression. *Quarterly Journal of Experimental Psychology*, 56A, 1269-1278.

Examining the relationship between free recall and immediate serial recall

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Six experiments examined whether free recall and immediate serial recall (ISR) are underpinned by similar cognitive mechanisms. Experiments 1-4 investigated the effects of performing the two tasks concurrently under different encoding conditions, and in each a trade-off was found between ISR and words that were rehearsed in free recall. In Experiments 5 and 6 participants saw sequences of eight words and had to perform one of the two tests. Different serial position curves for free recall and ISR were obtained,

but there was no effect of pre-cueing or post-cueing the type of test to be performed. We conclude that rehearsal is common to both tasks, and that the different serial position curves found for the two tasks reflect different task instructions, output orders, and scoring systems.

Jamais vu: inappropriate sensations of unfamiliarity

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One of the phenomena associated with déjà vu, jamais vu has been described as a subjective experience of unfamiliarity for a highly familiar stimulus; in essence the reverse of déjà vu. Evidence for this type of sensation has come from a few retrospective diary studies, and has largely taken parapsychological or individual differences viewpoint. One problem with the literature on jamais vu and other forms of déjà vu, is that it is has been difficult to induce in the laboratory. We used a strictly experimental approach, with the aim of examining jamais vu in the laboratory. Ninety participants were required to repeatedly write out 12 single words (4 highly familiar, 4 moderately familiar and 4 unfamiliar) as fast as they could or until the item felt peculiar. Participants made subjective report of their phenomenological experience if they felt peculiar whilst writing. We observed jamais vu in a substantial proportion of our participants, and this experience was described as similar to other sensations experienced in everyday life. Most interestingly, the incidence of jamais vu varied significantly across word type, with participants reporting more jamais vu for familiar words, supporting the notion that jamais vu is an inappropriate sensation for highly familiar stimuli. A novel theory of the phenomenology of memory is introduced.

Testing the “associative responses” account of false recall and false recognition

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Three experiments tested the view that false memories in the laboratory are caused by associative responses to studied items. Experiment 1 showed that preventing the generation of associates by a secondary task (random number generation: RNG) reduced false "remember" responses. Experiment 2 showed that explicitly instructing participants to make associations to study items increased false "remember" responses. Experiment 3 compared the effects of different secondary tasks on false recall using the DRM procedure. The false recall of critical lures was reduced by RNG but increased by a secondary task that did not prevent the generation of associates (digit monitoring). The findings support the view that false recall and false recognition are caused by participants making associations to items presented at study.

Domain-specific expertise in solving insight puzzles

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The paper reports an empirical study that compared experienced designers and financiers attempting to solve insight puzzles. The puzzles had presentation formats that were either predominantly visual (e.g., the nine-dot problem) or verbal e.g., (the 554bc problem). Solution rates for the puzzles varied by group and by type, the visual problems being solved more often by designers than by financiers, with no group differences for the verbal problems. Analysis of solution protocols suggests that flexibility in the use of visualization strategies may underlie these differences. Specifically, both groups made the same kinds of early attempts that revealed similar solution ideas and errors on both verbal and visual problems. However, group differences emerged with visual problems once participants had encountered an impasse, with designers using sketching (either actual or virtual) to search for alternate problem representations that might reveal novel move attempts. To our knowledge, this is the first demonstration of a group difference in insight problem-solving competence. The results also cast light upon the role of sketching in creative idea discovery.

Predicting performance from a model of insight in a suite of novel ball-weighing problems.

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We have recently developed a theoretical model of insight problem-solving, which is successful in predicting patterns of outcome in a variety of tasks such as the nine-dot, eight-coin and six-coin problems (Chronicle et al, 2004; MacGregor et al, 2001; Ormerod et al, 2002). The model assumes that problem solvers tend to monitor their progress against a plausible criterion, and that they maximize the value of moves made early in their attempt. Impasse occurs when maximizing moves that meet the criterion of progress – but are incorrect – are selected and retained. We here introduce a suite of novel ball-weighing problems that permit manipulation of the criterion of progress, and compare model predictions against human performance. In Experiment 1, participants were significantly less likely to solve the 8-ball version of the problem, in which a maximizing first move was incorrect, than the 7-ball version of the problem in which a maximizing first move was correct. Some unusual moves on a third version of the problem are noted and discussed. In Experiment 2, participants attempted the same problems represented on an interactive computer display, enabling measurement of response latency and trials to criterion. Quantitative predictions from the model across three versions of the problem were again supported by data. Results from both experiments support our view that maximization and progress monitoring are of central importance in understanding both failure and success in insight problems.

Chronicle, E. P., MacGregor, J. N. and Ormerod, T. C. What makes an insight problem? The roles of heuristics, goal conception and solution recoding in knowledge-lean problems. *Journal of Experimental Psychology: Learning, Memory and Cognition* 2004, 30, 14-27.

MacGregor, J. N., Ormerod, T. C. and Chronicle, E. P. Insight and information-processing: a process model of performance on the nine-dot and related problems. *Journal of Experimental Psychology: Learning, Memory and Cognition* 2001, 27, 176-201.

Ormerod, T. C., MacGregor, J. N. and Chronicle, E. P. Dynamics and constraints in insight problem-solving. *Journal of Experimental Psychology: Learning, Memory and Cognition* 2002, 28, 791-799.

Examining insight in children

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Insight is an “aha!” experience that has rarely been examined in children, even though the development of insight could provide clues as to what the insight process involves. The effect of giftedness and the use of hints on insight were examined by two studies of insight using 274 children between the ages of 7 and 10. The insight task for both studies involved a taxi car needing to be maneuvered out of a car park (Jones, 2003), the insight being the taxi move itself. Experiment one showed no effect of giftedness, while experiment two showed that children benefit from the use of a hint. Across both experiments, the first taxi move took significantly longer than the previous and post moves, indicating that children reach impasse and achieve subsequent insight. Interestingly, there was a gender effect in both studies, with males completing the insight problem more quickly than females. Furthermore, there was an interaction between hint and gender, with no-hint females taking longer than all other conditions. Children can achieve insight and can benefit from the use of a hint related to the insight. Further studies need to examine the effect that gender has on insight problem solving.

Jones, G. (2003). Testing two cognitive theories of insight. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 29, 1017-1027.

Insights from the cheap necklace problem

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A current question in problem-solving research is whether the processes invoked in solving insight and non-insight problems are qualitatively different. We compare two alternative theories, chunk decomposition (Knoblich et al., 1999) that holds insight problem-solving as a special process, and progress monitoring (MacGregor et al., 2001),

that posits the same processes for insight and non-insight problem-solving. We report experiments that test competing hypotheses derived from these theories with the ‘cheap necklace’ problem, a task in which participants must fix a broken chain with resources that appear, at first sight, to be insufficient to complete the task. Performance was not facilitated in experiments where explicit and implicit cues to chunk decomposition were provided. Patterns of initial moves indicate that participants selected moves on the basis of perceived progress rather than as a result of cues to chunk decomposition. Further experiments manipulated the point at which participants experienced failure of a criterion to judge the progress made by move sequences. The experiments suggest that, while both chunk decomposition and progress monitoring may play a role in mediating problem difficulty, when these factors are ameliorated, the cheap necklace remains a difficult problem. A number of problem-specific features are discussed that may lie at the source of its difficulty.

Knoblich, G., Ohlsson, S., Haider, H., & Rhenius, D. (1999). Constraint relaxation and chunk decomposition in insight problem solving. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 25, 1534-1555.

MacGregor, J. N., Ormerod, T. C., & Chronicle, E. P. (2001). Information-processing and insight: A process model of performance on the nine-dot and related problems. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 27, 176-201.

Why do problem solvers get stuck? Inappropriate heuristics vs. inappropriate representations.

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At present, there are two different approaches to explain why problem solver encounter impasses. The progress monitoring theory (MacGregor et al, 2001) assumes that inappropriate heuristics cause impasses. The representational change theory proposes that impasses result from an inappropriate problem representation (Knoblich et al, 1999). We conducted an experiment (N = 120) that allowed us to systematically assess the influence of both sources of difficulty. The participants solved a number of two-move matchstick arithmetic problems which could be solved using a hill-climbing heuristic or which could not be solved with this heuristic.

In addition, the problems required a more or less extended representational change. There was no evidence that the applicability of a hill-climbing heuristic affected the solution rates. However, the solution rates varied systematically with the degree to which a representational change was necessary.

Knoblich, G., Ohlsson, S., Haider, H., & Rhenius, D. (1999). Constraint relaxation and chunk decomposition in insight problem solving. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 25, 1534-1555.

MacGregor, J.N., Ormerod, T. C., & Chronicle, E. P. (2001). Information-processing and insight: A process model of performance on the nine-dot and related problems. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 27, 176-201.

Differentiating insight from non-insight problems

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This study aimed to investigate whether a range of tasks which have been classed in the literature as requiring insight form an empirically separable group of tasks distinct from tasks generally classed as non-insight.

24 diverse tasks assumed to be good examples of insight tasks, 10 non-insight tasks and a range of tests of individual differences in cognitive abilities and working memory were administered to 60 participants. Performance measures were used as the basis of a cluster analysis of the problem solving tasks. The results indicated that the presumed insight problems did tend to cluster with other presumed insight problems and similarly the presumed non-insight problems tended to cluster with other presumed non-insight tasks. This finding supports the view that insight tasks do form separable groups of tasks distinct from non-insight tasks. Analysis of correlations between individual difference measures and performance on the various tasks indicated that performance on presumed insight problems was particularly linked to measures of ideational fluency and flexibility with a different pattern of results for the non-insight tasks. These findings were supported by analysis of composite insight and non-insight task scores which also indicated particular links between insight problem solving and fluency and flexibility. Overall, these results supported the distinction between insight and non-insight tasks.

The pattern of correlations of working memory measures with composite insight scores was similar to that with non-insight composite scores and indicated that working memory processes play a role in insight problem solving.

Lexical predictors of word association

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In order to investigate recent theoretical accounts of semantic processing, we report a study in which participants were required to generate associates to presented words. We used a discrete word association task, where participants were required to produce verbally an associate to a visually-presented word. Age of acquisition and frequency were significant predictors of performance, but there was no independent influence of cumulative frequency on responses. We conclude that age of acquisition and frequency both exert an influence on semantic processing, and our data fit well with Steyvers and Tenenbaum's (2004) semantic growth model, which proposes that: (1) the nodes that represent the meanings of early-acquired words have higher connectivity values than the nodes that represent the meanings of late-acquired words in the semantic network, and (2) frequency is an important determinant of how much information is stored within a word's semantic representation.

Steyvers, M. & Tenenbaum, J. (2004). The Large-Scale Structure of Semantic Networks: Statistical Analyses and a Model of Semantic Growth. *Unpublished manuscript*.

Further investigations of the on-line processing of relative quantifier scope during reading

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Filik, Paterson, and Liversedge (in press) investigated the processing of doubly quantified sentences like ‘Kelly showed a photo to every critic’ that are ambiguous between the indefinite (‘a photo’) specifying single or multiple referents. Ambiguity resolution requires the computation of relative quantifier scope: whether ‘a’ or ‘every’ takes wide scope, thereby determining how many entities or events are to be represented. Factors proposed to influence this process include: the linear order of the quantifiers in the sentence; the grammatical function of each quantified phrase, and the characteristics of the individual quantifiers. Using eye-tracking, both Filik et al. and the current study found evidence for the competition of alternative analyses during the processing of relative quantifier scope, with increased reading times at the quantified region of the sentence when factors affecting scope processing were in conflict. Both studies found a preference for singular NP anaphor continuations to the quantified sentence. The current study showed that replacing ‘every’ with ‘each’ (which has stronger distributive properties) did not affect scope processing. We conclude that relative quantifier scope is computed on-line during reading through the competition of alternative analyses, but may not be a prerequisite for the resolution of NP anaphors unless required by secondary tasks.

Filik, R., Paterson, K. B., & Liversedge, S. P. (in press). Processing doubly quantified sentences: Evidence from eye movements. *Psychonomic Bulletin and Review*.

Retention of words suppresses semantic associates: the prime-retention effect

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The well-known theoretical explanation of semantic priming based on spreading of activation is tested using a slight variation of the lexical decision paradigm. In this paradigm, a participant is required to remember the prime while conducting a lexical decision to a target and then subsequently report the prime word. In a series of experiments, it is shown that compared to a standard control condition, the priming effect in this retention-condition is eliminated. This "prime-retention effect" is shown to be strongest for weakly related targets than for strongly related targets and at long compared to short stimulus-onset asynchrony. These results are interpreted within a Center-Surround framework, where an inhibitory mechanism suppresses the activation of semantically related items within the mental lexicon, thereby avoiding distractability within working memory.

Similarity effects in children, working memory span

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Two experiments investigated the effects of similarity between processing and storage stimuli on the complex memory span of children aged seven and nine years of age. In Experiment 1, the processing tasks involved either number operations or sentence processing, and the stimuli to be recalled were either words or digits. A domain-similarity decrement was found, with superior memory span when the items to be remembered belonged to a different category than the material that was processed. Experiment 2 examined whether disruptive effects of similarity in the lexical-verbal domain operate at a lexical or phonological level. Recall of word and nonword stimuli was compared under conditions of concurrent word processing, nonword processing and articulatory suppression. Word recall was impaired to a significant but small extent by concurrent nonword processing, and to a much greater extent by concurrent word processing. In contrast, both word and nonword processing led to small but significant decrements in the recall of nonwords. These findings provide evidence for domain-specific interference between the processing and storage elements of complex memory tasks that appears to operate at the lexical-semantic level. The possible role played by inhibitory processes within working memory is discussed.

The Tip-of-the-Tongue effect in children: Do their gestures facilitate lexical access?

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The role of gesturing has been studied extensively in adults and is found to play a role in both communication and cognition. Two main theories explain the role of gesturing in cognition; the Information Packaging approach, in which gesture aids the speaker in 'thinking' and the Lexical Retrieval hypothesis where gestures function more to facilitate 'speaking'. Research into children's gesturing offers considerable support for the Information Packaging approach but less attention has been paid to how gestures may also facilitate lexical access in children. The study to be presented is an experimental investigation of the lexical retrieval hypothesis, with 65 children participating aged from 6 to 8 years. It employs a paradigm used by Beattie & Coughlan (1999) with adults. The children were asked to name objects presented pictorially under two conditions: *gesture-allowed* and *gesture-restriction*. When allowed to gesture children identified reliably more items correctly, compared to when their hand gestures were restricted. Children also resolved significantly more tip-of-the-tongue (ToT) states in the *gesture-allowed* condition. Thus restricting gestures had a detrimental effect on children's lexical access and impeded their ability to resolve a ToT state. These findings suggest that gestures are important in aiding lexical retrieval in children.

Beattie, G. & Coughlan, J. (1999). An experimental investigation of the role of iconic gestures in lexical access using the tip-of-the-tongue phenomenon. *British Journal of Psychology*, 90, 35 - 56.

How analysing microgenetic data can reveal predictors of conceptual insight: Findings from a study of early numeracy

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Microgenetic training studies allow for analysis of individual-level effects while modelling strategy-change. We used binomial modelling to assess patterns of change in young children's grasp of cardinal numbers as markers of relative quantity. Children who consistently compared length rather than count to compare sets took part in three training sessions. On half the trials both sets were counted accurately, but on the other half the experimenter purposely miscounted one set. Success across all trials demanded that children learn the relevance of cardinals for numerical comparisons and realize when it is appropriate to trust these cardinals to infer numerical equivalence. Accuracy of number judgments increased for all children over time. However, explaining either the experimenter's or one's own judgments produced greater learning than simply receiving feedback, and identifying the experimenter's miscounts was a key factor in determining the effectiveness of those explanations. Statistical modelling suggested why children who failed to make the connection between counting principles and cardinality persisted with perceptual judgments on a post-test. These results show that reasoning can play an important role in even young children's developing grasp of what counting achieves and extend their understanding of when counting can be employed.

Perceptual load determines the extent of “inattentional blindness”

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Observers often fail to notice the presence of an object appearing unexpectedly in a display whilst engaged with another task, producing the phenomenon of “inattentional blindness”. We report a series of experiments examining the effect of perceptual load in a task on the level of subjective inattentional blindness. Perceptual load was varied by increasing relevant set size or by increasing the difficulty of perceptual judgments. On a critical trial, an additional unexpected stimulus (e.g. square figure) was also presented. Immediately following this trial, subjects' awareness of this critical stimulus was probed. The results show that more subjects reported being unaware of the critical stimulus in conditions of high perceptual load than in conditions of low perceptual load. Additional experiments rule out accounts for the results in terms of longer reaction times (and hence longer delay until awareness probe) in high (vs. low) load tasks. These findings suggest that inattentional blindness critically depends on whether the task engages full attention (in conditions of high perceptual load) or may leave spare attention (in conditions of low perceptual load) and thus confirm the role of attention (rather than expectation or memory) in this phenomenon.

Symposium: “Attention in the brain”

Organiser: Nilli Lavie

Attentional response modulation in the human visual system

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Evidence from functional brain imaging reveals that attention operates at various processing levels within the visual system and beyond. First, the lateral geniculate nucleus appears to be the first stage in the processing of visual information that is modulated by attention, consistent with the idea that it may play an important role as an early gatekeeper in controlling neural gain. Second, areas at intermediate cortical processing levels such as V4 and TEO appear to be important sites at which attention filters out unwanted information by means of receptive field mechanisms. Third, the attention mechanisms that operate in the visual system appear to be controlled by a distributed network of higher-order areas in frontal and parietal cortex, which generate top-down signals that are transmitted via feedback connections to the visual system. The overall view that emerges is that neural mechanisms of selective attention operate at multiple stages in the visual system and beyond and are determined by the visual processing capabilities of each stage. In this respect, attention can be considered in terms of a multilevel selection process.

Frontal cognitive control of visual selective attention

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Lavie and colleagues recently suggested that cognitive control functions that are mediated by frontal cortex such as working memory provide goal-directed control of selective attention, serving to minimize interference by goal-irrelevant distractors. Evidence for this is described from event-related fMRI experiments using both Stroop-like and attentional capture tasks. These experiments highlight the involvement of frontal cortex in determining the neural activity related to the presence (vs. absence) of an irrelevant distractor, as well in determining distractor interference effects on behaviour. Behavioural tests confirm a causal role for working memory in determining interference by irrelevant distractors in both Stroop-like and attentional capture paradigms. Distractor interference effects in both paradigms are greater when working memory is loaded with unrelated material during performance of the selective attention task. The results converge to show a general role for frontal cognitive control of selective attention by working memory in minimizing the interference by irrelevant distractors.

Biased competition in binocular rivalry

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The Biased Competition model of visual attention has proved a compelling and enduring framework with which to understand how competition between visual stimuli for limited processing resources is biased by top-down control signals. Current behavioural priorities, maintained in working memory, are one source of such control signals. Consistent with the biased competition model, both brain activity and behavioural interference caused by ignored and irrelevant visual stimulation are increased during concurrent working memory load. This suggests that working memory is required to actively ignore irrelevant stimuli, suppressing their impact on perception and awareness. This presentation will consider whether working memory plays a more general role in visual perception, whenever visual stimuli have a diminished impact on perception and awareness as a result of competition. Experiments that investigate the neural mechanisms and top-down control of binocular rivalry (a fundamental form of visual competition) will be discussed. It will be argued that the Biased Competition model can be usefully extended beyond attention to encompass visual perception in the widest sense.

The functional architecture of divided visual attention

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When we identify a visual object such as a word or letter our ability to detect a second object is impaired if it appears within 400 ms of the first. This phenomenon has been termed the attentional blink (AB) or dwell time and has been the topic of many research reports since 1992 when the first AB paper was published. During the first decade of research on this topic, the focus has been on 'behavioural' approaches to understanding the AB phenomenon, with manipulations made on the stimulus parameters (e.g., type and spatial distribution), nature of the stimuli (uni-modal or cross-modal), and importantly the role of masking. More recently, researchers have begun to focus on neurophysiological underpinnings of the AB – studying patients with focal lesions and using approaches such as ERP, TMS, fMRI, and MEG. My talk will focus on the results of a number of such neurophysiological techniques, suggesting that localisation, in combination with activation and synchronisation methods have begun to unravel a dynamic temporo-parietal frontal network of structures involved in the attentional phenomenon known as the 'attentional blink'.

Consciousness is gated by attending for action: Evidence from Hemispatial neglect

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Research in patients with hemispatial neglect has shown that, in spite of their dramatic exclusion from awareness, neglected stimuli are processed to a level of semantic encoding. Thus, unawareness of unattended stimuli cannot be entirely explained by attenuation of processing early in the visual pathway; access to consciousness must be determined at a later stage of processing, after the identity of the unattended item has been encoded. I will summarise evidence that limitations for awareness might arise at the level of representations for action and response. The experiments were based on a simple bedside observation: that visual extinction is less when the competing items, that have to be individually identified and reported, are different than when they are same. They showed that the degree of extinction was determined by whether the competing items shared the same response, regardless of whether they shared or differed in their visual features or semantics. Not only was there more extinction between (ONE+ONE) than (ONE+TWO): there was just as much extinction between (ONE+1) or (ONE + WON) as there was between (ONE + ONE).

End of Symposium

University Accommodation

Accommodation has been reserved on campus for the 29, 30 June and 1 July. There are en-suite and standard rooms. Reservations for University accommodation, and / or the conference dinner, can be made on the enclosed booking form, which should be returned to John Towse **before 16 June**. Keys should be collected from the conference office reception, which will be open from 8am to 11pm.

Cheques must be made payable to "University of Lancaster" and sent to "Dr John Towse, EPS meeting, Dept. of Psychology, Fylde College, University of Lancaster, Bailrigg, Lancaster, LA1 4YF"

Alternative accommodation.

Lancaster House Hotel is a 4-star hotel directly opposite the Green Lane campus entrance. A discounted rate has been negotiated at £89.00 per Single Room and £94.00 per Double or Twin Room, Inclusive of Breakfast for these dates. This rate also includes full use of the hotel Leisure Club (pool, gym room, etc). These rooms are subject to availability, and you are urged to reserve rooms asap as they can be busy around that time of year. Please contact reservations on 01524 844822 and quote 'EPS rate'.

Alternative places to stay can be found at:

- <http://www.visitlancaster.co.uk/accom.htm>

Messages

Messages can be left at the conference office, Tel: 01524 592444, Fax: 01524 843695

Internet Access

The Department of Psychology intends to make a computer room available for those members who wish to access emails, etc. during the meeting. Directions for this will be provided at the meeting.

Travel

For information on directions and maps, you are invited to consult:

- <http://www.lancs.ac.uk/travel/travel.htm>

By Air

The most convenient airport is likely to be Manchester. There are trains from the airport to Lancaster. There are flights to Blackpool (eg from Stansted) and Liverpool airport also.

By Rail

Trains to Lancaster from Euston station take around 3 hours, according to the particular service. Trains to Lancaster from Glasgow take around 2.5 hours. For specific information contact National Rail, 08457 484950, or www.rail.co.uk.

By Car

The University is close to the M6. Come off at junction 33, turn right at the roundabout off the sliproad, and follow the signs to campus.

Parking

Parking space varies with campus activities. There is a gravel pay and display car park area next to Fylde avenue by the psychology department, which costs £2 per day. There is a ticket machine. Outer zone (ie the ring road) parking permits will be available at the meeting.

Local Taxis

The main taxi rank is situated next to the bus station or outside KFC at the top of Penny St.

Beat the Stream Taxis: 01524 32090

A1 Taxis: 01524 35666

Taxis: 01524 848848

Bus

University to city

Stagecoach busses: X2, 3 (go via A6) 4

Eating and Drinking

Campus

Slightly limited options during vacation period. George's Restaurant, for Jacket potatoes and hot meals (Chaplaincy Centre, behind the conference centre). Grizedale Café Bar serves toasted sandwiches and paninis (located near George Fox building). Shops: Greggs bakery (Alexandra Square), Diggles and Spar (Edwards Court), which has a deli section as well as the usual prepacked sandwiches, are options. The Venue (along the spine, just off Alexandra square) offers light food and drink. Lancaster House Hotel (Green Lane) serves food throughout the day. Cartmel, Grizedale and Graduate College Bars will be open in the evening. (Graduate Bar is unusual for a student bar as it made it to the CAMRA Good Beer Guide)

Restaurants in Lancaster

There are numerous restaurants and pubs in Lancaster and the city is safe to explore. Some of our favourites:

For a good Indian head for *The Sultan* (Brock Street) (but note that it is unlicensed), while the best Chinese is probably *The Golden Dragon* (George St). Mediterranean food is served at *Bistro Il Morini* on Sun Street (has fish specials and several veggie options) - also worth a look on Sun Street is the *Sun Café*. Mexican Wine Bar *Crows* (near Waterstones on China Street) and a modern French restaurant *Quite Simply French* (St Georges Quay) are fine, while the out of town Gastro Pub *The Bay Horse* (just off the A6 before you reach Forton) has a deservedly good reputation (and so you may need to book: 01524 791204).

There are plenty of other places to try around the town centre, at a range of prices. You can find Greek, Japanese, Chinese & Indian cuisine, together with the usual pasta & pizza type haunts.

Pubs in Lancaster

The Water Witch (path on the left after the Infirmary) is a relaxed canal-side pub. It offers excellent range of beers, wine and whisky. Serves good food and a great cheese board. *John O Gaunt* (town centre near Barclays Bank) another place for good beer usually a live jazz or blues band. *Walkabout* (Dalton Square) is an Australian-themed sports bar. *Bentleys* (Brock Street) wine bar is another option. *Vodka Revolution* specialises in, you've guessed it, vodka based cocktails, and is the only bar with a late licence.

Places of interest

There is varied and spectacular countryside on the doorstep of Lancaster. For example

- <http://www.lunevalley.co.uk/>
- <http://www.forestofbowland.com/>
- <http://www.golakes.co.uk/>
- <http://www.settle.co.uk/> (for the Three Peaks area, etc.)

For places to see closer to Lancaster, see:

- <http://www.lancasterukonline.net/visitors/attractions.htm>

The Lancaster House Hotel is connected to a 'sister' Waterhead Hotel on the shores of Lake Windermere (also a 4-star hotel). Should you want to stay there after the meeting, they have offered accommodation at the following rates: £72.00 per night bed and breakfast in a single bedded room, £85.00 per night bed and breakfast single occupancy in a double / twin room, £94.00 per night bed and breakfast double / twin occupancy in a double / twin room. For reservations or further enquiries, please contact the reception (the contact is Almarie Chambers) on 015394 32566.

Conference dinner

The conference dinner will take place at the Castle Hotel, Hornby, about 10 miles from the university, in the Lune valley. Transport will leave from the Conference Centre at 7.30pm. The cost will be £35. Postgraduates may attend the dinner at the subsidised price of £17.50. In this instance the booking form must be accompanied by a statement from an EPS member confirming postgraduate status. Please book, and indicate any dietary requirements, on the enclosed form and this should be returned to:

“Dr John Towse, EPS Meeting, Department of Psychology, University of Lancaster, Fylde College, Bailrigg. Lancaster LA1 4YF”, **before 16 June.**

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