



# LONDON MEETING

**6-7 JANUARY 2003**

A scientific meeting will be held at the Department of Psychology, University College London on 6/7 January, 2003. The local organiser is Dr Jamie Ward.

**Office of Science and Technology Foresight Cognitive Systems:  
Presentation and Open Discussion**

Monday 6 January 5.30-6.00

What ever happened to Artificial Intelligence? - the new Foresight  
project on Cognitive Systems

Chair: Professor Richard Morris (University of Edinburgh)  
Mrs Prue Backway, Mrs Mary Lawrence (OST)

**Special Session in advance of Foresight Presentation**

Monday 6 January 3-5.30

Four invited speakers will review recent progress in their research  
programmes

**EPS Prize Lecture**

Tuesday 7 January 2.00-3.00

Crossmodal attention and multisensory integration

Charles Spence (Oxford University)

**Symposium:**

Tuesday 7 January 9.00-12.30

The interplay between language and thought: Defining the constraints

Organisers Jules Davidoff, Michael Siegal and Gabriella Vigliocco

**Presentations**

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

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

There will be a drinks reception on Monday evening at 6.00 in the third floor common room. The conference dinner will be at 7.30 at Bertorelli's, 19-23 Charlotte Street, London WC1 – (020-7636 4174). A booking form is enclosed.

## START OF PARALLEL SESSION

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

- 9.00        **Sebastian J Crutch\* and Elizabeth K Warrington** (Dementia Research Group, Department of Clinical Neurology, Institute of Neurology, University College London and Division of Neuroscience and Psychological Medicine, Imperial College)  
The selective impairment of fruit and vegetable knowledge: a multiple processing channels account of fine-grain category specificity.
- 9.30        **R A McCarthy** (University of Cambridge)  
The strangeness of beasts: sensory, structural or semantic?
- 10.00       **Mark Haggard and Elaine Nicholls\*** (MRC-ESS-CMED Cambridge)  
Effects of hearing problems on child development – causal inference from intervention combined with multi-domain modelling
- 10.30       COFFEE
- 11.00       **Jill Boucher and Francisco Pons\*** (University of Warwick and University of Geneva)  
Mental time travel and temporal knowledge in children with autism
- 11.30       **Susan E Gathercole, Clare Tiffany\*, Annabel Thorn and Josie Briscoe\*** (University of Durham, University of Bristol and Cardiff University)  
Developmental consequences of impairments of phonological short-term memory
- 12.00       **Martin A Conway and Amanda J Barnier\*** (University of Durham and University of New South Wales, Australia)  
On the accessibility of autobiographical memories: Shaping the self.
- 12.30       **David W Green** (University College London)  
The heart has its reasons
- 1-2        LUNCH

## START OF PARALLEL SESSION

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

- 9.00        **Lauren Stewart\***, **Vincent Walsh** and **Uta Frith** (Institute of Cognitive Neuroscience, University College London)  
Reading music shapes spatial representation
- 9.30        **Emily K Farran\*** (University of Reading) (Introduced by Chris Jarrold)  
An unusual pattern of perceptual grouping performance in Williams syndrome
- 10.00       **Keith Langley\*** (University College London) (Introduced by Jamie Ward)  
The orientation specific component of contrast adaptation: De-correlation or de-noising?
- 10.30       COFFEE
- 11.00       **Guy Wallis\*** (Queensland University) (Introduced by Roland Baddeley)  
The influence of millisecond stimulus asynchrony on perceptual grouping can be explained by ocular microtremor
- 11.30       **Benjamin W Tatler\***, **Roland J Baddeley** and **Iain D Gilchrist** (Sussex Centre for Neuroscience and Laboratory of Experimental Psychology, School of Biological Sciences, University of Sussex and University of Bristol)  
Exogenous and endogenous determination of gaze position whilst viewing natural images
- 12.00       **Louise Alston\*** and **Glyn Humphreys** (Brunel University and Birmingham University)  
Lower visual field advantage supports dorsal route for subitization
- 12.30       **Helen Hodgetts\*** and **Dylan M Jones** (Cardiff University)  
Interruptions in the Tower of London task: Goal activation and retrieval
- 1-2        LUNCH

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

- 2.00 **Mike Oaksford** (Cardiff University)  
Causal conditional inference and constraint satisfaction:  
Reconciling probabilistic and mental models approaches?
- 2.30 **Clare Harries\***, **Marian Gomez Beldarrain\***, **Jordan Grafman\*** and **J Carlos Garcia-Monco\*** (Leeds University Business School, Galdakao Hospital, Vizcaya, Spain, and NINDS, NIH, Bethesda, MD, USA) (Introduced by Nigel Harvey)  
Using advice and assessing advisors: Decision Making in patients with frontal lobe damage

**SPECIAL SESSION in advance of FORESIGHT PRESENTATION**

- 3.00 **Tim Shallice**, **Carlo Reverber\***, **Antonio Lavoroni\***, **Gian Luigi Gigli\*** and **Miran Skrap\*** (Institute of Cognitive Neuroscience, University College London, Scuola Internazionale di Studi Avanzati, Trieste, Italy and Ospedale Santa Maria della Misericordia, Udine, Italy)  
Rule abstraction and frontal lobe functions
- 3.30 **John Duncan** (MRC Cognition and Brain Sciences Unit, University of Cambridge)  
Prefrontal cortex and selective attention to a current task
- 4.00 TEA
- 4.30 **L K Tyler** (Centre for Speech and Language, University of Cambridge)  
Neural differentiation in the language system
- 5.00 **Andy Ellis** (University of York)  
Early learning and mature representations: Insights from 'age of acquisition' effects in lexical processing and beyond.
- 5.30 **Office of Science and Technology Foresight Cognitive Systems Presentation and Open Discussion**  
**Professor Richard Morris** (University of Edinburgh), **Mrs Prue Backway** (Project Leader, OST), **Mrs Mary Lawrence** (Project Coordinator, OST)  
What ever happened to Artificial Intelligence? - the new Foresight project on Cognitive Systems
- 6.00 DRINKS RECEPTION (Third Floor Common Room)
- 7.30 CONFERENCE DINNER, BERTORELLI'S



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

- 9.00        **Angus Gellatly and Geoff Cole\*** (Open University and University of Durham)  
Spatial cueing amplifies attention to onset objects; boxes diminish it
- 9.30        **Geoff G Cole\*, Robert Kentridge\*, Angus Gellatly and Charles Heywood\*** (University of Durham and Open University)  
Attentional capture by onsets and offsets in the change detection paradigm.
- 10.00       **Nilli Lavie\*, Diane Beck\*, Vincent Walsh and Geraint Rees** (University College London, Princeton University and Institute of Cognitive Neuroscience, University College London)  
Neural correlates of change detection and "change blindness"
- 10.30       COFFEE
- 11.00       **Gustav Kuhn\* and Zoltan Dienes** (Sussex University)  
Play it again Sam, until we like it. Can implicit learning in music go beyond the learning of adjacent chunks?
- 11.30       **Sarah E MacPherson\*, Sergio Della Sala, Robert H Logie** (University of Aberdeen)  
Effect of task titration on dual task at encoding and retrieval: Evidence from healthy adult ageing and patients with alzheimer's disease
- 12.00       **Graham Hitch** (University of York)  
Using the Hebb Effect to investigate computational models of serial order.
- 12.30       Annual General Meeting (Lower Ground Floor Theatre)  
(Members only)
- 1-2         LUNCH

END OF PARALLEL SESSION

*Session B***Lower Ground Floor Lecture Theatre****Symposium:** The interplay between language and thought: Defining the constraints

Organisers: Jules Davidoff, Michael Siegal and Gabriella Vigliocco

- 9.00        **Debi Roberson and Jules Davidoff** (University of Essex and Goldsmiths College, University of London)  
Colour category acquisition in Himba and English children – a longitudinal study.
- 9.30        **Michael Ramscar\* and Lera Boroditsky\*** (Stanford University and Department of Brain & Cognitive Sciences, Massachusetts Institute of Technology)  
Moving on: from language and thought to thought and language.
- 10.00       **Lera Boroditsky\*, Wendy Ham\* and Michael Ramscar\*** (Department of Brain & Cognitive Sciences, Massachusetts Institute of Technology, and Stanford University)  
Does language shape thought? Tense and the perception of actions in English and Indonesian.
- 10.30       COFFEE
- 11.00       **Gabriella Vigliocco\*** (University College London)  
The interplay of language-specific syntactic properties and semantics
- 11.30       **Bencie Woll\*, Jo Atkinson\*, Jane Marshall\*, Alice Thacker\* and Ruth Campbell** (Language and Communication Science, City University, St George's Medical School and University College London)  
Language and thought in signers of BSL before and after CVA: Comparing RH and LH strokes
- 12.00       **Rosemary Varley\* and Michael Siegal\*** (Department of Human Communication Sciences and Department of Psychology, University of Sheffield)  
Reasoning without grammar: Evidence from aphasia
- 12.30       Annual General Meeting (Lower Ground Floor Theatre)  
(Members only)
- 1-2        LUNCH

END OF PARALLEL SESSION

**Lower Ground Floor Lecture Theatre**

- 2.00        **EPS Prize Lecture - Charles Spence** (Oxford University)  
Crossmodal attention and multisensory integration
- 3.00        **Caterina Cinel\* and Glyn Humphreys** (University of Essex  
and University of Birmingham)  
Cross-modal illusory conjunctions between vision and touch
- 3.30        **Jon Driver, Martin Eimer and Emiliano Macaluso\*** (Institute  
of Cognitive Neuroscience, University College London and  
Birkbeck College)  
ERP and fMRI measures indicate that supramodal control  
processes for spatial attention modulate 'unimodal' sensory  
processing.

End of Meeting

The selective impairment of fruit and vegetable knowledge: a multiple processing channels account of fine-grain category specificity.

Sebastian J Crutch<sup>1,2</sup> and Elizabeth K Warrington<sup>1</sup>

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We report the case of a gentleman, FAV, who developed a grave anomia and selective comprehension deficit following a left temporo-occipital infarction. The aim of our study was to investigate the nature of fine-grain category specific deficits of conceptual knowledge, and thereby to evaluate cognitive theories of conceptual organisation.

Category specificity was examined in a series of tasks testing word retrieval and comprehension skills. FAV's word retrieval abilities were significantly more impaired for living things than man-made artefacts. There was no difference between his performance when naming to confrontation and naming to verbal description. However, further assessment revealed a more fine-grain deficit at the level of comprehension. FAV had significantly more difficulty with fruit and vegetables than animals or non-living foods on a multiple level semantic category probe test. This finding was corroborated by results from a word-picture matching task, in which FAV again showed significantly more accurate performance with both animals and foods than with fruit and vegetables.

Narrowly delimited dissociations provide the opportunity for detailed hypotheses regarding the cerebral organisation of conceptual knowledge. Neither the Sensory Functional Theory (Borgo and Shallice, 2001) nor the Domain Specific Hypothesis (Caramazza and Shelton, 1998) provide an adequate account of the selective impairment of fruit and vegetable knowledge in the context of preserved animal and, importantly, non-living food knowledge. We conclude that this pattern of performance and other fine-grain category effects within the realms of living and non-living things are best explained by a multiple processing pathways account.

The strangeness of beasts: sensory, structural or semantic?

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Patient PHD has a category-specific visual agnosia characterised by impaired recognition of animals and relatively spared recognition of objects. His understanding of animal names was relatively spared. We explored his sensitivity to the perceptual structure of animals that he was unable to name, match or define from visual input by using a chimera judgment task. PHD was

unable to discriminate real from composite animals but had no problem in differentiating real from composite objects. Mixed animal-object chimeras were trivially easy for him. These effects were found across a range of different grades of task difficulty and visual complexity. In a second experiment he was more likely to retain information about real than composite animals in a delayed copying task. These findings indicate that PHD's category-specific problem cannot be attributed to a "low level" visual impairment but is more plausibly explained in terms of selective loss of the structural descriptions of living things - or their visual semantic representations.

Effects of hearing problems on child development – causal inference from intervention combined with multi-domain modelling

Mark Haggard and Elaine Nicholls  
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In a large sample of children affected by otitis media with effusion (“glue ear”), we studied the influences both of natural variation and of randomised (ie experimental) intervention for hearing problems to improve developmental outcomes, in areas for which performance measures were impractical. We achieved replicable and interpretable structural equation (path) models, good as to their fit, parsimony, and structure on permutation tests. These path models were consistent with, but more informative as to process than, the (experimental) univariate treatment group contrasts. The natural and the experimentally induced patterns of covariation were highly similar.

One intervening variable, auditory impairment, offered both a performance-based and a reported measure. A sufficiently strong multivariate regression between the two enabled a separation of the performance-linked and the “subjective” components of the reported measure, more efficiently than by taking a standardised difference. The first component is predictively richer than the performance measure used to define it, so adds usefully. The second can be conceived of as a variable response bias, having both intervention-related and naturally varying sub-components. Although they originate in a single type of measure, the two main separated components showed patterns of prediction of developmental variables consistent with their lying in the separate domains of performance and subjective judgement.

No single model from covariance-based techniques can itself determine causality, or resolve an ambiguity of status as to control or dependent variable. However, well-fitting “mixed” models of multivariate covariance structures permit appropriate and well-controlled experimental and observational hypothesis testing; they give some leverage on the relative truth of the assumption in the particular context that an experimental design has frozen or deliberately varied the main independent variables. The domain-separation technique can throw light on, and adjust for, the inevitable biases such as expectancy in those numerous interventions where blinding of participants (placebo-control) is not possible.

Mental time travel and temporal knowledge in children with autism

Jill Boucher<sup>1</sup> and Francisco Pons<sup>2</sup>

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People in regular contact with individuals with autistic spectrum disorders (ASDs) often comment that people with ASDs have a very poor intuitive sense of time. There have been recurrent suggestions that impaired 'sequencing' (e.g., Ricks & Wing, 1975; Tanguay, 1984; Allen, Lincoln, & Kaufman, 1991), or a lack of social timing (Newson, 1984; Wimpory, Nicholas, and Nash, 2002) may be a contributory cause of autism. Boucher (2001) hypothesised that deficits in biopsychological time-processing mechanisms might underlie certain of the cognitive and linguistic impairments characteristic of autism, as well as contributing to the social impairments.

There is, however, almost no research evidence confirming the clinical and anecdotal reports of a poor time sense. The aim of the present study was to gather data on mental time travel and temporal knowledge in children with ASDs. Four experiments were carried out, based on tests of diachronic thinking, or mental time travel, in typically developing children (Montangero & Pons, 1995; Pons & Montangero, 1999). The performance of a group of 23 children and adolescents with ASDs, of mixed ability, was compared with that of controls matched for age, verbal and non-verbal ability. The first three experiments showed highly significant group differences in the predicted direction, and the fourth showed a trend in the same direction. There were no clear relationships between performance on the tests of diachronic thinking and age, verbal, or nonverbal ability, but scores on the experimental tests tended to correlate. These findings tend to confirm the claim by Pons & Montangero (1999) that the ability to think using a temporal dimension is a specific rather than a general cognitive ability.

Developmental consequences of impairments of phonological short-term memory

Susan E Gathercole<sup>1</sup>, Clare Tiffany<sup>2</sup>, Annabel Thorpe<sup>2</sup> and Josie Briscoe<sup>3</sup>

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The extent to which phonological short-term memory contributes learning and scholastic attainments over the early school years was investigated in 40 8-year old children selected on the basis of very poor phonological memory function at 5 years. A subgroup of 16 of the children had persisting phonological memory deficits and marked under-achievement in literacy at 8

years, but had normal language abilities. The remaining children had less marked although significant phonological memory deficits relative to control children, but showed a distinctive profile of very poor language function. These findings suggest that the developmental consequences of weak phonological memory skills alone may be compensated over the middle childhood years, although reading development may be compromised. More serious and persistent learning difficulties are encountered by children whose primary deficits lie in the general domain of language rather than in short-term memory more specifically.

On the accessibility of autobiographical memories: Shaping the self.

Martin A Conway<sup>1</sup> and Amanda J Barnier<sup>2</sup>

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In five list-method directed forgetting experiments, we extended the investigation of inhibitory memory control from simple, episodic information to autobiographical memories. We found that recently recalled autobiographical memories can be inhibited by a direct instruction to forget, and identified three boundary conditions on this effect: (1) inhibition is enhanced by segregation, and compromised by integration, of the to-be-forgotten and to-be-remembered material; (2) inhibition is relatively unsuccessful for emotionally negative experiences; and (3) neither the initiation nor the effects of these inhibitory processes are under intentional control. We discuss these findings in terms of inhibitory processes in directed forgetting, our understanding of concepts such as repression, and the use of memory management processes to shape both everyday and pathological personal remembering.

The heart has its reasons

David W Green  
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Are decisions based on affective tags or on reasons? I argue that this opposition in decision procedures is flawed and show, in two studies, a close equivalence between them. Individuals listed and rated the affective value of elicited images, feelings and thoughts on a controversial issue - GM crops - and then indicated which, if any, of these they would use in the context of an argument. The second study also showed that thinking counterfactually about a conjectured future world in which GM crops were banned made current opinion about GM crops more favourable but the negative affect associated with its banning exerted an opposite effect, contrary to a complete equivalence of the decision procedures.

Reading music shapes spatial representation

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Sight-reading for keyboard performance involves a sensorimotor translation based upon spatial dimensions, from vertical (on the staff) to horizontal (on the keyboard). We devised a musical Stroop task where positions on the staff were either congruent or incongruent with respect to the positions they specified on the keyboard. We were able to demonstrate that musical notation is automatically processed in trained pianists, despite conscious efforts to ignore it. A nonmusical, spatial version of this task showed that ability to read music is associated with permanent changes in the mental representation of two-dimensional space. While pianists showed comparable interference from incongruent spatial location, regardless of whether the stimuli were varying horizontally or vertically, nonpianists showed significantly greater interference when stimuli varied horizontally. We propose that pianists and nonpianists alike have a default horizontal-to-horizontal stimulus response mapping but pianists possess an additional vertical-to-horizontal mapping of comparable magnitude. We propose that this new mapping arises due to the acquisition of the specific vertical to horizontal visuomotor mappings which are required to read and play keyboard music.

An unusual pattern of perceptual grouping performance in Williams syndrome

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Individuals with Williams syndrome (WS) have an approximate IQ of 60, which is comprised of poorer visuo-spatial performance relative to verbal ability. A predominant hypothesis suggests that individuals with WS show a local processing bias. The present study investigates how perceptual grouping is used in WS to integrate the local elements into a global form. Fourteen individuals with WS, and 14 control children took part, matched individually by performance on the Ravens Coloured Progressive Matrices (RCPM; Raven, 1993). Participants were presented with a matrix of local elements and asked to indicate whether the elements were grouped into rows or columns. Spatial grouping was measured using proximity and alignment. Visual grouping was measured using geometric similarity (colour, orientation, and shape) and topological similarity (closure). Results showed that individuals with WS demonstrated the same pattern of performance as the TD controls when geometric and topological grouping ability were compared. Further analysis indicated different patterns of performance between the WS and TD groups among the three types of geometric grouping. Performance on the spatial

grouping tasks also showed an interaction between the groups: individuals with WS were performing at the same level as the controls on the alignment, but not the proximity task, where performance was significantly poorer than that of the control group. Finally, an interaction was revealed when overall performance on the visual and the spatial tasks was compared. This revealed that individuals with WS were poorer at both types of grouping, but to a lesser extent on the spatial tasks than on the visual tasks. Results are discussed in relation to local and global processing in WS.

The orientation specific component of contrast adaptation: De-correlation or de-noising?

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After adaptation to a high contrast sinusoidal grating image signal, the threshold contrast at which a similar grating may be detected by visual inspection is raised. The elevation in threshold contrast is found to be both orientation and spatial frequency tuned. The purpose of the experiment reported in this paper was to test the theoretical predictions made by two models of contrast adaptation: the de-noising model (Langley and Atherton, 2002) and the de-correlation model of contrast adaptation (Attick et al., 1993). Subjects adapted to an image pattern composed from the sum of two high contrast orthogonally oriented sinusoidal gratings. Threshold elevations for a single sinusoidal test grating whose spatial frequency matched the test pattern were determined using a standard staircase procedure. Across different experiments, the orientation of the test grating was varied relative to the orientation of the adapting gratings. Contrast threshold elevations were found to be highest when the orientation of the test grating matched the orientation of one of the adapting gratings, and found to be smallest when orientation of the test grating differed from the adapting gratings by forty-five degrees. The result is inconsistent with the predictions made by the de-correlation model of adaptation because this model suggests that adaptation is a self-calibration mechanism that assumes a priori that the distribution of visual signals is isotropic: hence orthogonal adaptation would not be expected to raise threshold contrast for a single sinusoidal test grating. The result is, however, consistent with the predictions made by a de-noising model of contrast adaptation because this model predicts that the effects of contrast adaptation are governed by an intrinsic multiplicative noise source that originates from the decomposition of the visual image signal by orientation and spatial frequency tuned channels.

The influence of millisecond stimulus asynchrony on perceptual grouping can be explained by ocular microtremor

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If two images are shown in rapid cyclical order, two percepts are possible. At slow rates the two images remain distinct and are seen to flicker, whilst at faster rates they fuse. Despite our lack of awareness of distinct images, recent studies have revealed that visual ordering and grouping can be influenced by presentation rates well beyond that of perceptible flicker. The mechanism for this sensitivity is still not known. It has, however, sparked excitement in the broader neuroscience community as it may reveal the presence of a 'temporal binding mechanism'. This mechanism would serve to keep multiple mental representations of one object distinct from those of other objects. An alternative explanation is that involuntary eye-movements are responsible for converting the temporal offset of the two images into a minor spatial offset in the compound, test image. To test this hypothesis I replicated one of the recent studies over several viewing distances and discovered a significant increase in performance as viewing distance increased. Further studies confirmed that this was not due to an associated change in retinal image size. Hence the work reveals a role for involuntary eye-movements in the perception of temporally asynchronous stimuli. As a result, our sensitivity to very brief temporal asynchrony is open to reinterpretation in terms of a purely spatial mechanism, thereby undermining support for the temporal binding hypothesis.

Exogenous and endogenous determination of gaze position whilst viewing natural images

Benjamin W. Tatler<sup>1</sup>, Roland J Baddeley<sup>2</sup> and Iain D Gilchrist<sup>3</sup>

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Eye movements relocate the small area of high retinal sampling density (the fovea) around the world at a rate of about 3 saccades per second. But what is it that targets saccades as we survey the world? Various models exist ranging from entirely exogenous (stimulus-driven) to entirely endogenous (stimulus-independent) saccade targeting theories.

Eye movements were recorded as subjects viewed a variety of images of everyday scenes. We found differences in the locations fixated by the observers between images, as well as differences between observers for the same images.

Low-level image statistics were extracted at fixation and used to assess likely candidates for exogenous determination of fixation position. These techniques suggest a role for contrast and edge-content in the targeting of eye movements, but not for chromaticity or luminance information. Analysis of eye position data over the course of viewing an image showed striking differences in the clustering of fixations over time. Exogenous factors appeared to dominate early in viewing but become less strong in the later part of viewing. This change may reflect an increased role for endogenously targeted saccades after a few seconds. These results support models in which the factors that influence saccade targeting change over time.

Lower visual field advantage supports dorsal route for subitization

Louise Alston<sup>1</sup> and Glyn Humphreys<sup>2</sup>

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We tested enumeration of randomly configured moving and static items presented briefly (200msec) to the upper or lower visual field. Fast and efficient enumeration, known as 'subitization,' occurred for moving targets with or without static distracters and for static targets presented alone. There was no subitization of static targets among moving distracters. A lower visual field advantage was found when the visual system was 'stretched' by including static distracters in the moving displays. This effect disappeared when the stimuli were presented in canonical patterns and appeared not to result from easier task conditions, since there was no lower visual field advantage even for the worst performers. It is proposed that canonical stimuli are enumerated via a pattern-recognition system within the ventral visual stream. In contrast, during subitization of random stimuli, there is a lower visual field advantage as well as a bias for moving over static items. This is consistent with processing via the dorsal visual stream, since there are more connections between the LVF and parietal cortex, along with greater use of magnocellular-based information in dorsal regions. Subitization of randomly configured items may rely on a spatial map in parietal cortex that allows individuation of separate instances of features.

Interruptions in the Tower of London task: Goal activation and retrieval

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Unexpected interruptions during execution of the Tower of London task incurred a cost in terms of time taken to make the next move in a solution sequence (Experiment 1). Length of the interruption was found to have little effect on performance (Experiment 2); more critical was the time at which interruptions occurred (Experiment 3). The cost of interruption was not reduced by prior warning (Experiment 3), although participants were able to resume the primary task quicker if the current state of that task was visible during the interruption (Experiment 4). The results are consistent with Altmann and Trafton's (2002) goal activation model, and suggest that this could be a useful theoretical framework for the study of interruptions.

Altmann, E.M., & Trafton, G.J. (2002). Memory for goals: An activation-based model. *Cognitive Science*, 26, 39-83.

Causal conditional inference and constraint satisfaction: Reconciling probabilistic and mental models approaches?

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A simple implementation of the probabilistic approach to causal conditional inference is proposed using a constraint satisfaction network. The default activation levels of nodes in the net correspond to the default mental model of the conditional. Further inference in the network involves clamping on or clamping off various nodes corresponding to the cause, its effect, possible defeaters and alternative causes. The act of clamping these nodes on or off corresponds to considering other structural possibilities in the mental models theory. Various phenomena can be explained in this way, for example, the suppression of the standard inferences associated with conditionals; the fact that strongly associated defeaters lead to more suppression of the valid inferences; the different behaviour observed when information about possible defeaters and alternative causes is given explicitly vs. implicitly. This simple model also explains the dissociation in the effects of possible defeaters and alternative causes shown by people who score highly on measures of schizotypy (Sellen, Oaksford, & Gray, in press). In sum, in the causal conditional inference task, mental models may be an emergent property of an implementation of the probabilistic approach in a neural network.

Using advice and assessing advisors: Decision making in patients with frontal lobe damage

Clare Harries<sup>1</sup>, Marian Gomez Beldarrain<sup>2</sup>, Jordan Grafman<sup>3</sup> and J Carlos Garcia-Monco<sup>2</sup>

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Frontal lobe damage is associated with impaired decision making. Studies examining this effect have focussed on differences in performance on gambling tasks. In this study, 29 patients with brain damage (20 frontal (14 OBF and 6 DL) and 9 Parietal) and 20 matched controls were compared in their ability to use and to assess advice in a computer presented task. Frontal patients (OBF and DL) were inconsistent at using advice and their forecasts were poor. DL but not OBF showed some ability to assess advice. Parietals were good at assessing advice but were slow at doing so. They were consistent but poor at using advice and their use was unrelated to their assessments. All three patient groups were overconfident in their own performance. In contrast Controls could both use and assess advice, their ability to use it was mediated by their ability to assess it, and they were less overconfident than the patient groups. Group differences on this task were not associated with differences in anxiety, nor impulsivity. But differences in ability to assess and forecast could be accounted for in terms of planning ability and working memory. Group differences in consistency of advice use were independent of working memory and planning

SPECIAL SESSION in advance of FORESIGHT PRESENTATION

Rule abstraction and frontal lobe functions

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A rule abstraction task sensitive to frontal lobe lesions – the Brixton task (Burgess & Shallice, 1996) – in which patients must abstract how a blue circle moves across a series of cards presented one at a time – was investigated in modified form. In part of the task the sequence of cards comprising one rule was interrupted by cards on which a red circle moved according to a different

rule. Thirty-nine patients with focal frontal lesions were tested. Left Lateral patients produced a significantly lower rate of correct responses, even when their working memory capacity was intact. Right Lateral patients, by contrast, were quite normal on the rate of correct responses but produced significantly more capture errors. Inferior Medial patients were less sensitive to an error signal. The results are explained in terms of the updated Supervisory System model (e.g. Shallice, 2002) where differential lateralisation of top-down schema selection and checking processes are hypothesised.

Burgess, P. & Shallice, T. (1996). Bizarre responses, rule detection and frontal lobe lesions. *Cortex*, *32*, 241-260.

Shallice, T. (2002). Fractionation of the Supervisory System. In D. T. Stuss & R. Knight (Eds.) *Principles of Frontal Lobe Functions*. New York: Oxford University Press.

#### Prefrontal cortex and selective attention to a current task

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The crucial role of prefrontal cortex in human cognition is shown by the broad disorganization of thought and behaviour that can follow prefrontal lesions. Certainly, neuroimaging data show prefrontal involvement in tasks from a wide range of cognitive domains; specific regions in and around the inferior frontal sulcus, the frontal operculum, and the anterior cingulate show a similar pattern of increasing activity with many different task demands. Both neuroimaging and neuropsychological data suggest a close link between prefrontal function and standard measures of general intelligence. Single cell studies in the behaving monkey show how prefrontal cells are selectively tuned to information of current task relevance, producing a dense, distributed description of inputs, outputs, rewards and other relevant events. By such flexible information coding, it is proposed that prefrontal cells produce an active internal model of some aspect of the world and what actions it affords; this model is crucial in guiding effective, organized behaviour.

#### Neural differentiation in the language system

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A key issue in cognitive neuroscience concerns the way in which language processes and representations are instantiated in the brain. Do they involve different types of mental computation instantiated in different brain structures, or does a single uniform system underlie all aspects of language

processing? The contrast between the regular (eg jump/jumped) and irregular (e.g. think/thought) English past tense has become pivotal in this debate. Previous studies reporting behavioural dissociations related to different lesion sites in patients suggest that processing regular and irregular past tenses involve different neural mechanisms. Here we show, using event-related fMRI that a network of regions including the anterior cingulate, L inferior frontal cortex and bilateral STG is preferentially activated for regular past tense forms, and this difference cannot be accounted for in terms of the phonological complexity of the regulars. These results suggest that the neural network involved in language processing is differentially sensitive to different types of linguistic processes.

Early learning and mature representations: Insights from 'age of acquisition' effects in lexical processing and beyond.

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Ellis and Lambon Ralph (2000) trained a simple 3-layer neural network to associate random patterns using a cumulative training procedure in which some ('early') items are entered into training before other ('late') items. When the network had stabilized after extensive training, the representations of the early items were superior to those of the late one. That effect was not explicable in terms of differences in total (cumulative) frequency of training. This simple phenomenon offers an account of data showing that early-learned words are processed faster than later-learned words in a range of tasks; also of results showing comparable effects in object and face recognition, and better preservation of early vocabulary following brain injury. More broadly, the network findings could help explain why early experiences have more of an influence on the structure of the mature cognitive system than equivalent later experiences.

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 & Cognition*, 26, 1103-1123.

What ever happened to Artificial Intelligence? - the new Foresight project on Cognitive Systems

Chair: Professor Richard Morris (University of Edinburgh)  
Mrs Prue Backway (Project Leader, OST)  
Mrs Mary Lawrence (Project Coordinator, OST)

It's two decades since the term 'AI' was coined - but only now have advances in life sciences and physical sciences reached the stage where it could

soon be possible to make an artificial system with cognitive capabilities. This new Foresight ([www.foresight.gov.uk](http://www.foresight.gov.uk)) project aims to produce a vision of future developments and help create an environment in which the UK is able to take advantage of these developments

END OF SPECIAL SESSION

Children's comprehension of sentences with focus particles

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Recently, there has been substantial interest in how readers interpret sentences containing focus particles. Almost all of this work has exclusively examined adult readers' processing. We report three studies comparing children and adults' comprehension of sentences containing the focus particle only. In Experiments 1 and 2, four groups of participants (six to seven years, eight to ten years, eleven to twelve years and adult) compared sentences with only in different syntactic positions against pictures that matched or mismatched events described by the sentence. Contrary to previous findings (Crain, Ni, & Conway, 1994) we found that participants used syntactic information to restrict the scope of the focus particle, but that young children often failed to process contrast information. Experiment 3 replicated these findings with pre-school children.

Crain, S., Ni, W., & Conway, L. (1994). Learning, parsing and modularity. In C. Clifton, L. Frazier, & K. Rayner (Eds.), *Perspectives on sentence processing*. Hillsdale, NJ: Lawrence Erlbaum.

Age of acquisition, not frequency, interacts with consistency in beginning readers.

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We report evidence to support the notion that age of acquisition (AoA) is fundamental to the reading system (e.g., Ellis & Lambon Ralph, 2000). In adults' reading, late-acquired words that are consistent in their pronunciation have been shown to be recognised faster than those with exceptional pronunciations. In children's word recognition there has been conflicting evidence as to whether word frequency interacts with consistency as it does

with adults (e.g., Waters, Seidenberg & Bruck, 1984; Masterson, Laxon & Stuart, 1992), but AoA has not been controlled. The Ellis and Lambon Ralph model predicts an AoA x consistency interaction for even the youngest readers. In our study, young children (6-8yrs) displayed main effects of frequency and regularity but no interaction when AoA was controlled. By 10yrs, however, this interaction emerged. Conversely, when frequency was controlled, even the youngest children displayed a strong interaction between AoA and consistency. This suggests that the frequency x consistency effect in beginning readers found in some previous studies may be due to a confound with AoA.

Ellis, A., & Lambon Ralph, M. (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 & Cognition*, 26 (5), 1103-1123.

Masterson, J., Laxon, V., & Stuart, M. (1992). Beginning reading with phonology. *British Journal of Psychology*, 83, 1-12.

Waters, G. S., Seidenberg, M., & Bruck, M. (1984). Children's and adults' use of spelling-sound information in three reading tasks. *Memory and Cognition*, 12, 293-305.

### Spatial cueing amplifies attention to onset objects; boxes diminish it

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In the absence of focused visual attention, newly appearing objects tend to capture attention. Observers more readily detect a target that is a new object than a target that is derived by transforming an existing (old) object. Capture occurs at the level of object description rather than at the level of simple luminance change detection for both singleton onsets (Yantis & Hillstrom, 1994) and multiple onsets (Gellatly and Cole, 2000). If onsetting objects capture spatial attention, then pre-cueing the location of the target should eliminate the new object advantage. However, Gellatly and Cole recently reported evidence that spatial pre-cueing can amplify rather than eliminate the new object advantage. In this paper we demonstrate that amplification by spatial cueing occurs even when the possibility of eye-movements to the cued location is eliminated. Conversely, the effect is diminished when stimulus objects appear in previously presented outline boxes, presumably due to inhibition of return of spatial attention to the box locations. We conclude that, perhaps in addition to spatial attention, new objects attract a distinct form of non-spatial attention. This “onset attention” interacts multiplicatively with spatial attention.

Yantis, S. & Hillstrom, A.P. (1994). Stimulus-driven attentional capture: Evidence from equiluminant visual objects. *Journal of Experimental Psychology: Human Perception and Performance*, 20, 95- 107.

Gellatly, A.R.H. & Cole, G. (2000). Accuracy of target detection in new-object and old-object displays. *Journal of Experimental Psychology: Human Perception and Performance*, 26, 889-899.

#### Attentional capture by onsets and offsets in the change detection paradigm.

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One of the central issues concerning visual attention is how effective object onset is in capturing stimulus-driven attention compared with other visual events. Evidence from the feature singleton paradigm suggests that the visual system is particularly sensitive to the appearance of a new object. However, the notion that object onset has a special status in attentional capture has not gone unchallenged. Other evidence suggests that the onset effect may be mediated by top-down goal-directed factors or by luminance artefacts. We took a different approach to the issue by using the change detection paradigm to index attentional capture. Assessing how susceptible the appearance of a new object is to change blindness compared with other events may reveal the relative effectiveness of onset in attentional capture. In 4 experiments we assessed whether onset has priority over offset. Results showed that onsets were detected with greater frequency and were also detected more rapidly than offsets. This occurred for displays made up of simple shapes as well as images of real objects. We argue that onset has priority over offset in attentional selection.

#### Neural correlates of change detection and "change blindness"

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Observers seem surprisingly poor at detecting a change if it occurs during a brief visual disruption, such as a 'flicker' ("change blindness", Rensink et al.,1997). Here we used fMRI, Transcranial Magnetic Stimulation (TMS) and behavioural experimentation to reveal the neural correlates of change detection and their potential psychological role. Our fMRI results demonstrated that conscious detection of visual changes was not only

associated with activity in areas of ventral visual cortex specialized for the category that changed (e.g. fusiform gyrus for changing faces) but also on parietal activity in regions that have been previously associated with attention. A causal role for parietal cortex in change detection was confirmed in a TMS study: stimulation of the parietal lobe induced temporary change blindness for faces, despite an intact ventral stream. Behavioural experiments demonstrated that change detection depends critically on the level of attentional load in a primary task of letter search. These results highlight the contribution of parietal cortex to visual awareness of change and support the claim that change blindness can be induced merely by detracting attention from the displays.

Play it again Sam, until we like it. Can implicit learning in music go beyond the learning of adjacent chunks?

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Most research in implicit learning is based on evidence from the visual modality, and emphasises the role of chunking adjacent elements in a sequence. The perception of music relies on knowledge about non-local dependencies, which suggests that this form of learning may go beyond recognising adjacent chunks.

Recent studies utilising serialist music transformations have suggested that this may be the case. The following series of experiments was designed to assess whether an abstract musical rule could be learnt in the absence of any chunking information. Participants were exposed to short musical tunes which all followed an inversion rule. It was found that when subjects were asked to explicitly distinguish between grammatical and ungrammatical tunes, they failed to perform any better than a control group. However when subjects' knowledge was assessed using an indirect measure (liking judgements, as used in Mere Exposure Effect experiments), knowledge about the inversion rule was found to be present. These findings suggest that implicit learning may go beyond pure associative learning, and may also go some way towards furthering our understanding as to why people like certain types of music.

Effect of task titration on dual task at encoding and retrieval: Evidence from healthy adult ageing and patients with alzheimer's disease

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Previous research suggests that age-related decrements during dual task at encoding and dual task at retrieval are confined to secondary task performance. These studies, however, typically have not taken into account the differential demands of the concurrent tasks across individuals. This paper will

describe two experiments examining the effects of dual task at encoding and retrieval when the demands of one (Experiment 1) or both (Experiment 2) of the concurrent tasks are titrated (equated) for individual ability levels. In Experiment 1, younger and older adults performed a response time task while simultaneously encoding or retrieving sequences of digits at span. Significant age-related dual task decrements were only demonstrated on the response time task which was not titrated for individual ability. In Experiment 2, healthy younger and older adults, and patients with mild Alzheimer's disease (AD) performed a tracking task while encoding or retrieving digit sequences. No significant age differences in dual task ability among healthy individuals were demonstrated at encoding or at retrieval. AD patients, however, showed a significant dual task decrement in both memory and tracking performance, especially during dual task at retrieval.

Using the Hebb Effect to investigate computational models of serial order.

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Computational models of serial order in the verbal domain typically identify several levels of control. In the case of verbal short-term memory, an important distinction is that between order over items (i.e. at a lexical level) and order within items (at a phonological level). Hebb's experimental procedure for obtaining serial learning from verbal short-term memory is used to explore this distinction. Effects of temporal grouping, phonemic similarity and articulatory suppression are found to fall into two clusters, consistent with selective action on ordering at the item and phonological levels. Results are discussed in the context of current computational models.

Symposium: The interplay between language and thought: Defining the constraints

Organisers Jules Davidoff, Michael Siegal and Gabriella Vigliocco

Colour category acquisition in Himba and English children – a longitudinal study.

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Previous investigations of colour category acquisition in young children have generally focussed on a narrow time window and on the attainment of those categories deemed 'basic' in Western languages. This study examined the extended process of colour category acquisition in two very different

populations who also differed in their colour terminology. The Himba (a semi-nomadic tribe in northern Namibia) have only 5 basic colour terms while English has eleven basic terms (and many secondary ones). Starting at approximately 3 years of age, a large group of Himba children were tested at 6-month intervals over a three-year period. Alongside this group a smaller group of English children were also tested at 6-month intervals. Gradual category acquisition was observed in both groups, rather than all-or-nothing performance, with accurate naming preceding comprehension, which in turn preceded a non-lexical memory measure. However, though the processes of acquisition appeared markedly similar for the two populations, the eventual categorisation was different and dependent on colour vocabulary. In addition, English children in the later stages of category acquisition showed a surprising dip in naming and recognition for 'basic' colours as their vocabulary increased to include secondary colour terms.

Moving on: from language and thought to thought and language.

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The focus of most recent work on the relationship between language and thought has been the consideration of the question of whether thought is universal, or whether specific differences in the world's myriad languages result in concomitant differences in speakers' underlying thoughts. In this talk I will review some recent work looking at tense marking in verbs that considers not just whether thought is universal and independent of language, but whether aspects of language that have been supposed to be innately universal and independent of thought are indeed so.

Does language shape thought? Tense and the perception of actions in English and Indonesian.

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Does the language you speak shape the way you think about the world? I will report a series of studies investigating how English and Indonesian speakers encode and represent action events. Unlike English, Indonesian verbs do not include tense markers. Indonesian speakers are not required to indicate whether an event has already occurred, is happening now, or will occur in the future. Does needing to include tense to speak English grammatically change

the way English speakers pay attention to, encode and remember events? We find cross-linguistic differences in memory, similarity, and categorization judgements between English and Indonesian speakers, as well as between Indonesian-English bilinguals tested in English and Indonesian. Further, we have investigated how these cognitive differences emerge in the course of linguistic development.

### The interplay of language-specific syntactic properties and semantics

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Languages differ in terms of how properties of things and events in the world are grammaticalised. For example, while in English nouns are either count (can be pluralised, e.g., "carrot") or mass (cannot be pluralised, e.g., "spinach"), in Japanese such a distinction does not exist. These differences lead to the question of whether the semantic representations of the corresponding words for speakers of English differ from those of Japanese speakers.

In the talk, I will present a series of experiments using both off-line and on-line techniques, in which I have explored within and between languages whether the presence/absence of a given syntactic property leads to differences in the semantic representations of the corresponding words.

### Language and thought in signers of BSL before and after CVA: Comparing RH and LH strokes

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It is generally agreed that sign languages are lateralised to the left hemisphere. This is borne out both by recent imaging studies of the processing of British Sign Language (BSL) sentences and earlier behavioural studies of LHD and RHD signers. However, there are a number of lines of evidence suggesting that the RH might be involved in some areas of sign language processing, notably those constructions which involve representations of real-world spatial relations (topographic sentences). This presentation reviews current research on LHD and RHD signers of BSL, exploring dissociations between impairments in the areas of sign/gesture and manual/non-manual sign/gesture, relating these to functional imaging and behavioural studies of normal signers.

Reasoning without grammar: Evidence from aphasia

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Understanding the inter-relationship between language and thought is fundamental to the study of human cognition. Evidence from aphasia can be used to illuminate issues of the role of language in the established cognitive processes of adults. Some investigators have proposed that propositions in natural language are the substance of certain forms of thinking such as those that involve causal or scientific reasoning. Alternative proposals suggest that language serves to scaffold thinking, for example, by providing a sequential structure to a massively parallel process. Here we describe evidence from a variety of patients with severe agrammatic aphasia. The results point to the considerable independence of cognition from propositional language that is generated by grammatical systems.

END OF SYMPOSIUM

**EPS Prize Lecture**

Crossmodal attention and multisensory integration

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In daily life, our attention has to be co-ordinated across several different sensory modalities simultaneously in order to selectively process relevant information and to avoid multisensory overload. A rapidly growing body of cognitive neuroscience research now highlights the existence of extensive and obligatory crossmodal links in attention between the senses that can both facilitate and limit our ability to process this multisensory information. In my talk, I will describe studies that have utilized a range of different experimental paradigms to examine issues related to selective/divided attention and multisensory integration across audition, vision, touch, smell, taste and pain. I will highlight some of the major findings to have emerged from this research, and also illustrate some of the issues currently vexing researchers in this area. Finally, I will illustrate how our growing understanding of the nature of the crossmodal links constraining attention and the rules governing multisensory integration are now being used in a number of applied settings such as product and interface design.

Cross-modal illusory conjunctions between vision and touch

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In visual perception, the binding problem concerns the ability of our visual system to integrate the features of multiple objects, and give the correct representation of the objects that are in the scene instead of one of the many alternative, but incorrect recombinations of their features (called illusory conjunctions). The binding problem has been widely investigated in visual perception. We have studied the binding problem not only within vision, but also in cross-modal perception.

In Experiment 1 we provided evidence for cross-modal illusory conjunctions (ICs) where, under conditions of divided attention, people can report felt textures as being seen. With Experiment 2 we showed that cross-modal ICs can be more frequent when tactile and visual stimuli are presented in the same hemifield than when they are presented in different hemifields, consistent with a perceptual locus to the effect. In Experiment 3 we provided more evidence for a perceptual rather than a memorial account of ICs using a forced-choice procedure. Experiment 4 showed that attention can reduce the occurrence of cross-modal ICs. In Experiment 5 we collected data from a patient with parietal damage and presented further confirmatory evidence for a perceptual account of ICs. Finally, in Experiment 6 we found the occurrence of the opposite type of cross-modal ICs, in which visual features are reported as tactile.

Our data are consistent with there being a cross-modal integration of sensory information, with the modality of origin sometimes being mis-attributed when attention is constrained.

ERP and fMRI measures indicate that supramodal control processes for spatial attention modulate 'unimodal' sensory processing.

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Numerous behavioural studies have now demonstrated crossmodal links in human spatial attention, such that attending to a particular location for one modality can influence performance at that location versus elsewhere in other modalities also (e.g. see Spence EPS-Prize lecture at this meeting). Here we discuss recent ERP and fMRI studies on the neural basis of such crossmodal interactions in spatial attention. These reveal that crossmodal interactions can influence sensory brain areas, and sensory ERP components, that would usually

be considered unimodal' (e.g. attending to a particular location in touch can modulate responses to visual stimuli from that location, in or over occipital cortex). The fMRI and ERP data also indicate that such effects may be produced by feedback-influences from multimodal control processes in frontal and parietal cortex.