EPS

Experimental Psychology Society

EXETER MEETING

10-11 APRIL 2003

A scientific meeting will be held at the School of Psychology, Washington Singer Laboratories, University of Exeter on 10-11 April, 2003. The local organiser will be Dr Andy Wills.

Symposia:

Thursday 10 April 2.00-5.30

<u>Infant Perception and Cognition</u>
Organiser: Alan Slater

Friday 11 April 9.00-12.30

<u>New directions in human associative learning</u>
Organiser: Andy Wills

Presentations

Sessions will be held in the School of Psychology, Washington Singer Laboratories, Rooms 025 and 219. Both theatres have data projectors for Powerpoint presentations. Presenters may provide their own laptops and connector leads, or bring 3.5" Windows/DOS formatted floppy disks or CDs for the on-site computers which run Powerpoint 2000 under Windows. Any queries about facilities in the theatres should be sent to the local organiser, Andy Wills, (a.j.wills@ex.ac.uk).

Coffee will be served in Room 028, School of Psychology.

The School of Psychology welcomes EPS delegates to a free wine reception on Wednesday 9 April, from 6.30pm, in Room 028.

There will be a drinks reception at 6pm on Thursday evening in Room 028, School of Psychology. The conference dinner will be at 7.30 at the Royal Clarence Hotel, Cathedral Yard. A booking form is enclosed.

START OF PARALLEL SESSIONS

Session A

Room 025

9.00   **Carlo De Lillo, Giovanna Spinozzi*, Valentina Truppa* and Sara Castelli*** (University of Leicester and Consiglio Nazionale delle Ricerche (C.N.R.), Rome)
The role of structure in the visual processing of embedded figures by capuchin monkeys (***Cebus apella***) **.**

9.30   **Martin Jüttner* and Ingo Rentschler*** (Neuroscience Research Institute, Aston University and Institute of Medical Psychology, University of Munich) (Introduced by Jules Davidoff)
Multimodal learning of 3D objects in late childhood and adolescence

10.00   **Mike Burton and Rob Jenkins*** (University of Glasgow)
Exemplars versus prototypes in face recognition

10.30   **Steve Kelly and Katie Wilkin*** (University of Keele)
A dual process account of performance on the digit invariance task

11.00   COFFEE

11.30   **Melina A Kunar*, Glyn W Humphreys and Kelly Smith*** (University of Wales Bangor and University of Birmingham)
Visual change with moving displays: More evidence for colour feature map inhibition during preview search

12.00   **D J K Barrett*, T Menneer*, L Phillips*, K R Cave* and N Donnelly** (Centre for Visual Cognition, Department of Psychology, University of Southampton)
The breakdown of efficient feature search for multiple, same dimension targets

12.30   **Stacy Eltiti* and Elaine Fox** (University of Essex)
Selective target processing and perceptual load

1-2   LUNCH

START OF PARALLEL SESSIONS

Session B

Room 219

9.00   **Tim Hodgson, Caroline Ketcham*, Dimitra Molyva*, Petroc Sumner* and Christopher Kennard*** (University of Exeter, Motor Control Laboratory, Arizona State University and Division of Neuroscience and Psychological Medicine, Imperial College London) Impaired memory-motor transformations in Parkinsons disease

9.30   **Michael A Ford*, William D Marslen-Wilson and Matthew H Davis** (MRC Cognition and Brain Sciences Unit, Cambridge) Morphemic frequency effects in lexical decision: The role of productivity

10.00   **Boris New* and Marc Brysbaert** (Royal Holloway, University of London) Inflectional morphology and the French plural

10.30   **Timothy Jordan and Geoffrey Patching*** (University of Nottingham) What do lateralized displays tell us about visual word perception? A cautionary note from the word-letter effect

11.00   COFFEE

11.30   **Marc Brysbaert and Kathy Rastle*** (Royal Holloway, University of London) Masked phonological priming in visual word recognition: New convincing evidence in English

12.00   **J Richard Hanley, Gary S Dell*, Janice Kay and Rachel Baron*** (University of Essex, University of Illinois, USA and University of Exeter) Evidence for the involvement of a nonlexical route in the repetition of familiar words; A comparison of single and dual route models of auditory repetition

12.30   **Rob Jenkins* and Mike Burton** (University of Glasgow) Facilitation and inhibition in repetition priming

1-2   LUNCH

Session A

Room 025

Symposium: <u>Infant perception and cognition</u>
                  Organiser: Alan Slater

2.00   **Christopher M Harris* and Siobhan Garbutt*** (University of
           Plymouth and Department of Visual Science, Institute of Child Health,
           London)
           Infant saccades are not slow

2.30   **Mike Van Duuren*** (King Alfred's College, Winchester)
           Early aesthetic choices: Infant preferences for attractive premature
           infant faces

3.00   **J Gavin Bremner*, Scott P Johnson*, Alan M Slater, Uschi
           Mason*, Kirsty Foster* and Andrea Cheshire*** (Lancaster
           University, Cornell University and University of Exeter)
           Four-month-olds' perception of object trajectories that change during
           occlusion

3.30   TEA

4.00   **Paul C Quinn*** (Washington and Jefferson University)
           Infant categorization of humans and nonhuman animals: Roles for
           knowledge access and perceptual process

4.30   **Graham Schafer** (University of Reading)
           Possible mechanisms of early word learning

5.00   **Rachel Hayes*, Alan Slater and Liz Brown*** (University of Exeter)
           The relationship between rhyme detection in early infancy and later
           phonological knowledge

5.40   Business Meeting (Room 025)

6.00   DRINKS RECEPTION (Room 028)

7.30   CONFERENCE DINNER, ROYAL CLARENCE HOTEL

Session B

Room 219

2.00   **Stephen Darling*** (Goldsmiths College) (Introduced by Tim Valentine)
Subdivisions of visuospatial working memory: the contributions of modality and sequentiality

2.30   **Stephen Monsell and Guy Mizon*** (University of Exeter)
Does the preparation effect in cued task-switching measure task-set reconfiguration?

3.00   **Petroc Sumner*, Eleni Orfanidou* and Lubna Ahmed*** (Department of Cognitive Neuroscience and Behaviour, Faculty of Medicine, Imperial College London and MRC Cognition and Brain Sciences Unit, Cambridge) (Introduced by Stephen Monsell)
Task switching and language switching: the effects of task-recency and stimulus-specificity.

3.30   TEA

4.00   **Jane L Morgan* and Antje S Meyer** (Behavioural Brain Sciences Centre, University of Birmingham)
The co-ordination of planning processes for successive items in a multiple-object naming task

4.30   **E P Chronicle, T C Ormerod and J N MacGregor** (Lancaster University and University of Victoria, Canada)
Global versus local processing in optimisation problem solving.

5.00   **Steven Glautier*** (University of Southampton) (Introduced by Andy Wills)
Asymmetry of generalisation decrement in causal judgements

5.40   Business Meeting (Room 025)

6.00   DRINKS RECEPTION (Room 028)

7.30   CONFERENCE DINNER, ROYAL CLARENCE HOTEL

Session A

Room 025

Symposium: New directions in human associative learning
Organiser: Andy Wills

9.00   **Catherine Myers*, J DeLuca* and M Gluck*** (Rutgers University and Kessler Medical Rehabilitation Research & Education Corporation)
Dissociating amnesic sub-types with simple associative tasks.

9.30   **Jan de Houwer Tom Beckers*, and Stefaan Vandorpe*** (University of Ghent and University of Leuven, Belgium)
Evidence for the role of deductive reasoning in forward blocking

10.00   **Andy Field** (University of Sussex)
I don't like it because it eats Brussels Sprouts: Conditioning preferences in children

10.30   **Andy Wills and Jan Zwickel*** (University of Exeter and University of Heidelberg)
Can there be error correction in the absence of error?

11.00   COFFEE

11.30   **Mike Le Pelley*** (Cambridge University)
The role of associative history in human causal learning

12.00   **Robin Murphy and Rachel Msetfi*** (University of Hertfordshire)
Sensitivity to outcome and no outcome density in causal learning tasks: An associative analysis of the *Depressive Realism* effect.

End of Symposium

12.30   **Tom Beckers* and Steven Glautier*** (University of Leuven, Belgium and University of Southampton) (Introduced by Jan De Houwer)
Evidence for a deductive reasoning account of cue competition in human contingency learning (HCL): forward blocking in Michotte's launching task.

1-2   LUNCH

Session B

Room 219

9.00   **Neil P McAngus Todd, Sally M Rosengren* and James G Colebatch*** (University of Manchester and Institute of Neurological Sciences, Prince of Wales Hospital, Sydney, Australia)
A short latency vestibular evoked potential produced by bone-conducted acoustic stimulation.

9.30   **Sven L Mattys** (University of Bristol)
A hierarchical approach to speech segmentation: Stress versus coarticulation

10.00   **Kathleen Rastle*, Karen Croot*, Natalie Molloy*, Sallyanne Palethorpe*, Ruth Brunsdon* and Kathleen Bakker*** (Royal Holloway, University of London, Macquarie Centre for Cognitive Science, Macquarie University, Australia, University of Sydney, Australia and Developmental Cognitive Neuropsychology Research Unit and Rehabilitation Department, The Children's Hospital, Westmead, Australia) (Introduced by Marc Brysbaert)
A single-case investigation of an acquired American accent following traumatic brain injury

10.30   **Matthew H Davis and Ingrid S Johnsrude*** (MRC Cognition and Brain Sciences Unit, Cambridge)
Hierarchical processing in spoken language comprehension

11.00   COFFEE

11.30   **J C Catling* and R A Johnston** (University of Birmingham)
Age of Acquisition effects on word generation

12.00   **Jelena Havelka* and Inoka Tomita Wijenayake*** (University of Kent in Canterbury) (Introduced by Marc Brysbaert)
AoA effects in naming Kanji and Kana

12.30   **M F Damian* and J S Bowers** (University of Bristol)
Effects of orthography on language production

1-2   LUNCH

Session A

Room 025

2.00   **Fraser Milton* and Andy Wills** (University of Exeter)
            The influence of stimulus properties on category construction

2.30   **Aureliu Lavric* and Nick Chater** (University of Exeter and
            University of Warwick)
            'Eager' and 'lazy' learning identified by spaced vs massed exposure

3.00   **Peter A Bibby** (University of Nottingham)
            Novelty and confidence in artificial grammar learning.

3.30   **Andrew Rutherford*,** (University of Keele) (Introduced by Steve
            Kelly)
            An examination of ICE model and cue-overload hypotheses with
            respect to EC-dependent recognition

END OF PARALLEL SESSIONS

End of Meeting

Session B

Room 219

2.00   **Colin J Davis* and Jeffrey S Bowers** (University of Bristol)
(Introduced by Marc Brysbaert)
What do letter migrations tell us about letter position coding?

2.30   **Ruth Filik*, Kevin Paterson*, Simon Liversedge** (Institute of
Behavioural Sciences, University of Derby, and University of Durham)
Processing quantifier scope ambiguities during normal reading

3.00   **Sarah J White*, Keith Rayner and Simon P Liversedge** (University
of Durham and University of Massachusetts)
Predictability and word length independently influence word skipping.

3.30   **Simon P Liversedge, Keith Rayner, Sarah J White*, Dorine
Vergilino-Perez*, John M. Findlay and Robert Kentridge***
(University of Durham, University of Massachusetts and University of
Paris)
Reading disappearing text

END OF PARALLEL SESSIONS

End of Meeting

The role of structure in the visual processing of embedded figures by capuchin monkeys (*Cebus apella*) .

Carlo De Lillo[1], Giovanna Spinozzi[2], Valentina Truppa[2] and Sara Castelli[2]
1.   University of Leicester
2.   Consiglio Nazionale delle Ricerche (C.N.R.), Rome
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Previous comparative analyses indicated that, in contrast with pre-school children tested in similar conditions (De Lillo, Spinozzi, Truppa & Naylor, 2002), capuchin monkeys show a local advantage in processing hierarchical visual stimuli (Spinozzi, De Lillo & Truppa, 2003). Here we report the results of three further experiments aimed at assessing the sensitivity of non-human primates to basic forms of spatial organisation, by using tasks based on an embedded figures paradigm. All the experiments employed a simultaneous matching-to-sample procedure. In the first experiment, six monkeys received a visual pattern as the sample and had to identify the comparison stimulus featuring some of its parts. Performance level was higher when the parts were ungrouped elements than when they formed structures of spatially interrelated parts. This was true irrespectively of whether the stimulus parts were organised as closed (e.g. squares or circles) or open (e.g. crosses) shapes. In Experiment 2, the sample featured the parts and the comparison stimuli the whole patterns. Here the advantage for ungrouped elements disappeared. The results of the first two experiments were replicated in a third experiment featuring novel stimuli and the counterbalancing of task presentation across subjects. These findings suggest that, within the scope of the tasks and stimuli featured here, monkeys are either hindered by or insensitive to some of the organisational factors which facilitate the processing of part-whole relationships in humans.

De Lillo, C. Spinozzi, G. Truppa, V. & Naylor, D.M. (2002). A comparative analysis of global and local processing of hierarchical visual stimuli in young children and monkeys (*Cebus apella*). *Perception*, 31(supplement): 75 (abstract).
Spinozzi, G., De Lillo, C. & Truppa, V. (2003). Global and local processing of hierarchical visual stimuli in tufted capuchin monkeys (*Cebus apella). Journal of Comparative Psychology.*

Multimodal learning of 3D objects in late childhood and adolescence

Martin Jüttner[1] and Ingo Rentschler[2]
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Spatial objects may be perceived both visually and by touch. In a crossmodal learning paradigm we investigated whether prior object knowledge acquired in either the haptic or visual sensory modality transfers to a subsequent visual learning task. Three molecule-like models served as learning objects. 30 school children (aged 8-14) and a reference group of 15 adults participated. With regard to visual learning we

observed a significant interaction between age and the sensory modality used during the exploratory phase. For younger children (age 8-9 years) haptic exploration reinforced visual categorisation less than visual preexploration did. In adolescence and adulthood (age 13-14 years and beyond) this effect was found to be the reverse. Our results provide evidence for a developmental transition between different modes of processing that might facilitate or hamper the multimodal binding of haptic and visual object representations.

Exemplars versus prototypes in face recognition

Mike Burton and Rob Jenkins
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Familiar face recognition is extremely good, and robust across many image variations. There are broadly two accounts of familiar face recognition: 1) An exemplar account, i.e. we store so many images of Rolf Harris, that any new image is likely to find a good match; and 2) A prototype account, i.e., we store an idealised representation of Rolf Harris which can be used to match any new image. Theoretical models of face recognition generally assume a version of the prototype account. Here we present evidence that an implemented prototype model of face recognition can perform much more accurately than an exemplar model. Furthermore, the efficiency of the abstract representation is sensitive to the number of images used to form it (i.e., one's representation improves with experience). We demonstrate that such a system delivers performance which is robust across superficial image changes which normally impede automatic face recognition systems. We also demonstrate that, in some well-defined circumstances, human viewers prefer our prototype (the ideal Rolf Harris) to real instances of Rolf Harris.

A dual process account of performance on the digit invariance task

Steve Kelly and Katie Wilkin
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McGeorge & Burton (1990) demonstrated incidental learning of an invariant characteristic of a stimulus set (the digit '3' was always present in a set of four digit numbers). A later account (Cock, Berry & Gaffan, 1994) suggested that learning in this task was based upon a similarity mechanism that compared the specific similarity of a test exemplar to that of a previously seen study exemplar. Cock et al noted that similarity was confounded with the invariance 'rule' in the original study and found that when the two processes were set in opposition, subjects seemed to use the similarity matching process. Newell and Bright (2002) report a failure to replicate this similarity effect.

We propose a dual process account of performance in the digit invariance task whereby performance may be mediated by a similarity matching process or by a prototype extraction process similar to the account of dot pattern recognition advocated by Homa, Sterling & Trepel (1981). We present data from several

experiments which show that a) under conditions where memory for individual study exemplars is subject to decay or interference, performance seems to be based on a prototype extraction mechanism which learns the invariance in the stimulus set and b) under conditions where individual study exemplars are likely to be relatively intact in memory, it is possible to show a similarity matching process may be operating. Further, we discuss the relative accessibility to conscious awareness of the learned information depending on which route was predominantly used for learning.

Cock, J., Berry, D.C. & Gaffan, E.A. (1994). New strings for old: The role of similarity processing in an incidental learning task. *Quarterly Journal of Experimental Psychology*, **47**, 1015 – 1034.

Homa, D., Sterling, S., & Trepel, L. (1981). Limitations of exemplar-based generalisation and the abstraction of categorical information. *Journal of Experimental Psychology: Human Learning and Memory*, **7**, 418-439.

McGeorge, P., & Burton, A. M. (1990). Semantic processing in an incidental learning task. *Quarterly Journal of Experimental Psychology Human Experimental Psychology,* **42**, 597-609.

Newell, B.R. & Bright, J.E.H. (2002). Evidence against hyperspecificity in implicit invariant learning. *Quarterly Journal of Experimental Psychology*, **55**, 1109-1126.

<u>Visual change with moving displays: More evidence for colour feature map inhibition during preview search</u>

Melina A Kunar[1], Glyn W Humphreys[2] and Kelly Smith[2]
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We investigated preview search with moving preview and search displays. The stimuli moved in multiple directions and items in the preview could change either their colour or their shape prior to the onset of the new (search) displays. In the baseline experiment (Experiment 1) we found no evidence for participants being limited to ignoring about 4 or 5 items, suggesting that attentive tracking of old items was not crucial to performance. In the change conditions (Experiments 1 and 2) we found no effects due to altering the shape of preview stimuli, along with disruptive effects when there was a colour change. In contrast, with static displays, shape but not colour change disrupted preview search (Experiment 3 and 4). The data suggest that preview search with moving displays is influenced by inhibition of a colour-map for old distractors. In contrast, preview search with static displays is influenced by inhibition of locations and/or shapes of old distractors.

The breakdown of efficient feature search for multiple, same dimension targets

D J K Barrett, T Menneer, L Phillips, K R Cave and N Donnelly.
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Search performance is most efficient when the target can be discriminated from other items in the display by its value along a single feature dimension (e.g. colour). Search can also be fairly efficient when a target can be discriminated from distractor items by a unique conjunction of values from separate feature dimensions (e.g. colour and orientation). We investigate whether this efficiency is maintained for multiple targets when each is specified by a different value within the same feature dimension. Participants responded to the absence or presence of a colour target among eight heterogeneous colour patches and mean exposure thresholds for 71% correct performance were calculated using a two-up one down staircase procedure. Comparisons across three target conditions (colour A, colour B, and colour A or B) revealed exposure thresholds for target A or B that were significantly greater than the sum of exposure thresholds for target A and target B individually. While guided search is possible for single targets specified by a unique feature, guided search breaks down and search becomes inefficient when the target item is specified by more than one potential value within the same feature dimension.

Selective target processing and perceptual load

Stacy Eltiti and Elaine Fox
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Perceptual load theory (Lavie, 1995) states that participants' cannot engage in focused attention when shown low load displays, because attentional resources are not exhausted by the display. An alternative 'cueing' hypothesis is that sudden onset distractors are particularly salient in low load displays and therefore capture attention. For example, Atchley, Kramer, and Hillstrom (2000) demonstrated that precue onsets captured attention, but that precue offsets only captured attention when the target also appeared as an offset. Three experiments were conducted to investigate the influence of distractor onset and offsets on selective processing while measuring interference effects. Low and high load displays were utilized. Perceptual load theory predicts that regardless of distractor presentation (onset or offset) interference should occur. The cueing hypothesis, however, predicts that interference should occur only when the distractor appears as an onset and not as an offset. The results showed that interference effects only occurred when the distractor was presented as an onset and never occurred when the distractor was presented as an offset. These results supported the cueing hypothesis.

Atchley, P., Kramer, A.F., & Hillstrom, A.P. (2000). Contingent Capture for Onsets and Offsets: Attentional Set for Perceptual Transients. *Journal of Experimental Psychology: Human Perception and Performance*, 26(2), 594-606.

Lavie, N. (1995). Perceptual Load as a Necessary Condition for Selective Attention. *Journal of Experimental Psychology: Human Perception and Performance*, 21(3), 451-468.

Impaired memory-motor transformations in Parkinsons disease

Tim Hodgson[1], Caroline Ketcham[2], Dimitra Molyva[3], Petroc Sumner[3] and Christopher Kennard[3]
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2. Motor Control Laboratory, Arizona State University
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Neuroimaging studies indicate that the rostral Caudate nucleus transforms spatial mnemonic information into actions. The caudate also suffers from dopamine depletion in early stage Parkinsons disease patients (PDs). Here we describe the performance of PDs on two tasks that require actions to be coordinated based on spatial information in memory.

In the first task, patients executed sequences of movements from memory. Performance was compared under conditions for which the sequence was the same on each trial or varied randomly. In a control condition targets were illuminated throughout the response period. PDs showed a reduction in accuracy relative to controls under all memory-guided conditions. However, the size of this deficit was not dependent on sequence length, delay or memory load. In the second task, patients learned a rule linking a coloured shape with a movement to the left or right. Patients made increased numbers of corrective movements in this task. However, their reduction in movement efficiency was not modulated by the occurrence of changes in rule mappings.

The results are consistent with a role for the striatum in transforming spatio-cognitive representations into action. We propose that this may be a core cognitive deficit in the early stage of Parkinsons disease.

Morphemic frequency effects in lexical decision: The role of productivity

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Morphemic frequency effects in lexical decision have been used as evidence that complex word forms are decomposed into their constituent morphemes. We present data from three lexical decision experiments, which used multiple regression to explore morphemic frequency effects with suffixed words and their interaction with productivity. Productivity is the extent to which a word or affix is likely to be involved in the formation of a new lexical form and may be an important factor in governing whether a word is or is not decomposed. Experiment 1 showed clear morphemic frequency effects, both of cumulative morpheme frequency and family size. These effects were stronger in the productively suffixed items. Experiment 2

directly addressed this issue and confirmed the results of Experiment 1, with morphemic frequency effects found only for the productive items. Experiment 3 re-examined this result with an improved stimulus set, and found that although unproductively suffixed derived forms do in fact show effects of family size, they do not show effects of cumulative morpheme frequency. In a meta-analysis of all three experiments there was a significant interaction of cumulative morpheme frequency and productivity. These data are discussed with reference to current theories of morphological processing.

Inflectional morphology and the French plural

Boris New and Marc Brysbaert
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There is a debate in the literature about how morphologically complex word forms are represented in the mental lexicon. Some authors claim that inflected word forms such as plurals are not stored separately, but are derived from the base forms by the application of a set of rules (at least when the plural word form is regular). Other authors defend the idea that all inflected as well as uninflected word forms are stored individually in the lexicon. Thus far, two studies have been reported on this issue, one in English and one in Dutch, with conflicting results. In Dutch, it was found that the processing times of singulars depended on the cumulative frequency of both the singular and the plural word forms, whereas the processing times of plurals were sensitive to the frequency of the plurals only. In English, however, the processing times for both singulars and plurals seemed to depend on their respective surface frequency only, with no hint of an influence of the cumulative frequency. A series of experiments was run to investigate the issue in French with the use of a lexical decision task. We found that the lexical decision times for singular forms depended on the cumulative frequency, whereas for plural forms, the processing times depended on both the cumulative frequency and the surface frequency. Our results are more in line with the Dutch data than with the English. At the moment, no linguistic difference between English on the one hand and Dutch and French on the other hand has been found that could explain this discrepancy. We are currently repeating the English study to find out whether this language really differs or whether some peculiarity in the experimental design could explain the deviating results.

What do lateralized displays tell us about visual word perception? A cautionary note from the word-letter effect.

Timothy Jordan and Geoffrey Patching
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A common assumption underlying laterality research is that visual field asymmetries in lateralized word perception indicate the hemispheric specialization of processes normally used when words are perceived foveally (i.e., in the centre of the visual field). We tested the validity of this assumption using a phenomenon (the

word-letter effect) frequently reported for displays viewed in the central visual field, where letters in words are perceived more accurately than the same letters presented in isolation. Words and isolated letters were presented in the left visual field (LVF), right visual field (RVF) and central visual field (CVF), the Reicher-Wheeler task was used to suppress influences of guesswork, and an eye-tracker ensured central fixation. In line with previous findings, lateralized displays revealed a robust RVF-LVF advantage for words (but not isolated letters) and CVF displays revealed a robust advantage for words over isolated letters. However, RVF and LVF displays both produced an advantage for isolated letters over words (a *letter-word effect*), indicating that processes subserving the advantage conferred by word context when participants viewed stimuli in foveal vision were unavailable for lateralized displays. Explanations and implications of this difference between central and lateralized displays are presented.

Masked phonological priming in visual word recognition: New convincing evidence in English

Marc Brysbaert and Kathy Rastle
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Some 15 years ago, masked priming provided the first empirical evidence for automatic, phonological coding in visual word recognition. The target word "CREEP" is more easily processed when it is preceded by the homophonic non-word prime "creap" than when it is preceded by the control non-word prime "crelp". However, despite repeated demonstrations of the phonological priming effect, a large number of researchers have remained sceptical about the effect. There are several reasons for this, including failures to replicate, poor stimulus materials, and the possibility of strategic influences on performance. We present two experiments in which we assessed the influence of a pseudohomophone prime on visual lexical decision performance, relative to the influence of an orthographic control prime. Word targets (e.g., JERK) were preceded by a pseudohomophone (e.g., JIRQUE) or a control (e.g., JORPHE) masked prime presented for 57 ms.

Pseudohomophones and control primes were created using the ARC Nonword Database (Rastle, Harrington, & Coltheart, 2002), ensuring that they formed legal letter sequences according to the phonotactic constraints of British English and that they comprised identical levels of similarity to the targets. In the first experiment, the nonword trials consisted of legal nonwords; in the second experiment, they included pseudohomophones. In both experiments, a reliable phonological priming effect was obtained. We discuss implications for computational models of reading.

Rastle, K., Harrington, J., & Coltheart, M. (2002). 358,534 nonwords: The ARC Nonword Database. *The Quarterly Journal of Experimental Psychology*, 55A, 1339-1362

Evidence for the involvement of a nonlexical route in the repetition of familiar words; A comparison of single and dual route models of auditory repetition

J Richard Hanley[1], Gary S Dell[2], Janice Kay[3] and Rachel Baron[3]
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In this paper, we attempt to simulate the picture naming and auditory repetition performance of two patients who are matched for picture naming score but who differed significantly in their ability to repeat familiar words. In Experiment 1, we demonstrate that the model of naming and repetition put forward by Foygel and Dell (2000) is better able to accommodate this pattern of performance than the model put forward by Dell, Schwartz, Martin, Saffran and Gagnon (1997). Nevertheless, Foygel and Dell's model underpredicted the repetition performance of both patients. In Experiment 2, we attempt to simulate their repetition performance using a new dual route model of repetition in which a lexical-semantic repetition route is augmented by an additional nonlexical repetition pathway. The new model provides a more accurate prediction of the real word repetition performance of both patients. It is argued that the results provide support for dual route models of auditory repetition (e.g. Hanley, Kay & Edwards, 2001).

Facilitation and inhibition in repetition priming

Rob Jenkins and Mike Burton
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Repetition priming is a common measure of processing in cognition research, and refers to the fact that stimuli that were previously presented in a prime phase ('primed' items) are typically processed more quickly than new ones ('unprimed' items) in a later test phase. Conventionally, this priming effect has been interpreted purely in terms of facilitation for the primed items, but some recent observations challenge this. In 3 experiments we manipulated subjects' expectancy for primed names in the test phase by varying the proportion of primed and unprimed names that were presented. Whenever the stimulus domain was the same at prime and test (names), facilitation onto the primed items was seen, regardless of whether or not it was rational to be expecting prime items. Whenever it *was* rational to be expecting prime items, *inhibition* onto *unprimed* items was always seen, regardless of the stimulus domain at prime (names vs. faces). We conclude that repetition priming can be split into two independent components - a facilitatory component that seems to be automatic, and an inhibitory component that seems to be 'strategic' in some sense.

Symposium: Infant perception and cognition
Organiser: Alan Slater

Infant saccades are not slow

Christopher M Harris[1] and Siobhan Garbutt[2]
1.   University of Plymouth
2.   Department of Visual Science, Institute of Child Health, London
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Saccadic eye movements are essential for redirecting the fovea at different visual targets. Infant saccades are markedly inaccurate with a strong undershoot bias, but little is known about the speed of saccades. A single previous study reported that infant saccades may be similar or slower than adults', but few saccades were recorded. We re-examine this issue using a new technique of measuring optokinetic quick phases, which are readily elicited from infants.

We measured the peak velocity and duration of saccades ('main sequence') using dc-electro-oculography from optokinetic quick phases in 18 infants aged 2 to 18 months and 8 adult control subjects. All infant saccades showed typical relationships between peak velocity, duration and amplitude. Overall, there was no significant difference between adult and infant main sequences. However, individual differences were present, and some infants produced saccades faster than adults, but not slower. There was no significant age trend. At least from the age of 2 months, infants generate saccades with similar or possibly slightly higher speeds than adults. This is in contrast to the rapid development in other oculomotor function, especially saccade accuracy. We discuss the possible evolutionary / perceptual advantages of rapid yet inaccurate movements.

Early aesthetic choices: Infant preferences for attractive premature infant faces

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Previous studies have shown that when newborn and young infants are shown attractive and unattractive adult faces they will look longer at the attractive faces. Three studies with infants ranging from 5 months to 15 months were conducted to examine whether this attractiveness effect holds for infants looking at infant faces. A standard preferential looking technique was used in which infants were shown pairs of colour slides of upright (Experiments 1 & 2, n=16) or inverted (Experiment 3, n=16) infant faces previously rated by adults for attractiveness. Although Experiment 1 did not reveal an attractiveness effect this effect did become manifest in Experiment 2 after increasing stimulus exposure time and replacing three of the original stimulus faces. The attractiveness effect was lost when faces were presented upside down. Findings are discussed in relation to the feature based versus configural processing debate in the face processing literature and in relation to the notion that attractiveness is based on pre-sexual maturity rather than 'cuteness'.

Four-month-olds' perception of object trajectories that change during occlusion

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Recent research shows that 4-month-old infants perceive an object's trajectory as continuous when it passes behind an occluder, provided the time or distance out of sight is short. In Experiment 1, 4-month-olds were habituated to an object travelling horizontally on a high (or low) trajectory on one side of the occluder, but emerging on a low (or high) trajectory on the other side. Test trials omitted the occluder and displayed a discontinuous trajectory showing just the two previously visible components, and a continuous trajectory in which the object travelled horizontally, then diagonally, then horizontally again. Infants showed no significant preference for either test event. In Experiment 2, 4-month-olds were habituated to an object moving on a falling oblique trajectory on the left of the occluder and re-emerging on a rising oblique trajectory. Test trials involved a discontinuous trajectory, and a continuous trajectory in which the object changed trajectory abruptly at the mid-point. Infants again showed no significant preference for either trajectory. Experiment 3 repeated Experiment 2 with the addition of a horizontal surface on which the object could 'bounce' to achieve the trajectory change. This manipulation led to no change in 4-month-old infants' preference on test trials. In all three studies, these null preferences depart significantly from that in a comparable condition involving a constant horizontal trajectory, which yielded positive results. There is thus no evidence that infants perceive trajectory continuity when the height or angle of trajectory change while the object is out of sight, even when a surface is provided that makes physical sense of the trajectory change. These findings confirm earlier conclusions that 4-month-olds' perception of trajectory continuity is limited to simple movements involving occlusions over very short distances or times.

Infant categorization of humans and nonhuman animals: Roles for knowledge access and perceptual process

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This talk will examine how young infants categorize humans and nonhuman animals in studies that measure infant looking time responses to visually presented exemplars. The evidence reviewed indicates that young infants' representations for nonhuman animal species are basic-level in their exclusivity, structured by summary-level information, anchored by part information, and formed on-line during the course of an experiment. In contrast, young infants' representation for humans is global in its exclusivity, based on exemplar information, configured by holistic-gestalt information, and constructed on the basis of previous experience. These data suggest

that young infants may represent humans at an 'expert' level, and imply more generally that 'expert' representations can occur early in development with sufficient experience.

Possible mechanisms of early word learning

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I contrast high level, domain general, theories about how infants might learn their first words, with low level, domain general learning. I argue that the latter type of theory may be more useful if we want to isolate real mechanisms at work in the emerging mind. For example, domain-specific theories are not very good at telling us HOW learning takes place, and may result in the generation of untestable theories, or in an inappropriate characterisation of the course of development. In essence, such theories often reify what we (as adults) already know about language; they do not address, in mechanistic terms, the source of such knowledge. I argue that it may be possible to isolate the source of this knowledge in domain-general processes. Using data from my own laboratory and that published by others, I challenge previous work which has posited either (a) a module for word learning, or (b) induction of purely linguistic rules in the service of early language learning. Instead I offer a (possible, tentative) mechanism for the induction of some aspects of linguistic knowledge rooted in domain-general processes observed in the first year of life.

The relationship between rhyme detection in early infancy and later phonological knowledge

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About four years ago we used a conditioning procedure to investigate 7½- to 13-month-old infants' ability to detect rhyming sounds. The infants, overall, demonstrated this ability and there were no age differences between those who succeeded and those who failed. However, the infants clearly differed in their ability to detect rhymes and they could be separated into four different groups: (1) those who could not be conditioned; (2) those who conditioned but did not succeed in the rhyming task; (3) those who succeeded in one rhyming task but not a second; (4) those who succeeded in two rhyming tasks, thereby demonstrating an ability to generalise across rhyming sounds. We know that there is a strong relationship between phonological abilities in preschool children and their later reading, writing and spelling abilities, and we are retesting our participants, now 4-year-olds, on their phonological abilities. In this paper we describe the relationship between the two measures taken in infancy and early childhood, and speculate on possible links between them.

End of symposium

Subdivisions of visuospatial working memory: the contributions of modality and sequentiality

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Evidence suggests that the visuospatial sketch pad of working memory can be subdivided into two parts, one that stores visual information, and another that stores spatial information. However, the precise nature of these subcomponents remains unclear. Three experiments are reported which address the relative importance of modality (appearance vs. location) and sequentiality (dynamic vs. static) in the segregation of the VSSP. In the first experiment, previous results supporting segregation using selective interference were replicated using a novel methodology involving the use of dynamic visual noise. The second experiment evaluated the role of modality and supported the claim that memory for appearance and memory for location recruited different cognitive systems. A final experiment further investigated the relative contributions of modality and sequentiality to segregation.

Does the preparation effect in cued task-switching measure task-set reconfiguration?

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Task-switching experiments require subjects to shift frequently between two (or more) tasks, and explore the behavioural consequences of so doing (e.g. "switch cost" -- longer RTs on task-switch than on task-repeat trials), and/or their neural correlates. Switch costs have been taken to reflect the performance of control processes necessary to impose the appropriate task-set (at least when stimuli afford more than one task). In particular, when subjects are allowed time to prepare to switch to a known task, the switch cost is typically reduced (though rarely eliminated). This preparation effect has widely been assumed to index an endogenous task-set reconfiguration process performed before the stimulus if time allows, and during the latent interval if not. However, Logan and Bundesen (in press) varied the interval between task cue and stimulus, each of two tasks being signalled by either of two cues (i.e. four cues in all). They obtained a preparation effect, but found that performance on trials when the cue, but not the task, changed resembled performance on task-switch trials rather than performance on task-repeat trials. The preparation effect must, they conclude, measure not task-set reconfiguration but the less interesting process of interpreting the cue. We have replicated and extended their observation with a different pair of tasks and cues, and will report further explorations of conditions in which endogenous task-set reconfiguration might be expected to reveal itself through a preparation effect.

Logan G.D. and Bundesen C. (in press) Clever homunculus: Is there an endogenous act of control in the explicit task-cueing procedure? *J. Exp. Psych.: Hum. Percept. & Perform.*

Task switching and language switching: the effects of task-recency and stimulus-specificity

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Cognitive control mechanisms are often studied using paradigms in which subjects repeatedly switch between tasks, but does the exact choice of stimuli have important effects on results?

Ruthruff et al (2001) reported that reaction times on a given trial systematically increased with the lag since that task was last performed. Monsell et al (2003) found the opposite result. The former study used single-affordance stimuli (which unambiguously cue the task to be performed), while the latter used dual-affordance stimuli (which do not). We have tested whether this methodological difference could account for the discrepancy in results, but we found that the two types of stimuli produced similar task-recency effects, and these more closely replicate the results of Monsell et al. than those of Ruthruff et al.

In a second study, we tested the effects of stimulus specificity on language switching in Greek-English bilinguals. Thomas and Allport (2000) found that language-specific orthography had no effect on the cost of switching between English and French word recognition, and concluded that the cost of switching language arises from outside the lexicon rather than from within-lexicon interference. However, we found that language specific orthography did reduce the switch cost, supporting the within-lexicon account.

Monsell, S., Sumner, P., Waters, H. (2003) Task-set reconfiguration with predictable and unpredictable task switches. *Memory and Cognition.* In press.

Ruthruff, E., Remington, R. W. and Johnston, J. C. (2001). Switching between simple cognitive tasks: the interaction of top-down and bottom-up factors. *Journal of Experimental Psychology. Human Perception and Performance* 27, 1404-1419.

Thomas, M. S. C. and Allport, A. (2000). Language switching costs in bilingual visual word recognition. *Journal of Memory and Language* 43, 44-66.

The co-ordination of planning processes for successive items in a multiple-object naming task

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In speech production research eye tracking has been employed to examine the temporal co-ordination of planning processes for several words. A series of picture naming experiments which employed a changing targets paradigm was run in order to assess to what extent an upcoming object is processed whilst it is still in the visual periphery. A three-object naming task was used where the second object to be named

changed from an interloper object to a target object contingent on the participant's gaze to it. The linguistic relationship between the interloper and target object was manipulated: The two object names were either identical, unrelated or homophones (e.g., "bat" *animal* vs. "bat" *baseball*). When the interloper and target object names were identical or homophones the subsequent viewing times of the target object were significantly reduced compared with the condition where the two object names were unrelated suggesting that the interloper had been processed to the word-form level whilst in the visual periphery. Further experiments investigated whether the homophone effect reduced when: (1) the percentage of trials where the interloper and target shared the same name was reduced; and (2) the interloper was not present from trial onset. The findings are discussed in terms of sequential versus parallel models of multiple-object naming.

Global versus local processing in optimisation problem solving.

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Can people outperform computers in solving complex problems? Recent results using instances of the Euclidean Traveling Salesperson Problem (E-TSP) suggest that they can, at least in certain circumstances. The E-TSP is a combinatorial optimisation problem that requires finding the shortest closed path through a set of points in the plane. Several studies of human performance have reported that untrained adults, solving E-TSPs "by eye", produced solutions that were as good as, or better than, a number of computer based heuristic algorithms working with perfect information.

Explanations of these and related results differ in whether they posit global or local processes. One global-process explanation holds that people use the boundary around the array of points as a guide in finding solutions. In contrast, one local-process explanation proposes that people simply avoid line-crossings. We report two experiments to test between these hypotheses. In the first, people solved instances of E-TSPs having only one non-boundary point. In the second, performances on closed versus open tours were compared. The results of both experiments supported the hypothesis of global rather than local processing.

Asymmetry of generalisation decrement in causal judgements

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Two computer-based experiments required volunteers to learn which of various "planes" caused high levels of pollution. Participants readily learned which planes caused high pollution levels. However, adding novel features to a plane that had been paired with high pollution levels had little impact on pollution judgements whereas removing features dramatically reduced judgements. This asymmetry of

generalisation decrement (adding versus removing stimulus features) was not predicted by a well known configural model of stimulus representation (Pearce, 1987) but was predicted by a recently proposed model of stimulus representation, the replaced-elements model (Brandon, Vogel, & Wagner, 2000). The results suggest that any model of the representation of compound stimuli must incorporate a mechanism to allow asymmetries of generalisation decrement.

Brandon, S., Vogel, E. H., & Wagner, A. R. (2000). A componential view of configural cues in generalization and discrimination in Pavlovian conditioning. *Behavioural and Brain Research*, 110, 67-72.
Pearce, J. M. (1987). A model of stimulus generalisation for Pavlovian conditioning. *Psychological Review*, 94, 61-73.

Symposium: New directions in human associative learning
Organiser: Andy Wills

Dissociating amnesic sub-types with simple associative tasks.

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In humans, anterograde amnesia can result from damage to the medial temporal (MT) lobes (including hippocampus), as well as to other brain areas such as basal forebrain (BF). Traditionally, these etiologies are classed as a single unified "organic amnesia" syndrome. However, animal studies as well as computational modeling suggest that MT and BF make dissociable contributions to associative learning. Specifically, while the hippocampus and related MT structures may not be needed for simple stimulus-response learning, they may normally contribute to this learning, and support the ability to transfer when familiar information is later presented in novel recombinations. Conversely, while BF structures may modulate the speed of learning in the MT and elsewhere, BF damage does not directly damage MT, and so hippocampal-dependent processing may be spared. We begun to test this proposed double dissociation in human amnesia, using classical delay eyeblink conditioning and computer-based associative learning tasks. Results support the idea that MT amnesia spares simple stimulus-response learning but impairs transfer, while BF amnesia results in the opposite pattern of slowed initial learning with preserved transfer. Together, these emerging data suggest that there are subtle but dissociable differences in the amnesic syndrome following damage to the MT lobes vs. basal forebrain, and that these differences may be most visible in non-declarative tasks such as eyeblink classical conditioning and simple associative learning. These findings in turn have implications for developing targeted rehabilitation strategies that make use of each patient population's individual pattern of impaired and spared learning abilities.

Evidence for the role of deductive reasoning in forward blocking

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Several studies have shown that contingency judgements for a cue T are lower when AT+ trials are preceded by A+ trials than when only AT+ trials are presented. Whereas these blocking effects have commonly been interpreted as evidence for associative models of human contingency learning, we argue that they can also be explained on the basis of a deductive reasoning account. According to this account, blocking is due to the fact that participants reason that T cannot be a cause of the outcome if the likelihood or intensity of the outcome does not differ on AT and A trials. In line with this hypothesis, we found that (1) blocking effects decreased in magnitude when participants performed a demanding secondary task, (2) manipulations that affected the magnitude of blocking (ceiling effects, secondary task difficulty) also affected the number of participants who engaged in adequate deductive reasoning, (3) only participants who reasoned adequately showed a blocking effect. Our deductive reasoning account is also compatible with other findings in the literature, even those that seem to favour associative models. Although we believe that associative processes are also important in human associative learning, we argue that the nature of these processes can be uncovered only if steps are taken to remove the impact of deductive reasoning.

I don't like it because it eats Brussels Sprouts: Conditioning preferences in children

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Previous work on evaluative learning has shown that adults' preferences can be changed through associative learning, however, these effects have never been demonstrated in children despite childhood being an important period for learning likes and dislikes. This talk reports the results of three experiments in which children aged 7-11 were shown pictures of novel cartoon characters called 'Futuremons'. Two Futuremons were selected pre-experimentally (based on pilot data showing that they were regarded as 'neutral') to act as conditioned stimuli (CS). Children engaged in an evaluative conditioning paradigm in which one CS was paired contingently and contiguously with a liked unconditioned stimulus, UCS (a picture of ice cream) and the other was paired with a disliked UCS (a picture of Brussels Sprouts). CSs and UCS were counterbalanced across groups. A control group were exposed to the same number of stimulus presentations but CSs and UCSs were never paired. The results indicate that preferences for the CSs were dependent upon the conditioning procedure when measured using self-report (Experiment 1) and using so-called implicit measures of attitudes such as the Implicit Association task (Experiment 2) and affective priming (Experiment 3). This study is the first to show evaluative conditioning in children. Preferences in children can be affected through association

between a novel stimulus and another stimulus that already has valence. This offers a useful paradigm to study preference learning in children, and to examine the parameters of human evaluative learning.

Can there be error correction in the absence of error?

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Previous demonstrations of forward blocking in humans have employed procedures where each response to a stimulus is followed by immediate and accurate feedback. It has been repeatedly demonstrated that people can learn in the absence of feedback but an implication of some theories of "learning without feedback" (e.g. Rumelhart-Zipser unsupervised network systems) is that one would not expect to find blocking in a free classification procedure. Free classification experiments employing complex icon stimuli and designs analogous to the classical blocking design show this implication to be false.

The role of associative history in human causal learning

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Rescorla (2000) noted that a number of influential theories of associative learning do not take the associative history of cues (i.e. the prior training that they have received) into account when calculating the associative change undergone by those cues. We sought to test this assumption in a human causal learning paradigm, and found associative history to be an important determinant of the learning undergone by cues that are presented on a trial. Moreover, associative history was also found to influence the amount of retrospective revaluation undergone by absent cues. These findings, while conflicting with many models of causal learning (e.g. Rescorla-Wagner, SOP and their derivatives) fit well with the predictions of the APECS model of learning and memory that we have developed in recent years.

Rescorla, R. A. (2000). Associative changes in excitors and inhibitors differ when they are conditioned in compound. *Journal of Experimental Psychology: Animal Behavior Processes*, 26, 428-438.

Sensitivity to outcome and no outcome density in causal learning tasks: An associative analysis of the *Depressive Realism* effect.

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Considerable research into learning event-outcome contingencies has demonstrated that humans discriminate positive from zero from negative correlations. However, in spite of this good discrimination ability subjects sometimes differentially rate two relationships having the same contingency, judgements are higher for the relationship in which the outcome occurs more frequently (the Outcome Density effect). In turn this effect may be influenced by mood. Subjects who score higher on scales of depression do not show an outcome density effect at least when exposed to zero contingencies (the depressive realism effect). Alloy and Abramson (1979); controversially claimed that this effect demonstrated that dysphorics were more accurate than non-dysphorics. In three experiments we explore the relation between sensitivity to outcome density and task type (control vs prediction) using dysphoric and non-dysphoric students. Our findings suggest that integration of the contextual exposure is the source of the effect. Non-dysphoric subjects integrate the contextual exposure between trials (the no outcome density) into their judgements and therefore could be argued to be more accurate than dysphorics. More importantly, associative theories that have been applied to contingency learning are able to model this context exposure sensitivity.

Alloy, L.B. & Abramson, L.Y. (1979). Judgment of contingency in depressed and nondepressed students: Sadder but wiser? *Journal of Experimental Psychology: General*, 108, 441-485.

End of Symposium

Evidence for a deductive reasoning account of cue competition in human contingency learning (HCL): forward blocking in Michotte's launching task.

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The observation of forward blocking in HCL has inspired the application of associative learning models to HCL (Dickinson, Shanks, & Evenden, 1984). However, forward blocking in HCL can also be understood from a deductive reasoning account, which sparks unique predictions (De Houwer, Beckers, & Glautier, 2002), e.g., that the observation of cue competition in HCL should depend on the causal status of the events considered. We used Michotte's (1954) launching task to investigate this prediction. On each trial, participants saw one or two coloured cue balls that moved from the left side to the middle of a computer screen, where the ball(s) made contact with a white outcome ball that did or did not move to the right

side of the screen, contingent upon the colour(s) of the cue ball(s). To manipulate perceived causality of the cue balls, offset of the cue ball(s) and onset of the outcome ball was either separated by a delay or not. Afterwards, participants predicted the displacement of the outcome ball on presentation of each of the coloured balls alone. Preliminary results suggest that the amount of competition (forward blocking) in the predictions elicited by the cue balls is modulated by their perceived causality.

A short latency vestibular evoked potential produced by bone-conducted acoustic stimulation.

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Recently de Waele et al. (2001) have demonstrated a short latency vestibular evoked potential (SLVP) with a peak latency of about 12 ms using galvanic stimulation of the exposed vestibular nerve. The aim of the work reported here was to attempt to replicate the de Waele et al. study but using acoustic stimulation, making use of the excellent acoustic sensitivity of the sacculus to bone-conducted sound (Welgampola et al. in press).

The experiment was conducted in two phases using bone conducted acoustic stimulation in normal subjects and in patients with a variety of inner ear lesions. In the first phase subjects were stimulated with 6 ms 500 Hz tone bursts in order to obtain the threshold V_T for vestibular evoked myogenic potentials (VEMP). The estimated threshold was then used as a reference value in the second part of the experiment to stimulate subjects over a range of intensities from - 6 to + 18 dB (re: V_T). Averaged EEG recordings were made with eight Ag-AgCl electrodes.

Below V_T auditory mid-latency responses (MLR) were observed. Above V_T two additional potentials appeared: a positivity at about 10 ms (P10) which was maximal at Cz, and a negativity at about 15 ms (N15) which was maximal at Fpz. Extrapolation of the growth functions for the P10 and N15 indicate a threshold just below V_T, consistent with a vestibular origin of these potentials, and the difference between bone conducted auditory and acoustic vestibular thresholds of no more than 15 dB.

We conclude that the P10 is most likely cortical, possibly parietal or temporoparietal, in origin but the N15 is most likely an electro-ocular (EOG) manifestation of the saccular-ocular reflex. Given the low threshold of vestibular acoustic sensitivity to bone conducted sound it is possible that saccular acoustic transduction may make a contribution to the perception of loud low frequency sounds (Todd, 2001). These potentials may also have some clinical application as a non-invasive and non-traumatic test of vestibular function.

Todd, NPM (2001) Evidence for a behavioural significance of saccular acoustic sensitivity. *J Acoust. Soc. Am.* 110(1), 380-390.
De Waele C, Baudonniere, PM, Lepecq, JC, Tran Ba Huy and Vidal PP (2001) Vestibular projections in the human cortex. *Exp. Brain Res* 141, 451-551.

Welgampola, MS, Rosengren, SM, Halmagyi, GM and Colebatch JG. (in press) Vestibular activation by bone-conducted sound. *J. Neurol. Neurosurg. Psychiatry.*

A hierarchical approach to speech segmentation: Stress versus coarticulation

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Although word stress has been hailed as a powerful spoken-word boundary cue, the results of several cross-modal fragment priming experiments reveal strong limitations to stress-based segmentation. Specifically, the stress pattern of auditory primes failed to have any effect on the lexical decision latencies to related test stimuli. The determining factor was whether or not the syllables of the primes were coarticulated to each other. Syllables whose onset was un-coarticulated (i.e., concatenated) from the preceding segments facilitated priming, whereas coarticulated syllables did not. However, when the primes were presented in a background of noise, the pattern of results reversed: Strong syllables generated more priming than weak syllables did, regardless of the coarticulatory cues. The results underscore the secondary role of stress-based segmentation in clear speech, and its efficiency in impoverished listening conditions. More generally, they call for an integrated, signal-contingent, and hierarchical approach to speech segmentation.

A single-case investigation of an acquired American accent following traumatic brain injury

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Foreign accent syndrome (FAS) is an acquired disorder of speech production in which an otherwise fluent speaker develops an accent that sounds non-native. The deficits contributing to the perceived foreign accent appear to be associated with articulatory levels of processing, for which there are at present only rudimentary cognitive models. We report the case of NC, a monolingual speaker of Australian English, who sustained a traumatic brain injury in a motor vehicle accident at the age of 13 years. Following his accident, he spoke with an altered accent that listeners perceived as North American. The accent disappeared after five months. Acoustic analyses of NC's speech revealed three characteristics contributing to the perceived accent: rhoticised vowels, a shift in vowel quality, and tapped productions of /t/ and

/d/. Further speech changes included staccato delivery, atypical stress and intonation, glottalisation, and unusually raised pitch. Our analyses suggest that the features of NC's 'foreign accent' are the result of a tense articulatory posture, which we attribute to a deficit in the programming of muscle movements. We argue that cognitive models of speech production must account for dissociable planning, programming, and execution processes.

Hierarchical processing in spoken language comprehension

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Understanding spoken language requires a complex series of processing stages to translate speech sounds into meaning. In this work we use fMRI to explore the brain regions involved in spoken language comprehension, fractionating this system into sound-based, and more-abstract, higher-level processes. We distorted English sentences in three acoustically different ways, applying each distortion to varying degrees to produce a range of intelligibility (quantified as the number of words that could be reported) and collected whole brain EPI data from 12 listeners using sparse imaging. BOLD signal correlated with intelligibility along the superior and middle temporal gyri in the left hemisphere, and in a less-extensive homologous area on the right, in the left inferior frontal gyrus (LIFG) and in left hippocampus. Regions surrounding auditory cortex, bilaterally, were sensitive to intelligibility but also showed a differential response to the three forms of distortion, consistent with sound-form based processes. More distant intelligibility-sensitive regions within the superior and middle temporal gyri, hippocampus, and LIFG were insensitive to the acoustic form of sentences, suggesting more abstract, non-acoustic processes. The hierarchical organisation suggested by these results is consistent with cognitive models and with auditory processing in non-human primates. Areas that were particularly active for distorted speech conditions and thus might be involved in compensating for distortion were found exclusively in the left hemisphere, and partially overlapped with areas sensitive to intelligibility perhaps reflecting attentional modulation of auditory and linguistic processes.

Age of Acquisition effects on word generation

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Ellis & Lambon-Ralph's (2000) model of Age of Acquisition (AoA) suggests that we should find AoA effects across any task where one is required to retrieve stored information. An early demonstration of the effects of AoA was found by Loftus & Suppes (1972). They showed that word frequencies in children's vocabulary had a significant effect on adult word generation times. However their stimuli were not explicitly rated for AoA. Our two experiments employed their methodology but made use of explicit AoA ratings. Stimuli consisted of a category

followed by an initial letter of a category member e.g. Vegetable: C. Response times from this study were entered into a multiple regression analysis along with 5 independent variables, (AoA, Frequency, Concreteness, Word length and Category position.) It was found through both multiple and individual regression analysis that AoA was the only consistently significant predictor of participant's response times. In a second experiment we implemented an orthogonal design using two groups of early and late acquired words. These groups were balanced on all of the relevant independent variables. Results show that the earlier acquired words were produced faster than the later acquired words. These results provide supporting evidence for AoA effects on word generation tasks.

AoA effects in naming Kanji and Kana

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Two experiments examined the effect of AoA on word naming in Japanese. In the first experiment words were presented in Kanji, and in the second experiment the same set of words was presented in Kana. In both experiments AoA effect was significant, but the magnitude of the effect was reduced when words were presented in Kana. When two experiments are analysed together, with type of script as between-group factor, significant interaction between AoA and type of script was observed. AoA effect was significantly larger when naming words presented in Kanji compared to naming of same words when presented in Kana. Implication of these results for a model predicting greater AoA effects for stimuli with arbitrary mapping between input and output is discussed (Ellis and Lambon Ralph, 2000).

Effects of orthography on language production

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Four experiments investigated potential influences of spelling on single word speech production. A form-preparation paradigm that showed priming effects for words with initial form overlap was used to investigate whether words with form overlap, but different spelling (e.g., "camel"-"kidney") also show priming. Experiment 1 demonstrated that such words did not benefit from the form overlap, suggesting that the incongruent spelling disrupted the form preparation effect. Experiment 2 replicated the first experiment with an independent set of items and an improved design, and once again shows a disruptive effect of spelling. To divert participants' attention from the spelling of the targets, Experiment 3 was conducted entirely in the auditory domain, but yielded the same outcome as before. Experiment 4 showed that matching initial letters alone, in the absence of matching sounds (e.g., "cycle"-"cobra") did not produce priming. These findings raise the possibility that orthographic codes are automatically activated in speech production by literate speakers.

The influence of stimulus properties on category construction

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It has been demonstrated that when individuals free classify stimuli presented simultaneously in an array, they have a preference to categorize by a single dimension (e.g. Medin, Wattenmaker & Hampson, 1987). However, when people are encouraged to categorize items sequentially, initial research has demonstrated that people sort by global similarity or family resemblance (Regehr & Brooks, 1995). This research was extended in the current series of experiments with only limited support being found for these findings. Results showed that category construction is influenced not just by the way stimuli are presented but also by the stimulus properties of the set. The perceptually simple stimuli with easily separable dimensions in experiments one and two evoked family resemblance sorting. However, the perceptually difficult stimuli with dimensions of greater integration examined in experiments three and four produced mainly single dimension sorting. Experiment five investigated directly the effect of perceptual difficulty and level of integration on categorization. Perceptual difficulty had no impact on the categorization strategy used, the level of integration had a significant effect in the opposite direction to that previously found (e.g. Handel & Imai, 1972) – the stimuli of greater separateness resulted in higher levels of family resemblance sorting.

'Eager' and 'lazy' learning identified by spaced vs massed exposure

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In machine learning, a distinction is made between 'eager' and 'lazy' learning mechanisms. The former learn by incrementally updating representations, without storing individual instances, which is equivalent to performing on-line generalisation. In contrast, a 'lazy' system creates new representations for individual items and only generalises when queried. Examples of psychological models that fit the description of 'eager' and 'lazy' are neural network models and exemplar models of categorisation, respectively.

Each of the two types of mechanisms has its advantages. 'Eager' processes are efficient memory users and excel at capturing the overlap between items. 'Lazy' mechanisms represent individual items with minimal interference and information loss. Therefore, it would seem advantageous for the human cognitive architecture to contain both. We set out to experimentally differentiate between the two types of processes.

Firstly, we attempted to identify tasks that would selectively engage the two kinds of processes. Identification of rules in artificial grammar strings sought to tax 'eager' processes, whereas retention of strings targeted 'lazy' processes. Secondly, we sought to identify conditions that would favour one mechanism. There is considerable

evidence suggesting advantages of distributed (spaced) exposure relative to massed exposure in memory (e.g. 'lazy' tasks). On the other hand, there is little reason to expect that spaced presentation facilitates 'eager' processes.

Our expectation that spaced exposure leads to better memory performance, while having no influence on rule identification, was fully confirmed by experimental outcomes. This lends empirical support for the distinction between 'eager' vs 'lazy' mechanisms in human cognitive architecture.

Novelty and confidence in artificial grammar learning.

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The failure to find a relationship between confidence and performance in artificial grammar learning has been used to argue that people lack explicit metaknowledge of those features of the grammar that allow above chance performance when categorising grammatical items.

Two experiments are reported that show that confidence is related to the identification of novel bigrams in artificial grammar learning. In experiment one, participants were more confident when they correctly identified novel bigrams than when they erroneously identified novel bigrams as belonging to the learnt grammar. There was no difference in confidence for learnt bigrams whether correctly or incorrectly identified. In a second experiment, two sets of test items were created. For one set of items the distractor items included novel bigrams that were previously misidentified as belonging to the learnt grammar. The second set of items included novel bigrams that were previously correctly identified as belonging to a second grammar. The results indicated that when non-grammatical letter strings included easily and confidently identified novel bigrams then performance on the categorisation task was above chance. However, when the non-grammatical items included previously misidentified bigrams performance on the categorisation task was not above chance.

Taken together the results suggest that at least part of the reason that participants perform above chance in artificial grammar learning is that they can recognise salient novel bigrams and that they are aware of this. It is concluded, given previous research findings, that there is little reason to believe that standard artificial grammar learning experiments provide satisfactory evidence for implicit learning.

An examination of ICE model and cue-overload hypotheses with respect to EC-dependent recognition

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The ICE model account (e.g. Murnane & Phelps, 1993; Murnane, Phelps & Malmberg, 1999) of environmental context (EC)-dependent recognition memory is described and new predictions concerning the effect of multiple presentation ECs are

derived. Experiment 1 tested the ICE model predictions in relation to predictions derived the cue-overload hypothesis (e.g. Watkins, 1979). In addition, the sensitivity of recognition RT as a measure of EC-dependent memory effects was examined. Minimal support was obtained for the ICE model, but greater support was provided for the cue-overload hypothesis. In Experiment 2, further manipulations were employed to test ICE model predictions and the cue-overload hypothesis, with relevance to the mental reinstatement and outshining hypotheses. Again support for the cue-overload hypothesis was obtained and an EC reinstatement effect with RT was detected. The ICE model is considered in respect of these findings.

Murnane, K. & Phelps, M.P. (1993). A global activation approach to the effect of changes in environmental context on recognition. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 19, 882-894.

Watkins, M.J. (1979). *Engrams as cuegrams and forgetting as a cue-overload effect: A cueing approach to the structure of memory.* In C.R. Puff (ed.), Memory Organization and Structure (pp. 347-372.) New York: Academic Press.

What do letter migrations tell us about letter position coding?

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Dividing attention across two simultaneously presented words occasionally results in misidentifications in which letters apparently "migrate" from one word to the other (e.g., STEP and SHOP may be misreported as STEP and STOP). Adherents of position-specific letter coding schemes have drawn support from the observation that these letter migrations typically preserve within-word letter position. However, the predominance of same-position migrations may simply reflect lexical constraints. To investigate this issue, word pairs like FIST and FLAT were selected in which a letter in one word could migrate to an adjacent letter in the other word to form an illusory word (FAST). All experiments used a partial report procedure, in which a post-stimulus cue indicated which of the two words was the target. Experiment 1 found that adjacent-position migrations occurred just as often as same-position migrations. Three subsequent experiments examined the effects of target-context similarity, lexical status and letter position on letter migrations. The results argue against the position-specific letter coding schemes that are employed in many computational models of reading. Instead, they provide support for a model in which letter position is coded relatively flexibly.

Processing quantifier scope ambiguities during normal reading

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Doubly quantified sentences are ambiguous; their interpretation depends on the relative scope of the quantifiers (e.g., 1):

(1) The celebrity gave an in depth interview to every reporter from the newspaper, but [the interview(s) was/ were] not very interesting.

If 'an' takes scope over 'every', readers should form a mental representation containing a single event, whereas if 'every' takes scope there can be multiple events. We contrast two accounts of how these sentences are processed. Using a judgement task, Tunstall (1998) concluded that the quantifier appearing first in the sentence takes wide scope, but when this is 'every', singular and plural continuations are equally acceptable, so the number of events is not specified. Using self-paced reading, Gillen (1991) found a preference for singular referents regardless of quantifier order or grammatical function. We investigated on-line quantifier scope preferences, manipulating the surface positions of the quantifiers, and the grammatical function of the quantifier. Consistent with Gillen, we found longer residual first-pass reading times for the region 'the interview(s) was/ were' for plural than singular continuations, suggesting that readers added a single event to their mental representation. We conclude that quantifier scope resolution is not a mandatory part of sentence processing.

Gillen, K., (1991). The comprehension of doubly quantified sentences. Doctoral dissertation, University of Durham.

Tunstall, S.L., (1998). The interpretation of quantifiers: semantics and processing. Doctoral dissertation, University of Massachusetts Amherst.

Predictability and word length independently influence word skipping.

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The experiment presented here addresses the question of whether word length information is necessary in order for predictability to influence the probability of word skipping. The experiment used saccade contingent boundary change in which the text changes contingent on the position of the eye. Participants were presented with sentences like (1-4). The forward slash denotes the position of the invisible boundary. Once the eye crossed the boundary the preview (shown in parentheses) changed.

(1) The explosives expert planted the large/(bomb under) bomb under the old tree.
(2) The explosives expert planted the large/(bombsunder) bomb under the old tree.
(3) The explosives expert planted the large/(rose under) rose under the old tree.
(4) The explosives expert planted the large/(rosesunder) rose under the old tree.

Critical words were either predictable (1, 2) or unpredictable (3, 4) and the word length preview was either correct (1, 3) or incorrect (2, 4). The critical four letter words were more likely to be skipped when they were predictable, regardless of the word length preview. The results show that word predictability influences word skipping regardless of word length information.

<u>Reading disappearing text</u>

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We report an eye movement experiment that investigated whether a "gap effect" occurs during reading. In our experiment participants read sentences under normal reading conditions or disappearing text conditions (in which the word that was fixated disappeared after 60 ms). We predicted that if a gap effect occurred under the disappearing text conditions, then the time to make a saccade would be reduced and reading speed would increase. In addition to the disappearing text manipulation, our sentences also contained high or low frequency and long or short target words.

Our results showed that reading speed remained constant under both presentation conditions and that no gap effect occurred. However, in the disappearing text conditions, even though the fixated word had disappeared after 60 ms, there was still a robust frequency effect wherein readers fixated longer on low frequency words than on high frequency words. As such, the results are consistent with cognitive control models of eye movement control and inconsistent with visual/oculomotor control models. While the uptake of visual information is clearly important for reading, it is the cognitive processes associated with understanding the fixated words that drive the eyes through the text.

EXETER INFORMATION

Accommodation

Accommodation has been reserved for the nights of 9, 10 and 11 April in St German's Hall (ensuite) and Hope Hall (non en-suite). Alternative accommodation is shown below and should be booked directly with the hotel or guest house. Reservations for University accommodation and/or the Conference Dinner; can be made on the enclosed booking form, which should be returned to Dr Andy Wills, School of Psychology, Washington Singer Laboratories, University of Exeter, Perry Road, Exeter, EX4 4QG, (Tel: 01392 264626) before 31 March, 2003.

Cheques must be made payable to University of Exeter

Hotels and guest houses

The following guesthouses are recommended as affordable accommodation close to the university:
- Hotel Maurice, Bystock Terrace, (01392) 213079
- Park View Hotel, 8 Howell Road, (01392) 271772
- Telstar Hotel, 77 St. Davids Hill, (01392) 272466

Exeter Council also maintains an accommodation list: http://www.exeter.gov.uk/visiting/accommodation/index.xml

Messages.

Messages for those attending the meeting can be left at Reception, School of Psychology, 01392 264625.

Access

See map inside back cover.

Directions by train

If you're coming by train, the Washington Singer building is about a 10 minute (uphill) walk from St. David's Station (the main station). It's about 5 minute taxi trip costing about £2.50.

If walking, leave the station via the main booking hall, and walk across the forecourt keeping to the right of the car parking area. You will meet Bonhay Road. Cross over at the zebra crossing. Turn left, and almost immediately right into a passageway called St. Clement's Lane. Follow this up the hill; it comes out on to St. David's Hill. Cross over and continue up the road opposite (Howell Road). You will then meet New North Road. Cross over at the zebra crossing, and turn left. The next major turning on the right is Streatham Drive. Take this, and fork left after a short distance (still called Streatham Drive). You will see a large map of the campus, and the Washington Singer building will be to your right.

Directions by car (from the East)

Leave the M5 at junction 30. Take the third exit (A379) and follow the sign-posted route to the University. See map inside back cover.

Further directions can be found at http://www.ex.ac.uk/univ/howtoexe.htm#directions

Parking

There are a number of pay-and-display car parks on campus. They cost £1 per day, and are in easy walking distance of the Washington Singer Labs. If you need to park directly outside the Washington Singer building, please contact Andy Wills (a.j.wills@ex.ac.uk) before arrival.

Eating and Drinking

Lunch

The University Shopping Centre sells a variety of take-away sandwiches (about £2), whilst the staff club at Reed Hall, and the post-graduate centre at Clydesdale House both serve hot and cold food at lunchtimes (about £5 and £3 respectively).

Restaurants

Exeter has quite a few restaurants but they are mostly in the town centre and hence a 15-20 minute walk from campus (there is also a bus service). A good collection of restaurants can be found around the cathedral (Cathedral Green), which is a 15 minute walk from campus.

Close to campus
Imperial, New North Road. Pub with very standard but cheap pub food. 5 min walk.
Taj Mahal, Queen Street, 01392 258192. Standard Indian restaurant. 10 min walk from campus.
Three Amigos, Bystock Square, 01392 270234. Reasonably good Mexican restaurant. 10 min. walk from campus.

Cathedral Green
Al Farid, 01392 494444. Moroccan. Good reports.
ASK, 01392 427127. Pizza and pasta. Reasonably good food at a good price.
Carved Angel, 01392 210303. European. Pretty good food.
Michael Caines' Restaurant, 10392 310031. Excellent but quite expensive French restaurant (expect to spend at least £25 per head plus wine).
Michael Caines' Brasserie. European. Pretty good food, and a lot cheaper than the restaurant.
Thai Orchid, 10392 214215. Thai. Good food, variable service.

Others in Exeter
Brazz, Palace Gate, 01392 252525. English / French. Reasonable food, slightly over-priced.

Chadni, Heavitree Road, 01392 411344. Standard Indian.
Cohiba, South Street, 01392 678445. Tapas. Pretty good.
Hotel Barcelona, Magdalen Road, 01392 281000. European. Good but slightly expensive
Mill on the Exe, Bonhay Road, 01392 214464. European. Nice location.
Olive Grove, Castle Street, 01392 411292). Mediterranean. Good vegetarian selection.
The Waterfront, Quay, 01392 210590. Good basic pizzeria with enormous pizzas. A little out of town.

Surrounding villages
22 Mill Street, Chagford, 01647 432244. A very good French restaurant. Expensive, but worth it.
Double Locks, Canal Banks, Exeter, 01392 256947. Pub that serves food. Nice location.
Drewe Arms, Broadhembury, 01404 841267. A pub-style restaurant with an excellent fish menu.
The Galley, Topsham, 01392 876078. Good fish restaurant.
Nobody Inn, Doddiscombsleigh, 01647 252394. English. Good food, good wine, great whisky list, nice location.

Places of Interest

Exeter
Some of the more popular attractions are:
St. Peter's Cathedral: An impressive building dating from the 12th century, although some aspects are as late as the15th century.
Underground passages: Dating from 14th century, these medieval passages under Exeter High Street were originally built to supply water.
Royal Albert Memorial Museum: Small provincial museum.
Quayside: Once a Roman waterway, later a 16th century port, now containing 17th and 18th century buildings which currently house shops and restaurants.
Full details of what to see and do can be found at http://www.exeter.gov.uk.

Conference Dinner

This will be held at the Royal Clarence Hotel, Cathedral Yard, Exeter. The cost including wine will be £25. Please book, and indicate any dietary requirements, on the enclosed form which should be returned to Dr Andy Wills, School of Psychology, Washington Singer Laboratories, University of Exeter, Perry Road, Exeter, EX4 4QG, (Tel: 01392 264626) before 31 March, 2003.