

## 1999 - January 4/5 University College London

### LONDON MEETING 1999

A scientific meeting will be held at The Department of Psychology, University College London on 4/5 January, 1999. The Local Secretary is Dr Patrick Haggard.

### PROGRAMME

#### Monday 4 January, 1999

*Lower Ground Floor Lecture Theatre*

9.00 Mike Burton (University of Glasgow)

Face recognition in difficult circumstances.

9.30 Vicki Bruce, Zoe Henderson\* and Mike Burton (University of Stirling and University of Glasgow)

Verification of unfamiliar face identities from images captured on video.

10.00 Karen Lander\* and Vicki Bruce (University of Stirling)

The role of movement in the recognition of famous faces.

10.30 Coffee (Third floor common room)

11.00 Michael B. Lewis\* and Hadyn D. Ellis (University of Wales, Cardiff)

Priming and power curves in face processing.

11.30 K. Langley\* and G. Abbonizio\*(University College London. Introduced by Dr Patrick Haggard)

Motion adaptation is responsible for direction repulsion in transparent plaids.

12.00 Glyn W. Humphreys and Hermann Müller (University of Birmingham and Universität Leipzig)

Figure-ground coding modulates feature detection: evidence from search asymmetries.

12.30 Geoff Cole\*, Angus Gellatly and Anthony Blurton\* (University of Keele)

The distribution of spatial attention following the onset of a new object in the visual field.

1.00 Lunch

2.00 Philip T. Smith (University of Reading)

A jigsaw puzzle theory of memory.

2.30 Martin A. Conway, Christopher W. Pleydell-Pearce and James T. Becker\* (University of Bristol, Burden Neurological Institute and University of Pittsburgh)

The neuroanatomy of autobiographical memory.

3.00 R. E. O'Carroll\*, E. Drysdale\*, L. Cahill\*, P. Shajahan\* and K. P.Ebmeier\* (University of Stirling, University of California, Irvine and MRC Brain Metabolism Unit, Edinburgh. Introduced by Professor Vicki Bruce)

Stimulation of the noradrenergic system enhances, and blockade reduces, memory for emotional material in man.

3.30 Tea (Third floor common room)

4.00 Rosanna Cousins\*, Donald O'Boyle, John Wearden, Nikki Stookin\* and Warren Searle\* (University of Manchester)

Temporal bisection and generalisation in patients with Parkinson's disease and young and elderly controls.

4.30 J.H. Wearden (University of Manchester)

Timing processes and the filled duration illusion.

5.00 David Green and David Over\* (University College London and University of Sunderland)

The causal selection task: on the spoor of human rationality.

5.45 Annual General Meeting (Members only)

6.30 Reception (Third floor common room)

8.00 Conference Dinner

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**Tuesday 5 January, 1999**

START OF PARALLEL SESSION

**Session A:**

*Lower Ground Floor Lecture Theatre*

9.00 Michael Thomas\* (King Alfred's College, Winchester. Introduced by Dr. D. C. Mitchell)

A connectionist model of bilingual word recognition: one network or two?

9.30 Jennifer Rodd\*, M. Gareth Gaskell and William D. Marslen- Wilson (MRC Cognition and Brain Sciences Unit, Cambridge)

Semantic competition effects during word recognition.

10.00 A. J. Stewart\*, M. J. Pickering and A. J. Sanford (University of Glasgow)

The influence of knowledge about consequences in language production and language comprehension.

10.30 Coffee (Third floor common room)

11.00 Patrick Haggard, Tammy Astor\* and Vladka Coupar\* (University College London)

Preparation for endogenous action.

11.30 G. M. Jackson\*, S.R. Jackson, Masud Husain\* and M. Harvey (University of Wales, Bangor, Imperial College, London and University of Bristol)

The planning and control of bimanual prehension movements.

12.00 R. I. Newport\*, S. R. Jackson and M. Harvey (University of Wales, Bangor and University of Bristol)

Sensorimotor integration in the control of goal-directed action: a case study of hemispatial neglect.

12.30 Timothy L. Hodgson\*, Adnan A. Bajwa\*, Adrian Owen\*, Winand Dittrich and Christopher Kennard\* (Imperial College School of Medicine, Charing Cross Hospital, London and MRC Cognition and Brain Sciences Unit, Cambridge)

Eye movements during a cognitive planning task.

1.00 Lunch

## **Session B:**

### *Ground Floor Lecture Theatre*

9.00 Peter Howell, James Au-Yeung\* and Stevie Sackin\*(University College London)

How does persistent stuttering arise out of normal childhood nonfluency?

9.30 Chris Moulin\* and Tim Perfect (University of Bristol)

The effects of repetition on study time and judgements of learning in Alzheimer's disease (AD).

10.00 Alexa Morcom\*, Alan Baddeley and Tim Perfect (University of Bristol)

Investigating repetition effects in task switching.

10.30 Coffee (Third floor common room)

11.00 Annabel S. C. Thorn\* and Susan E. Gathercole (University of Bristol)

The native-language advantage in verbal short-term memory.

11.30 J. N. Towse, G. J. Hitch and U. Hutton\* (Royal Holloway University of London and University of Lancaster)

When adults behave like children (sort of): the case of working memory span.

12.00 Michel Treisman (University of Oxford)

There are two opposed word length effects in verbal short-term memory: evidence against decay theories of short-term memory loss.

12.30 Susan E. Gathercole, Susan J. Pickering\*, Simon A. Lloyd\* and Melanie Hall\* (University of Bristol)

Working memory and English children's achievements in the national curriculum at seven years.

1.00 Lunch

### **Afternoon Session:**

*Lower Ground Floor Lecture Theatre*

2.00 M. Jane Riddoch, Glyn W. Humphreys and Martin G. Edwards\* (University of Birmingham)

Separating selection of objects from selection of action: neuropsychological evidence on manual interference.

2.30 A. Giersch, Glyn W. Humphreys and M. Boucart (Hospices Civils de Strasbourg, INSERM U 405 and University of Birmingham)

HJA, a patient with visual agnosia, computes occluded contours: evidence for early computation prior to figure-ground coding.

3.00 S. R. Jackson, R. Ward\*, F. Burbary\*, D. L. Morris\* and R. Newport\* (University of Wales, Bangor)

Awareness and form discrimination in a blindsight patient.

3.30 Tea (Third floor common room)

4.00 Peter Garrard\*, Matt Lambon Ralph, Karalyn Patterson and John R Hodges (University of Cambridge and MRC Cognition and Brain Sciences Unit, Cambridge)

Prototypicality, distinctiveness and intercorrelation: analyses of the semantic attributes of living and nonliving concepts.

4.30 David R. Shanks and Theresa Johnstone\* (University College London)

Implicit learning and attention.

5.00 Meeting ends.

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## ABSTRACTS

### **Face recognition in difficult circumstances.**

Mike Burton

University of Glasgow

Most studies of face recognition use high quality photographic stimuli. Video- based security devices often provide very poor quality images. Two experiments are reported in which subjects try to match security-camera video clips to high quality photographs. Experiment 1 shows that people familiar with targets are extremely accurate in matching. However, subjects unfamiliar with targets are extremely poor. A sample of police officers show no advantage in accuracy over unfamiliar subjects. In Experiment 2, the basis of this familiarity-advantage is explored. Subjects were shown security-camera videos edited to obscure the gait, body or head of the targets. Obscuring the gait or body had little effect on recognition rates. However, obscuring the head reduced accuracy substantially. The results suggest that familiar faces are recognised in very poor quality images. Many of these face images are represented across very few scan lines. This implies that familiar faces can be recognised in rather low spatial scales.

### **Verification of unfamiliar face identities from images captured on video.**

Vicki Bruce<sup>1</sup>, Zoe Henderson<sup>1</sup> and Mike Burton<sup>2</sup>

1. University of Stirling
2. University of Glasgow

Three experiments investigated how well people could match target faces grabbed from high quality video tape, against arrays of studio portraits of these people shown with distractors. In Experiment 1 targets were present in the arrays on 50% of trials, and absent in the remainder. Accuracy was highest when the target matched the array in viewpoint and expression, a change in expression reduced accuracy somewhat and a change in viewing angle reduced performance significantly. However, there was a very high error rate in all conditions. In Experiment 2 targets were present in every array, so that the task was only to find the array face that resembled the target most closely. Performance was again worst with a change in viewpoint, but there was a high error rate even in optimal conditions. Control studies confirmed that when the pictures of target and array faces were identical, performance was at or near ceiling. In Experiment 3 participants attempted to match short video clips to the arrays. Even when they were free to re-play and inspect the videos as often as they wished, performance levels overall were not much better

than in Experiment 2. Experiment 4 compared matching performance when only internal features, only external features or whole faces of the targets were available for matching, and confirmed that performance in this task is dominated by external feature matching. The results show that pictorial factors affect face matching even when there is no memory load, and have implications for the use of video-images as means of identifying people who have committed crimes.

### **The role of movement in the recognition of famous faces.**

Karen Lander and Vicki Bruce

University of Stirling

There has been considerable research into the area of face recognition typically using static images (photographs). However the faces we see on a day to day basis tend to be moving. The experiments described aim to quantify the potential beneficial effects of movement on the task of famous face recognition and investigate the possible explanations for these effects. Images were presented positive, upside down (inverted), pixellated and thresholded. Results indicate that under all these conditions moving faces were recognised significantly better than static ones. One possible account of this effect could be that a moving sequence contains more static information about the different views and expressions of the face, compared with a single static image. However even when the amount of static information was equated (Experiments 3 and 4) there was still an advantage for moving sequences which contained their original dynamic properties. Results suggest that the dynamics of the motion provides additional information, helping to access an established familiar face representation. Both the theoretical and practical implications for these findings will be discussed.

### **Priming and Power Curves in Face Processing.**

Michael B. Lewis and Hadyn D. Ellis

University of Wales, Cardiff

Priming experiments traditionally tend to employ just one repetition of an item to demonstrate facilitation; however, from Burton's (1994) model of face processing, it can be predicted that repetition priming should occur beyond the first repetition, albeit with a reduced facilitation. The model, in fact, specifically predicts that the reaction times would be a negative power function of the number of repetitions. Three experiments were conducted in part to test this prediction using two semantic categories of faces each repeated up to 65 times. In all three experiments, participants' reaction times to subsequent target repetitions followed a negative power curve; and, further, this power curve was still evident after an interval of two months. The second series of three experiments investigated the curvilinear effects of self priming (facilitation following consecutive, but different, views of the same persons). A set of 320 views of Diana, Princess of Wales were employed to investigate the cumulative effect of up to 35 consecutive repetitions. These experiments found that the reaction times fitted negative power curves of the number of previous consecutive presentations. Non-consecutive presentations had little effect on reaction times. The six experiments, taken

together, demonstrate that the power function appears to be fairly ubiquitous throughout face priming. Consequently, further repetitions will always produce faster reaction times but the size of this effect will decrease as the number of repetitions increases so that the reaction times will tend to an asymptote.

### **Motion adaptation is responsible for direction repulsion in transparent plaids.**

K. Langley and G. Abbonizio (Introduced by Dr Patrick Haggard)

University College London

Two square-wave gratings (S-WGs) of equal contrast, speed, and spatial frequency but of different orientations may be seen to move either coherently as a single surface, or transparently as in two S-WGs. The nature of the transparency is, however, unusual. The two S-WG may appear to move in opposing directions (a direction repulsion) rather than the normal direction prescribed by each S-WG's spatial orientation. Here, we report that the percept of coherence of two S-WGs may be altered into a transparent one following motion adaptation. Our experiments have measured the magnitude of the direction repulsion under various conditions. After motion adaptation to a single moving sinusoidal grating, subjects viewed two moving S-WGs. The perceived direction of motion for each S-WG was measured. The S-WG's velocities were found to depart by up to 55 deg. from their normal direction. This largest effect occurred when the adapting grating moved downwards and was parallel to the coherent velocity of the two S-WGs. The magnitude of the direction repulsion depended upon the absolute orientation and contrast of the adapting grating: it was maximum when the adapting grating moved in a meridional direction and minimum when the adapting grating moved in a cardinal direction. Direction repulsion and the percept of transparency were more likely when the absolute contrast of both S-WGs was low. This suggests that the percept of motion coherence is influenced by nonlinearities introduced into the motion pathways that process visual information. When the relative orientation between the two S-WGs was varied, direction repulsion was reported for S-WGs that differed in space-time orientation by 70 deg or more. When the relative orientation between the adapting grating and two S-WGs was varied, a direction attraction was found. This occurred when the motion of the adapting grating was opposite to the direction of the coherent velocity of the S-WGs. The induced direction repulsion (and attraction) is inconsistent with the view that motion adaptation reflects neural fatigue of opponent motion mechanisms. Rather, these data may be explained by a two-dimensional model of motion transparency that incorporates an inhibitory signal arising from motion adaptation.

### **Figure-ground coding modulates feature detection: evidence from search asymmetries.**

Glyn W. Humphreys<sup>1</sup> and Hermann Müller<sup>2</sup>

1. University of Birmingham
2. Universität Leipzig

Figure-ground relations play a crucial role in the perceptual organisation of the visual world, enabling us to address actions to perceptual 'figures' and to ignore information in the perceptual 'ground'. We report evidence from visual search indicating that figure-ground coding plays an early role in visual processing. We show that search asymmetries, diagnostic of primitive features coded by the visual system, are modulated by local figure-ground relations between stimuli. In particular, asymmetries favouring concave over convex targets can be reversed according to whether regions of field are coded as figure or ground. The evidence demonstrates that figure-ground relationships are coded in a spatially parallel manner, with this coding determining the primitive used for subsequent visual processing.

### **The distribution of spatial attention following the onset of a new object in the visual field.**

Geoff Cole, Angus Gellatly and Anthony Blurton

University of Keele

Six experiments are reported which investigate how the onset of a new object in the visual field re-configures the spatial distribution of visual attention. There is considerable evidence that the onset of a novel visual object has the effect of influencing visual space. For example, Suzuki and Cavanagh (1997) refer to objects 'distorting' space, inducing so called 'attentional repulsion', whilst Ruda (1998) refers to 'zones of attraction and repulsion' and the 'warped geometry' created by new objects. Similarly, Posner (1980) showed that one of the consequences of attentional capture by an object is the enhancement of visual processing in the immediate spatial vicinity of the object. The present research provides converging evidence from Response Time methodology and the Temporal Order Judgement paradigm to demonstrate that this area of processing enhancement is not uniform in nature. Areas adjacent to corners of an object receive greater attentional processing compared with areas adjacent to straight parts of the object. Control experiments using chromatically defined and motion defined stimuli ruled out non-attentional accounts in terms of low- level luminance masking, as well as accounts in terms of eccentricity of targets presented to index the effect.

Posner, M. I., (1980) Orienting of attention. *Quarterly Journal of Experimental Psychology*, 32, 3-25.

Ruda, H., (1998) The warped geometry of visual space near a line assessed using a hyperacuity displacement task. *Spatial Vision*, 11, 401-419.

Suzuki, S., & Cavanagh, P., (1997) Focused attention distorts visual space: an attentional repulsion effect. *Journal of Experimental Psychology: Human Perception and Performance*, 23, 443-463.

### **A jigsaw puzzle theory of memory.**

Philip T. Smith

University of Reading

The central idea of this paper is that when an episodic memory is retrieved for the first time it is synthesised from memory fragments, and that

this synthesis is achieved via simulated annealing. This leads to a general framework for memory retrieval phenomena, where the bulk of the literature can be handled by manipulations of a small number of parameters. Detailed modelling results are presented for tip-of-the-tongue states, failure to retrieve phonological information such as proper names, implicit memory phenomena, recovered and false memories, memory retrieval in depressives and in the elderly, and a possible non-monotonic relation between prompt specificity and retrieval performance.

### **The neuroanatomy of autobiographical memory.**

Martin A. Conway<sup>1</sup>, Christopher W. Pleydell-Pearce<sup>2</sup> and James T. Becker<sup>3</sup>

1. University of Bristol
2. Burden Neurological Institute
3. University of Pittsburgh School of Medicine

Two neuroimaging studies investigated brain regions active in the retrieval of autobiographical memories. In the first study changes in slow wave DC potentials were monitored as participants recalled memories to cue words. It was found that in the initial retrieval phase networks in the left frontal lobes were highly active with some more restricted activation of right frontal sites. Following retrieval and while a memory was held in mind activation switched from the frontal lobes to bilateral temporal and occipital lobes, with activation most extensive in the right cortical hemisphere. In the second study PET data were collected during the retrieval of autobiographical memories and the same striking left frontal lobe activation was again detected. These findings fit well with our model of autobiographical remembering. The left frontal activation reflects the operation of control processes during retrieval and the posterior activation reflects access to event-specific knowledge.

### **Stimulation of the noradrenergic system enhances, and blockade reduces, memory for emotional material in man.**

R. E. O'Carroll<sup>1</sup>, E. Drysdale<sup>1</sup>, L. Cahill<sup>2</sup>, P. Shajahan<sup>3</sup> and K. P. Ebmeier<sup>3</sup> (Introduced by Professor Vicki Bruce)

1. University of Stirling
2. University of California, Irvine, CA.
3. MRC Brain Metabolism Unit, Edinburgh

We tested the hypothesis that stimulation of the noradrenergic system would result in the enhancement, and blockade impairment, of long term memory for emotional stimuli in man. Thirty-six healthy young adults were randomly allocated to one of three conditions; (a) 20 mg yohimbine hydrochloride (Yo), which stimulates central noradrenergic activity (b) 50 mg metoprolol (M), a widely used clinical beta-blocker, or (c) matched placebo (P). All capsules were taken orally 90 minutes prior to viewing a narrated 11 slide show, in a double-blind design. The slides and story describe a boy being involved in an accident, with the emotionally arousing elements introduced during the central phase of the story (Cahill, L., et al. *Nature*, 371, 702- 704). We predicted an ordered effect, namely that Yo would stimulate, and M reduce noradrenergic function (and resulting memory), relative to placebo. Yo significantly elevated and M reduced mean heart rate during the slide show, thus confirming the

efficacy of the pharmacological manipulation. Seven days later subjects were asked to recall all they could remember from the narrated slide show they had seen the previous week. As predicted, Y0 subjects recalled significantly more, and M fewer, total number of slides relative to placebo. We conclude that stimulation of the noradrenergic system results in the enhancement, and blockade in a reduction, of recall for emotional material in man. Emotional experience may activate the central noradrenergic system, thus modulating encoding so that the incident is clearly remembered.

### **Temporal bisection and generalisation in patients with Parkinson's disease and young and elderly controls.**

Rosanna Cousins, Donald O'Boyle, John Wearden, Nikki Stookin and Warren Searle

University of Manchester

There is considerable current interest in the questions of how and where time is represented in the nervous system. Ivry (1996), for example, has argued that a primary neural substrate for timing computations is provided by the cerebellum. On the other hand, there is an accumulating body of evidence which suggests that basal ganglionic systems also play an important role in both motor timing (O'Boyle et al., 1966) and temporal perception (Meck, 1996). We are currently studying temporal perception in patients with PD (which is considered to be the best available human model of basal ganglionic disease) within the theoretical context of scalar timing theory. Here we report the results of an experiment in which we examined the performance of 21 PD patients (while on routine dopaminergic medication) and 20 elderly and 20 young control subjects on tasks of temporal bisection (TB) and temporal generalisation (TG), in each case over ranges of short (TB: 100 ms - 400 ms; TG 100 ms - 700 ms) and long (TB: 1 s - 4 s; TG 1 s - 7 s) tone-stimulus durations. There was little evidence that the PD patients were impaired on either task, irrespective of the range of stimulus durations examined. We are currently extending these experiments to compare PD performance between 'on' and 'off' medication conditions.

Ivry R., (1996). *Current Opinion in Neurobiology*, 6: 851-857.

Meck W., (1996). *Cognitive Brain Research*, 3: 227-242.

O'Boyle D. J., Freeman J. S., Cody F. W. J., (1996). *Brain*, 119: 51-70

### **Timing processes and the filled duration illusion.**

J. H. Wearden

University of Manchester

One of the most venerable effects reported in time perception is the 'filled duration illusion', in its commonest form the observation that an interval of time which is 'filled' with a continuous stimulus (e.g. a tone) is perceived as longer than the same interval which is 'empty' (e.g. started and ended by brief clicks). In spite of 100 or more years of research on this effect, the basic question of why it occurs still remains unanswered. The present paper demonstrates the filled duration effect in various different ways but, more importantly, tries to relate the data to

contemporary internal clock based timing theory. Using temporal generalisation and verbal estimation methods, unfilled intervals (intervals delimited by clicks, or gaps in tones) are shown to be considerably shorter in perceived duration than tones. They are, in addition, usually perceived as considerably more variable than tones. The mathematics of internal clock theory (discussed in Wearden et al., 1998) allow us to test whether the mean duration difference is explainable in terms of 'pacemaker speed' (i.e. the idea that the internal clock pulses faster for the filled than unfilled interval), or has some other cause, and the pacemaker speed hypothesis was supported by the results. An additional manipulation showed that both filled and unfilled durations could be 'speeded up' by a technique used by Penton-Voak et al. (1996), suggesting that the filled/unfilled difference was probably due to different rates of operation of a single pacemaker, or two very similar ones.

Penton-Voak, I. S., Edwards, H., Percival, A., & Wearden, J. H., (1996). Speeding up an internal clock in humans? Effects of click trains on subjective duration. *Journal of Experimental Psychology: Animal Behavior Processes*, 22, 307-320.

Wearden, J. H., Edwards, H., Fakhri, M., & Percival, A., (1998). Why "sounds are judged longer than lights": Application of a model of the internal clock in humans. *Quarterly Journal of Experimental Psychology*, 51B, 97-120.

### **The causal selection task: on the spoor of human rationality.**

David Green<sup>1</sup>, and David Over<sup>2</sup>

1. University College London
2. University of Sunderland

Individuals in the standard selection task fail to meet the prescriptions of logic. In contrast, in the much more realistic causal selection task we describe they do meet general decision theoretic prescriptions. We first link the causal selection task to causal contingency tables (and so integrate two hitherto distinct areas of research; work on the selection task and work on causal judgement). Next we show that in testing a causal claim ("If you drink from the well you will get cholera") in a causal selection task, under resource constraints, that performance should be sensitive to the probabilistic context of the claim. We confirm such contextual effects and consider the implications for research on human rationality.

### **A connectionist model of bilingual word recognition: one network or two?**

Michael Thomas (Introduced by Dr. D. C. Mitchell)

King Alfred's College, Winchester

Most of the traditional models of monolingual word recognition have been extended to the bilingual case (e.g. serial search, verification, interactive activation). The question each model must address is whether the information about the words in each language should be stored separately or together within the model. Evidence of language switching costs and of language context effects on recognition times has pushed theorists towards an independent lexicons account. However, evidence of between-language interference effects confuses the picture. In this

work, I will explore possible extensions of the distributed model of word recognition to the bilingual case. I will present simulation results which suggest that an appropriate model is one which employs a single network to generate the meanings of word forms in two languages. Within the model, the two word sets are distinguished by tagging the input and output representations by their language membership. The model captures both evidence of language independence and between-language similarity effects found in lexical decision studies with bilinguals. However, the model disagrees with the existing empirical literature in at least two respects: the ability of bilinguals to ignore words presented in the wrong language context, and the patterns of between-language repetition priming one would expect for word forms existing in both the bilingual's languages but with a different meaning in each. An empirical study is described which supports the prediction of the Single Network model.

### **Semantic competition effects during word recognition.**

Jennifer Rodd, M. Gareth Gaskell and William D. Marslen-Wilson

MRC Cognition and Brain Sciences Unit, Cambridge

Word recognition is often viewed as a competitive process; for a given input, candidate words compete with each other and one word is eventually recognised. In many recent models of word recognition, words directly compete for activation of distributed semantic representations. However, there is little experimental evidence to support the idea that lexical competition occurs at the semantic level itself. This study looks for effects of such competition using a visual lexical decision task. Using stimuli that were controlled for frequency, familiarity, concreteness and length, response latencies were longer for homographs with two unrelated meanings (e.g. cricket) than for words with only one meaning (e.g. weapon). This disconfirms the often-reported ambiguity advantage, but is consistent with the prediction that recognition of homographs is slowed by increased competition at the semantic level relative to words that only have one meaning. Furthermore, within the set of homographs, responses were slower when the homograph's two meanings were semantically unrelated (e.g. cricket) than when they were related (e.g. letter). This can also be attributed to increased competition at the semantic level for words with unrelated meanings

### **The influence of knowledge about consequences in language production and language comprehension.**

A. J. Stewart, M. J. Pickering and A. J. Sanford

University of Glasgow

In this talk we report a new type of verb semantic bias which influences the language system. We illustrate its influence with reference to experiments on language production and language comprehension. We propose that implicit consequentiality information is used by the language processor in a manner similar to the way in which implicit causality information is used (Garnham, Traxler, Oakhill & Gernsbacher, 1996; Stewart, Pickering & Sanford, 1998). We examine how implicit consequentiality is used to interpret ambiguous pronouns and the way in which its influence is affected by the presence of additional information such as gender.

### **Preparation for endogenous action.**

Patrick Haggard, Tammy Astor and Vladka Coupar

University College London

Little is known about the intention and preparation of willed actions. We have studied the preparation of endogenous action in three experiments by truncating intention/preparation with a reactive signal instructing subjects to make the very same movement they had been preparing. Subjects were instructed to press a key with the right index finger at a time of their own choosing. In the truncation condition, the process of preparing this endogenous action was interrupted on some trials by a randomly-occurring beep, to which subjects reacted with an identical right keypress. Subjects also performed two control conditions in which they did not prepare any endogenous action but simply reacted on hearing the beep (SRT), and in which they prepared and executed endogenous actions without the possibility of a reactive stimulus. We unexpectedly found significantly higher RTs in the truncation condition, when subjects had been endogenously preparing the very same movement, compared to the SRT control condition. This RT cost of endogenous preparation averaged 73 ms across 3 experiments. Thus, intention and preparation of endogenous action appears to inhibit use of the same motor output by a second, reactive task. Possible explanations of this finding are discussed.

### **The planning and control of bimanual prehension movements.**

G.M. Jackson<sup>1</sup>, S.R. Jackson<sup>1</sup>, Masud Husain<sup>2</sup> and M. Harvey<sup>3</sup>

1. University of Wales, Bangor

2. Imperial College, London

3. University of Bristol

Many everyday tasks (e.g., unscrewing a jar) require that we use our hands co-operatively. For tasks where both hands are required to perform the same action, a common motor program may be used. However, where each hand needs to perform a different action, independent control of the hands may be necessary. We examined the coordination of bimanual reach-to-grasp movements in circumstances where each hand is required to perform the same (congruent) or a different (incongruent) action toward two objects. Our results suggest that while there is an overall cost associated with carrying out two movements simultaneously (compared to a unimanual movement), kinematic measures are not affected by whether congruent or incongruent actions are executed by each hand. Thus, the problem of executing incongruent bimanual movements appears to be solved by synchronising both hands to a common movement duration. We also examined the coordination of bimanual movements in a patient recovering from a CVA which resulted in a dense hemianaesthesia of the left arm. Our results indicated that unimanual movements executed by our patient using her non-sensate hand were relatively unimpaired. In contrast, during bimanual movements, reaches executed by our patient using her non-sensate hand showed gross directional errors and spatiotemporal irregularities. Namely the inappropriate coupling of movement velocities. These data are discussed with reference to the role of proprioception in the planning and control

of prehension movements.

### **Sensorimotor integration in the control of goal-directed action: a case study of hemispatial neglect.**

R. I. Newport<sup>1</sup>, S. R. Jackson<sup>1</sup> and M. Harvey<sup>2</sup>

1. University of Wales, Bangor

2. University of Bristol

The spatial hand paths of visually-guided reaching and pointing movements have frequently been described as being slightly curved in nature. Furthermore, it has been suggested that patients with hemispatial neglect exhibit hand paths with an additional curvature bias towards the ipsilesional side. The planning of visually-guided reaching movements is thought to take place in an extrinsic coordinate system whereas proprioceptively-guided reaches may be planned with respect to an intrinsic frame of reference. The current study investigated whether proprioceptively-guided pointing movements are subject to the same curvature and biases as visually-guided movements. The hand paths and spatial errors of pointing movements executed to visually and proprioceptively defined targets by 6 control subjects and one patient with hemispatial neglect (LGC) were examined. Our results indicated that for both LGC and controls, the hand paths for visually-guided movements were gently curved whereas those for purely proprioceptively-guided movements were comparatively straight suggesting a possible shift from an object or hand centred frame of reference for visually-guided reaches to a joint centred frame of reference for proprioceptive reaches. The hand paths for visually-guided movements to proprioceptively defined targets appeared to be a mixture of the purely proprioceptive and visual conditions. LGC's hand paths did not show a rightward bias when reaching into left space. These results will be discussed with respect to the frame of reference used to control hand action.

### **Eye movements during a cognitive planning task.**

Timothy L. Hodgson<sup>1</sup>, Adnan A. Bajwa<sup>1</sup>, Adrian Owen<sup>2</sup>, Winand Dittrich<sup>1</sup> and Christopher Kennard<sup>1</sup>

1. Imperial College School of Medicine, Charing Cross Hospital, London

2. MRC Cognition and Brain Sciences Unit, Cambridge

We report an experiment designed to investigate the processes involved in cognitive planning and problem solving through the analysis of eye movements. Participants viewed a series of pictures showing four coloured balls arranged in six pockets. The task was to plan the shortest sequence of moves required to rearrange the balls in one half of the display (the workspace) to match the arrangement of balls pictured in the opposite half of the display (the model). Participants had to plan, rather than execute the moves and pressed a response button when they had solved the problem. They then indicated the shortest number of moves required to solve the problem (either one, two or three moves). One group of participants were required to solve the problems with the workspace arrangement in the upper half of the display. The other group of participants were instructed to solve the problems in the lower half of the display. However, both groups were presented with an identical set of

pictures. Analysis of scan-paths revealed that for 3 move problems fixations early during a trial were more likely to land on the model compared to the workspace. In the middle part of a trial fixations were directed at the workspace area, while towards the end of the trial fixations were more likely to return to the model. This pattern was found regardless of whether the participants solved the problems in the lower or upper visual field, indicating that fixations on the workspace correlate with planning. People also made more horizontal shifts in eye position while fixating the workspace compared to the goal arrangement. For one and two move problems fixations were more evenly distributed between the model and workspace. It is concluded that analysis of eye movements will prove useful in understanding the processes underlying cognitive planning and problem solving.

### **How does persistent stuttering arise out of normal childhood nonfluency?**

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Diagnosis of childhood stuttering is difficult because many of the types of dysfluency that occur are also seen in children whose language develops normally. In addition, it is possible that some children may have been misdiagnosed as stutterers given the high rate of spontaneous recovery (up to 90%). It is dangerous, on the other hand, not to seek improved methods of diagnosis as once children persist in stuttering beyond about age 9, the chances of permanent recovery are low. In this contribution, a theoretical proposal is offered to explain how stuttering arises out of childhood nonfluency. The starting point for the theory is Clark and Clark's (1977) explanation of dysfluency patterns observed by Maclay and Osgood (1959) in fluent adult speakers' speech. Maclay and Osgood's (1959) data show that a high proportion of repetition of function words occurs when they precede a content word. Clark and Clark (1977) explained this by assuming that planning for the following word is not complete and the redundant repetition of function words allows further time for planning the subsequent word. We test predictions about the prevalence of this strategy in young fluent speakers and children who stutter using Selkirk's (1984) phonological word segments. It is shown how this pattern changes as people who stutter get older and how it contrasts with the pattern in fluent speakers.

Clark, H., & Clark, E., (1977) *Psychology and language: An introduction to psycholinguistics*. New York: Harcourt.

Maclay, H., & Osgood, C. E., (1959) Hesitation phenomena in spontaneous English speech. *Word*, 15, 169-182.

Selkirk, E., (1984) *Phonology and syntax. The relation between sound and structure*. Cambridge, MA: MIT Press.

### **The effects of repetition on study time and judgements of learning in Alzheimer's disease (AD).**

Chris Moulin and Tim Perfect

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Greene et al. (1996) suggest that AD patients approach repeated trials in a learning test as if they are single unrelated trials. To explore this, two measures of metamemory were taken across repeated presentations of items: A judgement of learning (JOL) is a declaration of how well an item

has been learned. Recall readiness (RR) is the study time allocated by participants to ensure proficient learning of an item. Items were repeated either once, twice or three times in the list. With repetition, age matched controls made RR judgements more quickly and reported higher JOLs, whilst AD patients showed faster RR, but did not alter their JOLs. We discuss the implications for theories of the learning deficit in AD, and the basis of metamemory measurements.

### **Investigating repetition effects in task switching.**

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It is generally the case that shifting from one task to another takes longer than repeating performance of the same task. Previous investigation has focused on contrasting contributions of participants' ability to prepare for a task shift, and of inertia-like effects of previous trials that may contribute to this shift cost. This experiment compared the effects of successive task repetitions on performance on nonswitch trials, and on subsequent switch trials, in a speeded-response task. 24 participants shifted between semantic classification of pictures and words. Task was varied randomly using flanking precues, with a 0.75 probability of a task repetition on each trial. At short cue-target interval (150ms), RT was progressively speeded by task repetition, but performance on a subsequent switch trial was not affected. These results are discussed in terms of possible mechanisms of task set activation, and evidence for carry-over effects from previous trials. Implications are considered for different accounts of task shift costs.

### **The native-language advantage in verbal short-term memory.**

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Three experiments examined the role of language-specific knowledge in verbal short-term memory for competent speakers of a second language. Experiment 1 assessed memory span for words and nonwords in English and French for native English and native French adults who spoke both languages proficiently. Recall was superior in the native language for both lexical and non-lexical items. In Experiment 2 native French adults' serial recall of French and English words was assessed with and without concurrent articulatory suppression. Recall was superior in the native language in both concurrent task conditions indicating that the native language advantage cannot be attributed to a slower rate of subvocal rehearsal in the second language. Experiment 3 used a serial recognition paradigm in which native French adults were required to identify order differences in French and English memory sequences. The native language advantage was eliminated. It is suggested that the superior recall of verbal material in the native language arises from a greater contribution of long-term phonological knowledge to enhance memory representations.

### **When adults behave like children (sort of): the case of working memory span.**

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Recent research has challenged the view that working memory span tasks illustrate general resource-sharing strategies in childhood, and in turn this questions the framework that changes in resource-sharing account for cognitive development (e.g. Hitch, Towse & Hutton, 1998; Towse & Hitch, 1995; Towse, Hitch & Hutton, in press). Instead, we have argued for the view that children switch between mental activities on tasks such as counting span, reading span, and operation span. We have also suggested that children's reading and number skills at least partly reflect different characteristics of these span tasks. The present paper reports an experiment in which adults were administered reading and operation span tasks, along with more general measures of processing speed. Replicating work with children, we obtained no support for the idea that resource-sharing occurs in working memory span, whilst finding significant evidence for a time-based account of performance. However, in contrast to the developmental data, individual differences in span did not appear to be related either to on-line measures of task speed, or to more general measures of processing speed. We briefly consider the measurement and possible mismeasurement of 'working memory capacity'.

Hitch, G. J., Towse, J., & Hutton, U., (1998). Time for a re-think: Explanations for children's working memory span and its relationship to reading and arithmetic skills. Experimental Psychology Society, York meeting.

Towse, J. N., & Hitch, G. J., (1995). Is there a relationship between task demand and storage space in tests of working memory capacity? *Quarterly Journal of Experimental Psychology*, 48A, 108-124.

Towse, J. N., Hitch, G. J., & Hutton, U., (in press) Are-evaluation of working memory capacity in children. *Journal of Memory and Language*.

### **There are two opposed word length effects in verbal short-term memory: evidence against decay theories of short-term memory loss.**

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Short-term memory is affected by serial position: the final items in a list may be better remembered (recency). It is also affected by the time it takes to pronounce a word: shorter words are better remembered (the word-length effect). A popular explanation for such results assumes that items are stored in a short-term memory store from which they are lost by automatic decay through time unless their strength is restored by passage through an 'articulatory control process'. Experiments on short-term memory for consonants and odours show that the recency curves differ for memory for content and for order. This presents a problem for decay theories. Experiments on the word-length effect show that when the duration and complexity of words are independently manipulated, we obtain two opposed word-length effects: there is an advantage for words spoken more quickly ('short' in terms of duration), but a disadvantage for words with fewer syllables ('short' in terms of complexity).

Both sets of results present a difficulty for rapid-decay short-term store theories.

**Working memory and English children's achievements in the national curriculum at seven years.**

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The relationship between working memory skills and national curriculum attainments was investigated in a study of children aged six and seven years of age. Each child was assessed on a battery of measures of working memory function. Close links were observed between performance on a subset of the working memory tests and the children's attainment levels in the three curriculum areas of English, mathematics and science. Scores on four verbally-based measures and one visuo-spatial memory task were highly effective at identifying children at risk of underachievement in these three curricular domains, and also at discriminating children with more substantial learning difficulties that warranted special education support. A linear dimension of risk for underachievement was identified, in which increasing risk of poor attainment in mathematics, English and all areas of the curriculum was associated with increasing severity of working memory impairment.

**Separating selection of objects from selection of action: neuropsychological evidence on manual interference.**

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Recently we have reported data on the effects of visual affordances and learned object-hand associations on manual interference responses in a patient ES, with corticobasilar degeneration (Riddoch et al., in press). We used a task in which the rule was to pick up the left side object with the left hand and the right side object with the right. Opposite hand responses (interference responses) were cued by the familiarity of the object and the compatibility between the object's parts and the hand used for action (e.g., the handle of a cup). The results showed impaired selection of action in this patient. Here we report data on manual interference responses when multiple objects were presented but ES had only to use one for action. We show that there was no effect of distractors on performance when they differed from targets in colour, size, shape or orientation, even when the distractors were more strongly associated with the required action than the target. Furthermore, a distractor in the path of action to a target blocked manual interference responses to that item. We conclude that ES could select the target object for action despite being impaired at then selecting the action for that task. Distractors are selected only when in the path of action to the target, and their subsequent rejection as targets also leads to the inhibition of linked manual interference responses. We discuss the data in relation to the distinction between anterior and posterior attentional systems in the brain.

Riddoch, M.J., et al. (in press) Visual affordances direct action: evidence from manual interference responses. *Cognitive Neuropsychology*.

## **HJA, a patient with visual agnosia, computes occluded contours: evidence for early computation prior to figure-ground coding.**

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The levels of processing at which figure-ground coding and completion of occluded contours occur remain controversial. We examined whether HJA, a patient with visual agnosia, was able to complete occluded contours despite his being impaired at binding contours to shapes and at computing foreground-background relations in overlapping shapes. Stimuli were composed of three superimposed or occluded shapes. Experiment 1 used a matching task in which distractors differed from targets by the location of two shapes. HJA was selectively impaired with occluded shapes as compared to superimposed shapes. Experiments 2 and 3 required discrimination of the central shape. In HJA, discrimination was facilitated as the length of the occluded contours decreased, but only when the central shape was in the background. In contrast, when it was in the foreground, discrimination was impaired as the length of the occluded contour increased. Free-choice shape judgements made to the central shape also suggested that HJA used both real and completed contours to segment foreground shapes inappropriately. Occluded contours might thus be computed early on in visual processing, prior to processes in which contours are bound to shapes and in which foreground-background relationships between shapes are resolved.

## **Awareness and form discrimination in a blindsight patient.**

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The phenomenon of 'blindsight' is observed when patients who are cortically blind (typically following damage to primary visual cortex) exhibit residual visual processing capabilities for stimuli presented within their scotoma to which they are otherwise unaware. Residual abilities can include the capacity to localise stimuli presented within the 'blind' field, or to reliably discriminate object attributes such as target orientation or the direction of target motion. However, it has long been held that the ability of discriminate form is not well preserved in blindsight patients. In this paper we report three experiments with the blindsight patient GY. In Experiment 1 we demonstrate that GY was unable to preshape his grasp when picking-up oblong blocks of differing size which were presented within his blind field. In Experiment 2 however, we demonstrate that GY was able to reliably preshape his grasp ( $p < 0.0001$ ) if he fixated the leftmost edge of the target object (so that part of the object appeared within his unaffected visual field). This result suggests that the processing of visual stimuli presented within his unaffected hemifield can facilitate the visual processing of stimuli presented within the 'blind' field to which he is unaware. Are such abilities limited to motor responses? In Experiment 3 we examined whether GY's ability to detect perceptual stimuli presented within his blind field was affected by the presentation of a stimulus at the mirror-image location in his unaffected field.

Our results indicate that GY's sensitivity to detect a stimulus is significantly enhanced when a stimulus is simultaneously present in his

good field. This 'anti- extinction' effect confirms the finding of Experiment 2, that processing of stimulus properties in GY's unaffected field, to which he is aware, can facilitate non-conscious processing of stimulus attributes presented with his blind hemifield.

### **Prototypicality, distinctiveness and intercorrelation: analyses of the semantic attributes of living and nonliving concepts.**

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Cognitive psychological, computational and neuropsychological approaches to the organisation of semantic memory incorporate the idea that concepts are, at least partly, represented in terms of their fine-grained features. We asked 20 normal volunteers to provide properties of 64 concrete items, drawn from living and nonliving categories, by completing simple sentence stems (e.g., an owl is \_\_, has \_\_, can\_\_). At a later date, the same participants rated the same concepts for prototypicality. The features were classified as to type of knowledge (sensory, functional or encyclopaedic), and also quantified with regard to both dominance (the number of participants specifying that property for that concept) and distinctiveness (the proportion of exemplars within a conceptual category of which that feature was considered characteristic). The resultant database was used to replicate, resolve and extend a variety of previous observations on the structure of semantic representations. For example, our results (i) corroborate some previous claims of higher intercorrelations between features of living things than of artefacts; (ii) resolve two conflicting claims regarding the relative ratio of sensory to other kinds of attributes in living vs. nonliving concepts; and (iii) offer new information regarding the types of features -- across different domains -- that distinguish concepts from their category co-ordinates. The results also demonstrate that rated prototypicality is related to both the familiarity of the concept and its distance from the average of the exemplars within the same category (the category centroid).

### **Implicit learning and attention.**

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Traditionally, implicit learning has been defined in terms of a lack of awareness of the process and products of learning. In the face of a number of conceptual and empirical difficulties with this definition, it has recently been suggested instead that the critical feature of implicit learning is that it proceeds without making any demands on attentional resources. As evidence for this, Frensch, Lin, and Buchner (in press) used a sequential reaction time task to show that implicit learning under single- and dual-task conditions was equivalent so long as testing took place under identical circumstances (i.e., either under single- or dual-task conditions). We report a test of Frensch et al.'s hypothesis with improved experimental procedures.

Frensch, P. A., Lin, J., & Buchner, A., (in press). Learning versus behavioural expression of the learned: The effects of a secondary tone-

counting task on implicit learning in the serial reaction task. *Psychological Research*.