

2000 - July 20/22 University of Cambridge Talk Program

Wednesday 19 July, 6.00pm Physiology Theatre The Hebb Award Lecture
Jane Stewart (Concordia Univ, Montreal)

Making Sense of Humours

Thursday 10 July, 9.00-10.40

Session A: Genetics Biffen theatre

Symposium: Role of knowledge, logic & normative standards in human inference **Organiser:** Valerie Thompson

9.00 Simon Handley and Joanna Lott (Univ of Plymouth)
The role of suppositions in the development of children's reasoning

9.20 Mike Oaksford, Nick Chater and Joanne Larkin (Cardiff Univ)
Probabilities and polarity biases in conditional inference

9.40 Jo Sellen and Mike Oaksford (Cardiff Univ)
Paradoxical individual differences in conditional inference

10.00 Jonathan Fugelsang and Valerie Thompson (Univ of Saskatchewan)
Knowledge-based reasoning about causes and consequences

10.20 Aidan Feeney and Jonathan Evans (Univ of Durham and Univ of Plymouth)
Background beliefs about the probability of the evidence in hypothesis testing

Session B: Biochemistry small theatre

Symposium: It's about time **Organiser:** Simon Grondin

9.00 Lorraine Allan (McMaster Univ)
The time of my life

9.20 C M Bradshaw, M-Y Ho, T-J Chiang, S Mobini and E Szabadi (Division of Psychiatry, Univ of Nottingham)
Temporal discrimination and temporal differentiation of behaviour: evidence for distinct neural mechanisms

9.40 Simon Grondin (Univ Laval, Québec)
It's about time making sense, or perhaps about senses making time

10.00 Peter R Killeen (Arizona State Univ)
DMTS as JOR

10.20 J H Wearden (Manchester Univ)
Infernal machines! Exploring internal clocks and other timing processes

10.40 COFFEE

Thursday 10 July, 11.20-1.00

Session A: Genetics Biffen theatre

(Symposium: Role of knowledge, logic & normative standards in human inference continued)

11.20 Valerie Thompson, Jonathan Evans and Simon Handley (Univ of Saskatchewan and Univ of Plymouth)
Warnings and inducements as argument

11.40 Steven Newstead, Simon Handley and Valerie Thompson (Univ of Plymouth and Univ of Saskatchewan)
Alternatives, falsification, and mental models theory

12.00 Peter Dixon (Univ of Alberta)

The p-value fallacy: Why inferential statistics don't describe results

12.20 R H Logie, S Della Sala*, G Cocchini* and A D Baddeley (Univ of Aberdeen and Univ of Bristol)
Dual task co-ordination versus task difficulty: Evidence from Alzheimer patients and healthy adults

12.40 Margaret Crossley (Univ of Saskatchewan)
A longitudinal study revealing age-related stability in dual-task performance

Session B: Biochemistry small theatre

11.20 Angelo Santi, Lori Ross and Andrew Miki (Wilfrid Laurier Univ, Ontario)
Stimulus modality and the perception of empty time intervals in pigeons

Symposium: Development of motion perception **Organiser:** Terri L. Lewis

11.40 J Anthony Movshon (Howard Hughes Medical Institute at New York Univ)
Processing of motion information in the primate cerebral cortex

12.00 Oliver Braddick, John Wattam-Bell, Alexandra Mason and Janette Atkinson (Visual Development Unit, Univ College London)
Interacting motion processing mechanisms in the developing infant

12.20 Paul Azzopardi, Mazyar Fallah, Charles Gross, Hillary Rodman and Alan Cowey (Univ of Oxford, Princeton Univ and Psychology Department and Yerkes RPRC, Emory Univ)
What does blindsight tell us about the functional architecture of motion perception?

12.40 Terri L Lewis, Dave Ellemberg, Daphne Maurer, Nancy Defina and Henry P Brent (The Hospital for Sick Children, Toronto; McMaster Univ and Univ of Toronto)
The perception of local and global motion after early pattern deprivation in humans.

1.00 LUNCH

Thursday 20 July, 2.00-4.00pm

Session A: Genetics Biffen theatre

2.00 M. Kathleen Pichora-Fuller, Bruce Schneider and Hollis Pass (Univ of British Columbia and Univ of Toronto)
Temporal jitter disrupts speech intelligibility: Simulations of auditory aging

Symposium: Cognitive aging **Organizers:** Patrick Rabbitt and Fergus Craik

2.20 Patrick Rabbitt (Age And Cognitive Performance Research Unit, Univ of Manchester)
Age slows, and so sometimes obliterates consciousness of events.

2.40 Elizabeth A Maylor and Derrick G Watson (Univ of Warwick)
Aging and visual marking: selective deficits for moving stimuli

3.00 Moshe Naveh-Benjamin (Ben-Gurion Univ of the Negev, Israel)
Adult-age differences in memory performance: tests of an associative deficit hypothesis

3.20 Tim Perfect, Chris Moulin and Martin Conway (Univ of Plymouth, Univ of Reading and Univ of Bristol)
Retrieval induced forgetting in normal aging

3.40 Louise Phillips and Mairi MacLeod* (Aberdeen Univ)
Adult aging and planning ability

4.00 Discussant: Fergus Craik (Univ of Toronto)

Session B: Biochemistry small theatre

Attention, space and time

2.00 Sébastien Tremblay* and Dylan M Jones (Cardiff Univ)

Auditory attentional blink in the presence or absence of filler items

2.20 Jay Pratt and Allison B. Sekuler (Univ of Toronto)

Attention, occlusion, and previous experience

2.40 S Soto-Faraco*, C Spence, A Kingstone, and J Duncan (Univ of British Columbia, Univ of Oxford and Cognition & Brain Sciences Unit)

Spatial modulation of intramodal and crossmodal temporal processing deficits

3.00 Raymond Klein, Bruce Dick, Jason Ivanoff and Tracy Taylor (Dalhousie, Halifax)

Is perception, attention or action inhibited following spatial reorienting?

3.20 Janice J. Snyder, William C. Schmidt and Alan Kingstone (Univ of Alberta, Univ at Buffalo and Univ of British Columbia)

A facilitatory effect does not contribute to the inhibition of return effect

3.40 Katherine Arbuthnott and Todd Woodward (Univ of Regina and Univ of British Columbia)

Is task-set inhibition in set switching location specific?

4.00 Sandra Pouliot and Sylvain Gagnon (Univ of Quebec)

Is egocentric space automatically encoded?

4.30-6.30 POSTERS AND TEA (Kings College)

7.15 WINE RECEPTION

8.00 DINNER (Kings College Dining Hall)

Friday 21 July, 9.00-10.20

Session A: Physiology Lecture Theatre III

Symposium: Neuroimaging of memory **Organiser:** Roberto Cabeza

9.00 Paul Fletcher (Research Dept of Psychiatry, Univ of Cambridge)
The role of the left prefrontal cortex in encoding of episodic memory

9.20 Roberto Cabeza (Univ of Alberta, Edmonton)
Involvement of prefrontal regions on episodic memory retrieval: Mode, success, effort, and GRAM

9.40 Adrian M Owen (MRC Cognition and Brain Sciences Unit, Cambridge)
The functional organisation of working memory processes within the lateral frontal cortex.

10.00 Cheryl L Grady (Rotman Research Inst, Univ of Toronto)
Age-related differences in brain activity during memory

Session B: Biochemistry Lecture Theatre

Attention

9.00 Eric Richards and Jennifer Stolz (Univ of Waterloo)
The resource demands of semantic priming

9.20 Bruce Milliken, Juan Lupianez, Karmen Bleile and Jason Leboe (McMaster Univ and Universidad de Granada, Spain)
Binding action to a source: Evidence from stroop priming

9.40 Jason Tipples, Andy Young, Philip Quinlan, Paul Broks and Andy Ellis (Univ of York and Univ of Sheffield)
Searching for threat

10.00 Michael E J Masson, Daniel N Bub, and Todd S Woodward (Univ of Victoria)
Modulation of specific processes in task switching

Session C: Geography Small Lecture Theatre

Language development and impairment

9.00 Sandra A Wiebe and James M Clark (Inst of Child Development, Univ of Minnesota, USA)
Assessing inhibitory control in children and adults with a picture choice task

9.20 Graham Schafer (Univ of Reading) (Introduced by Professor D Berry)
Intervention in early word learning: An experimental approach

9.40 G M McArthur, and D V M Bishop (Univ of Oxford)
Mismatch negativity and auditory backward recognition masking performance in people with a specific language impairment

10.00 Dorothy Bishop, Courtenay Frazier Norbury and Josie Briscoe (Univ of Oxford)
"Yesterday I stroke a horse": Can children's problems with verb morphology be explained in terms of a low-level auditory deficit?

10.20 COFFEE

Friday 21 July, 11.00-1.00

Session A: Physiology Lecture Theatre III

Symposium: Temporal lobe function in episodic and semantic memory **Organisers:** Karalyn Patterson and Kim Graham

11.00 Elisabeth A Murray (National Inst of Mental Health, Bethesda, USA)
Perceptual-mnemonic functions of the perirhinal cortex in macaques

11.30 Morris Moscovitch (Univ of Toronto at Mississauga)
Remote memory and the hippocampal complex in humans

12.00 Kim S Graham (MRC Cognition and Brain Sciences Unit, Cambridge)
Semantic dementia: A challenge to the multiple-trace model of memory consolidation?

12.30 Faraneh Vargha-Khadem, David G Gadian and Mortimer Mishkin (Inst of Child Health, Univ College London and National Inst of Mental Health, Bethesda, USA)
Dissociations in cognitive memory: The syndrome of developmental amnesia

Session B: Biochemistry Lecture Theatre

11.00 EPS Undergraduate Project Prize

Donna M Lloyd (Univ of Manchester)
Crossmodal links in covert endogenous spatial attention between audition and touch

Symposium: Confidence in human judgement Organisers: Joseph V Baranski and Nigel Harvey

11.20 Tim Rakow, Sarah Finer and Nigel Harvey (Univ College London)
Moderation of base rate neglect by group discussion and range specification: A calibration study

11.40 Alastair McClelland, John Haynes and Zhuo Jia Sun (Univ College London)
The hard-easy effect in the calibration of subjective probabilities: The effect of defining 'difficulty' in terms of absolute difference rather than familiarity

12.00 William M Petrusic and Joseph V Baranski (Carleton Univ, Ottawa and DCIEM, Toronto)
Judging confidence influences decision processing

12.20 Jack B Soll and Joshua Klayman (INSEAD, Fontainebleau, France and Univ of Chicago, USA)
Explaining extreme overconfidence on interval questions

12.40 Joseph V Baranski and William M Petrusic (DCIEM, Toronto and Carleton Univ, Ottawa)
Subjective probability in the assessment of threat: Comparing expert vs. novice use of inconclusive information

Session C: Geography Small Lecture Theatre

Hearing, touch and vision

11.00 Susan E Boehnke and Dennis P Phillips (Dalhousie Univ, Halifax)

The spatial tuning of human auditory perceptual channels under binaural and monaural conditions

11.20 C D Tsang and L J Trainor (McMaster Univ)

The effect of spectral slope on infants' discrimination of timbre

11.40 D A Hall, I S Johnsrude, M S Gonçalves, M P Haggard, A R Palmer, A Q Summerfield, M A Akeroyd, and R S J Frackowiak (MRC Inst of Hearing Research, Nottingham and Wellcome Dept of Cognitive Neurology, London)

Hierarchical processing in the auditory cortex? fMRI mapping of responses to spectral and temporal complexity

12.00 Sophie K Scott, Stuart Rosen, Catrin Blank and Richard J S Wise (Inst of Cognitive Neuroscience and Dept of Phonetics, Univ College London, MRC Cyclotron Unit, Hammersmith Hospital) (Introduced by James Blair)

Subsystems in the human auditory cortex - evidence from functional neuroimaging studies

12.20 Susanna Millar and Zainab Al-Attar (Univ of Oxford)

Multisensory coding: Implications of findings on tactile illusions

12.40 Gemma Calvert (Univ of Oxford) (Introduced by Professor D Bishop)

How does the brain solve the crossmodal binding problem? Insights from fMRI studies of audio-visual and visuo-tactile integration.

1.00 LUNCH

Friday 21 July, 2.00-3.20

Session A: Physiology Lecture Theatre III

Symposium: Parietal lobe in vision and visuomotor control **Organisers:** Melvyn A Goodale and A David Milner

2.00 Melvyn A Goodale and Yaoping Hu (MRC Group on Action and Perception, Univ of Western Ontario)
Frames of reference and timing in the visual control of skilled actions

2.20 A David Milner and H Chris Dijkerman (Univ of Durham and Univ of Utrecht, Netherlands)
Two routes from vision to action: Effects of bilateral posterior parietal damage

2.40 Michel Desmurget (Psychophysique et Neuropsychologie Espace et Action, INSERM Unité 94, Bron, France)
How does the posterior parietal cortex control visually guided actions?

3.00 Jody C Culham, Rieko Osu, A David Milner, Joseph S Gati, Ravi S Menon, and Melvyn A Goodale (MRC Group on Action and Perception, Univ of Western Ontario and Univ of Durham)
Visually guided grasping produces fMRI activation in human anterior intraparietal sulcus.

Session B : Biochemistry Lecture Theatre

Symposium: New research on human motivations for alcohol use **Organiser:** S H Stewart

2.00 N Comeau, S H Stewart, P Loba, E Rhyno and H L Loughlin (Dalhousie Univ, Halifax)
Adolescents' motives for cigarette smoking and marijuana use: Factor structure and relations to motives for alcohol use.

2.20 S H Stewart, C J Roney, D R Lehman, L Chung, N Lawson and A Mueller (Dalhousie Univ, Halifax, Kings College, Ontario and Univ of British Columbia)
Relations of drinking motives to promotion- and prevention-focus in other behavioral domains

2.40 P J Conrod, P Woicik, S H Stewart and R O Pihl (State Univ of New York at Stony Brook, USA, Dalhousie Univ, Halifax and McGill Univ)
Relations between four personality risk factors for alcohol abuse and reinforcement-specific motives for drinking in non-alcoholic and substance abusing samples

3.00 W M Cox (Univ of Wales, Bangor)

Motivational patterns as predictors of alcohol use and the likelihood of change

Session C: Geography Small Lecture Theatre

Categorization and diagnosis

2.00 John R Vokey, Jason M Tangen and Kevin Eva (Univ of Lethbridge and McMaster Univ)
PCA network models of memory and perceptual processes: A matter of style

2.20 A J Wills (Cambridge Univ) (Introduced by I P L McLaren)
Categorization and the "Ratio Rule"

2.40 Lee R Brooks and Sam D Hannah (McMaster Univ)
Relation between perceptual and informational learning of family resemblance structures

3.00 Kevin W Eva and Lee R Brooks (McMaster Univ)
The under-weighting of implicitly generated alternatives

3.20 TEA

Friday 21 July, 4.00-5.20

Session A: Physiology Lecture Theatre III

Causal learning

4.00 Robin A Murphy and Stefanie Schmeer (Univ of Hertfordshire)
An associative learning model of the illusory correlation effect

4.20 I P L McLaren (Univ of Cambridge)
Associatively mediated anti-generalisation in memory

4.40 Jan De Houwer (Univ of Southampton) (Introduced by Professor David Shanks)
Two new forms of retrospective revaluation in human contingency learning

5.00 David R Shanks and J Perales (Univ College London and Univ of Granada, Spain)
Normative and descriptive accounts of the influence of power and contingency on causal judgment

Session B: Biochemistry Lecture Theatre

Movement and skill

4.00 Friederike Schlaghecken and Martin Eimer (Univ of Cambridge)
Motor activation and inhibition elicited by masked primes: A threshold model and experimental evidence

4.20 Georgina M Jackson and Stephen R Jackson (Univ of Nottingham)
Selection-for-action: Evidence from bimanual reach-to-grasp movements directed toward single and multiple 'objects'

4.40 Marco Bertamini and Heiko Hecht (Univ of Liverpool and Man-Vehicle Lab, Cambridge, MA, USA) (Introduced by Dr R Lawson)
Understanding projectile acceleration

5.00 Peter McLeod, Nick Reed and Zoltan Dienes (Oxford Univ and Sussex Univ)
Implicit knowledge and motor skills: What people who can catch a ball do not know

Session C: Geography Small Lecture Theatre

Drugs and hormones

4.00 Denys deCatanzaro (McMaster Univ)
The role of androgens and estrogens in the Bruce effect

4.20 Lianne Stanford, Scott M Weiss and Kelly J Stanhope (Depts of Psychology and Neuroscience, Dalhousie Univ, Halifax and Dept of Neuropharmacology, Cerebrus Ltd., Wokingham)

Effects of the benzodiazepine receptor agonist chlordiazepoxide & the 5-HT1A antagonist WAY100635 on behaviour in the rat elevated zero maze are not influenced by the light/dark cycle.

4.40 Lisa E Kalynchuk, Janet Menard and Michael J Meaney (Dalhousie Univ and Douglas Hospital Research Center, McGill Univ)
The effect of long-term amygdala kindling on emotional behavior may be related to receptor regulation within the dentate gyrus.

5.30 EPS Business meeting (Geography Small Lecture Theatre)

6.00 Physiology Large Lecture Theatre 28th Bartlett Lecture

Anthony Dickinson (Univ of Cambridge)
Causal learning

Saturday 22 July, 9.00-10.40

Session A: Physiology Lecture Theatre III

Neuropsychology

9.00 Chris McManus and Julia Tomlinson (Univ College London)
Objects look larger with the left eye than the right eye

9.20 Alex Easton (Univ of Oxford) (Introduced by Dr D Gaffan)
The medial forebrain bundle must interact with the cortex for normal object recognition memory

9.40 R J R Blair (Inst of Cognitive Neuroscience, Univ College London)
Response reversal impairment in Psychopathic individuals

10.00 Jill Boucher, Patty Cowell, Paul Broks, Neil Roberts, Matthew Howard and Andrew Mayes (Univ of Warwick, Univ of Sheffield and Univ of Liverpool)
A combined neuropsychological and structural MRI study of high functioning autism

10.20 Andrew J Calder, Jill Keane and Andy Young (MRC Cognition and Brain Sciences Unit, Cambridge and Univ of York)
A selective impairment in the recognition of facial and vocal signals of disgust following brain injury.

Session B: Biochemistry Lecture Theatre

9.00 Mark R Cole (Huron College, Univ of Western Ontario)
Performance as a function of number and spatial arrangement of food locations on a large radial maze

Symposium: Spatial cognition in animals **Organiser:** Ron Weisman

9.20 Marcia Spetch (Univ of Alberta)
Visual scene analysis in pigeons

9.40 Sue Healy and Robert Biegler (Univ of Edinburgh)
Seasonality and spatial memory in birds.

10.00 Ken Cheng (Macquarie Univ, Australia)
Place finding in insects: Stereotypical servomechanisms

10.20 Leslie Phillmore, Chris Sturdy and Ron Weisman (Queen's Univ)
Auditory distance perception in black-capped chickadees

Session C: Geography Small Lecture Theatre

Vision

9.00 D C Donderi (McGill Univ, Montreal)
A practical metric for the complexity of graphic displays

9.20 Frederick A A Kingdom and Anthony Hayes (McGill Vision Research Unit, McGill Univ)
Mechanisms for detecting texture gradients

9.40 Kathy T Mullen, Tatsuya Yoshizawa, Curtis L Baker (Dept of Ophthalmology, McGill Univ)
Motion of drifting "isoluminant" chromatic gratings is mediated by a luminance mechanism

10.00 Andrew M Derrington, Amanda Parker and Greg G Goodson (Univ of Nottingham)
A colour concept in male marmoset monkeys

10.20 Robert F Hess, Tim Ledgeway and Steven Dakin (McGill Vision Research, McGill Univ and Dept of Visual Science Univ of London)
Impoverished second-order input to global linking in human vision

10.40 COFFEE

Saturday 22 July, 11.20-1.00

Session A: Physiology Lecture Theatre III

Symposium: Neuropsychology of human long-term spatial memory **Organisers:** R G Morris and A R Mayes

11.20 R G Morris, C Worsely, H Spiers, C E Polkey and M Recce (Insts of Psychiatry and Cognitive Neuroscience, Univ College London; Academic Neurosurgery Unit, The King's Neuroscience Centre and New Jersey Inst of Technology, Newark, USA)
Path integration following unilateral temporal lobectomy

11.40 H J Spiers, N Burgess, E A Maguire, S A Baxendale, T Hartley and J O'Keefe (Inst of Cognitive Neuroscience, Univ College London, Wellcome Dept of Cognitive Neurology, Inst of Neurology, Univ College London and National Hospital for Neurology and Neurosurgery, London)
The temporal lobes, navigation and memory in large-scale virtual space

12.00 S Abrahams, R G Morris, C E Polkey and A Pickering (Inst of Psychiatry; Academic Neurosurgery Unit, The King's Neuroscience Centre and St. George's Hospital Medical School, London)
Spatial memory and the hippocampal region: A structural MRI analysis of patients with unilateral mesial temporal lobe sclerosis

12.20 J S Holdstock, A R Mayes, J P Aggleton and N Roberts (Univ of Liverpool, Dept of Clinical Neurology, Univ of Sheffield, Cardiff Univ and Magnetic Resonance and Image Analysis Research Centre, Univ of Liverpool)
Spatial memory dissociations following lesions to the hippocampus and other medial temporal lobe regions

12.40 S Köhler, B Milner and J Crane (Montreal Neurological Inst, McGill Univ, Canada)
Right medial-temporal contributions to human episodic memory for object location and object identity in visual scenes: Evidence from functional neuroimaging

Session B: Biochemistry Lecture Theatre

Language, speech and reading

11.20 Antje S Meyer, Ardi Roelofs, and Pim Levelt (Univ of Birmingham and Max Planck Inst for Psycholinguistics, Nijmegen, Netherlands)
Where is the word length effect? Right here! A reply to Bachaud-Levi et al. (1998).

11.40 Ilhan Raman, Bahman Baluch and Derek Besner (Middlesex Univ and Univ of Waterloo)
A critical test of the changing routes versus changing deadlines debate in print to sound translation

12.00 Thomas M Spalek. and Steve Joordens (Univ of Toronto)
Instantiating counter-intuitive frequency effects within a distributed memory model of naming

12.20 Jamie I D Campbell and Vanessa Hernberg (Univ of Saskatchewan)
Repetition blindness for words but not non-words

12.40 Colin M MacLeod (Univ of Toronto at Scarborough)
Putting automaticity in context: Reducing the stroop effect

Session C: Geography Small Lecture Theatre

Visual and face processing

11.20 Richard Latto, Douglas Brain and Brian Kelly (Univ of Liverpool)

An oblique effect in aesthetics: Homage to Mondrian (1872-1944)

11.40 Mike J Dixon, Daniel Smilek, Cera Cudahy and Philip M Merikle (Univ of Waterloo)
Five plus two equals yellow: Concept-driven photisms in digit - colour synaesthesia

12.00 K Lander and V Bruce (Univ of Stirling)
Repetition priming for moving faces.

12.20 Vicki Bruce and Zoe Henderson (Univ of Stirling)
Getting to know you...how we learn new faces

12.40 P A McMullen, P Dunham, and F Dunham (Dalhousie Univ, Halifax)
Individual differences in the development of face recognition: Support for a maturational change at age eight

1.00 BBCS Business meeting part 2 (Biochem Lecture Theatre)

1.00 LUNCH

Saturday 22 July, 2.00-4.00

Session A: Physiology Lecture Theatre III

Language II

2.00 Andy Ellis, Antonina Scarna, Josephine Monaghan and Matt Lambon Ralph (Univ of York and MRC Cognition and Brain Sciences Unit, Cambridge)
Correlation, consistency, and age of acquisition effects in adult lexical processing

2.20 Penny M Pexman and Stephen J Lupker (Presenter: Stephen J. Lupker) (Univ of Calgary and Univ of Western Ontario)
Homophone effects in lexical decision: An examination of a feedback account

2.40 Christina L Gagne (Univ of Western Ontario)

Lexical and relation-based influences on the interpretation of noun-noun phrases

3.00 Isabelle Gonthier, Alain Desrochers and Dominique Landry (Univ of Ottawa)

Phonological mediation in a semantic discrimination task: Evidence from French

3.20 William Marslen-Wilson and Mike Ford (MRC Cognition and Brain Sciences Unit, Cambridge)

Separating form and semantics from morphology: Evidence from cross modal masked priming

3.40 Helen Bird, Matthew A Lambon Ralph, Karalyn Patterson and John R Hodges (MRC Cognition and Brain Sciences Unit and Univ Neurology Unit, Addenbrooke's Hospital, Cambridge)

The rise and fall of frequency and imageability: Noun and verb production in semantic dementia

Session B: Biochemistry Lecture Theatre

Memory

2.00 Peter E Morris and Catherine O Fritz (Lancaster Univ and Bolton Inst)

The Name Game: Using retrieval practice to learn the names of group members

2.20 Marty W Niewiadomski and William E Hockley (Presenter: William E. Hockley) (Wilfrid Laurier Univ)

Interrupting recognition memory: Tests of the increment-to-familiarity account of the revelation effect

2.40 D J K Mewhort and E E Johns (Queen's Univ)

Feature frequency in recognition from short-term memory: A challenge for current theory

3.00 Philip A Higham (Univ of Northern BC)

Estimating monitoring, bias and retrieval

3.20 C A G Hayman, J Fugelsang, J Cofell and R P Cribbie (Lakehead Univ, Univ of Saskatchewan, Univ of Western Ontario and Univ of Manitoba)

The role of source memory in setting the criteria for signal decision processes

3.40 Bruce W A Whittlesea and John R Price (Simon Fraser Univ)

Implicit/explicit memory versus analytic/nonanalytic processing: Re-thinking the mere exposure effect

Session C: Geography Small Lecture Theatre

Animal learning and behaviour

2.00 V Simonds and C M S Plowright (Univ of Ottawa)

Unlearned and learned behaviour of bumble bees in the absence of reward

2.20 David N George and John M Pearce (Cardiff Univ)

The discrimination of structure

2.40 Bob Boakes and Paul Whitfield (Univ of Sydney, Australia)

Losing a conditioned aversion to a taste: Extinction or counter-conditioning?

3.00 Cheryl L Limebeer and Linda A Parker (Wilfrid Laurier Univ)

The anti-emetic drug, ondansetron, interferes with lithium-induced conditioned rejection reactions, but not lithium-induced taste avoidance

3.20 Jennifer A Mather (Dept of Psychology & Neuroscience, Univ of Lethbridge)

Do squid make a visual language on their skin? The case of the Zebra display

3.40 Peter J McLeod, Simon Gadbois and Will Moger (Acadia Univ, Nova Scotia)

The relation between stress and the social organization of wolves and other wild canids

4.00 END OF MEETING

2000 - July 20/22 University of Cambridge Talk Abstracts

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Wednesday July 19, 6pm

The Hebb Award Lecture

Making sense of humours

Jane Stewart

Concordia University

In the study of motivation and emotion, body 'humours' have long played an explanatory role. This talk will be concerned with how our concepts of 'humours' have evolved. Using examples from recent behavioral studies I will discuss how modern knowledge of the effects of the ever increasing numbers of 'humours' and their modes of influence is increasing our understanding of how motivational states are induced, about the role of learning in motivation and about how state variables alter behavior.

Session A - Thursday 20 July 9-10.40 am

Symposium: "Role of knowledge, logic & normative standards in human inference"

Organiser: Valerie Thompson

The role of suppositions in the development of children's reasoning

Simon Handley and Joanna Lott

University of Plymouth

This paper reports the results of two experiments that examined the development of conditional reasoning in six age groups (7,9,11,13,15,17 and adult). Rule-based theories of deduction provide detailed accounts of the developmental stages in conditional reasoning. These theories predict a reduction in Modus Tollens (MT) reasoning in mid to late adolescence as children begin to resist invited inferences but do not possess competence in applying the indirect suppositional strategies necessary to solve MT. However, the evidence for this trend in MT reasoning is equivocal and depends to a great extent on the method of problem presentation. In Experiment 1 we presented conditional syllogisms to six age groups, carefully controlling the presentation of the problems. The results showed a general increase in reasoning competence with age, a reduction in fallacies amongst the older age groups and a significant reduction in MT reasoning at 17 years of age. In Experiment 2 we used the negations paradigm, with conclusions to be evaluated that were either consistent or inconsistent with the logical conclusion. Two notable effects emerged an increase in negative conclusion bias with age and higher rates of MT reasoning amongst the older age groups on those problems in which the inconsistent conclusion was presented. We interpret these findings as resulting from the development of the same underlying competence; the ability to engage in suppositional reasoning. The implications of the findings are discussed in the context of rule-based and model-based theories of human reasoning.

Probabilities and polarity biases in conditional inference

Mike Oaksford¹, Nick Chater² and Joanne Larkin²

1. Cardiff University

2. University of Warwick

A probabilistic computational level model of conditional inference is proposed that can explain polarity biases in conditional inference (e.g., J. St.B. T. Evans, 1993). These biases are observed when J. St.B. T. Evans' (1972) negations paradigm is used in the conditional inference task. The model assumes that negations define higher probability categories than their affirmative counterparts (M. Oaksford & K. Stenning, 1992), e.g., $P(\text{not-dog}) > P(\text{dog})$. This identification suggests that polarity biases are really a rational effect of high probability categories. Three experiments revealed that, consistent with this probabilistic account, when high probability categories are used instead of negations a high probability conclusion effect is observed. In the General Discussion the relationships between the probabilistic model and (i) other phenomena and (ii) other theories, in conditional reasoning are discussed.

Paradoxical individual differences in conditional inference

Jo Sellen and Mike Oaksford

Cardiff University

Paradoxical individual differences, where a dysfunctional trait correlates positively with some preconceived notion of the normatively correct answer, provide compelling evidence that the wrong norm has been adopted. We report a result showing that logical performance on conditional inference is positively correlated with schizotypy. Schizotypy is strongly negatively correlated with IQ. Therefore following Stanovich and West's (in press) reasoning, logic may not be normative in conditional inference, the prototypically logical task. This is consistent with recent models of conditional that take a probabilistic rather than a logical approach (Oaksford, Chater & Larkin, 2000).

Knowledge-based reasoning about causes and consequences

Jonathan Fugelsang and Valerie Thompson

University of Saskatchewan

When evaluating causal candidates, peoples' judgments may be influenced by both the observed empirical evidence (e.g., Cheng, 1997), and the belief in a causal mechanism (e.g., White, 1989). Fugelsang and Thompson (2000) presented a series of experiments which demonstrated that people weigh empirical evidence in light of their pre-existing beliefs, such that empirical evidence is given more weight for believable than for unbelievable candidates. The goal of the current experiments was to determine what elements of a reasoner's beliefs produces this interaction. The results of two experiments demonstrated that it is the belief in a causal mechanism, rather than the belief that the cause and effect covary, that determines the use of empirical evidence.

Background beliefs about the probability of the evidence in hypothesis testing

Aidan Feeney¹ and Jonathan Evans²

1. University of Durham

2. University of Plymouth

Previous work (Feeney, Evans and Clibbens, 1997; in press) has demonstrated that people's background beliefs about the probability of the evidence affect both their selection and interpretation of evidence on the pseudodiagnosticity task. I will present the results of two experiments designed to investigate the processes underlying such probabilistic effects. Although both experiments replicate the background belief effect in evidence selection, they also demonstrate that hypothesis testers are inflexible in the face of explicit statistical and implicit contextual manipulations of the likely information to be gained from selecting evidence with low a priori probability. It will be argued that these results suggest the operation of a rarity heuristic in hypothesis testing whilst possible adaptive functions for such a heuristic will also be discussed.

Session B - Thursday 20 July 9-10.40 am

Symposium: "It's about time"

Organiser: Simon Grondin

The time of my life

Lorraine Allan

McMaster University

Allan and Kristofferson (1974) concluded that "There are few quantitative theories of duration discrimination and few established empirical phenomena to guide theorizing." (p. 26). Five years later, Allan (1979), referring back to Allan and Kristofferson (1974), stated that "Since that time, there has been a dramatic change. Many articles on the discrimination of brief temporal intervals, and several new quantitative models, have appeared in a period of a few years." (p. 340). At BBCS/EPS 2000, it will be two decades since Allan (1979). We now have an abundance of sophisticated quantitative models for time perception and a wealth of intriguing empirical data. My contribution to the ITS ABOUT TIME symposium will be a personally-oriented tour through the psychophysical timing literature of the past two decades.

Temporal discrimination and temporal differentiation of behaviour: Evidence for distinct neural mechanisms

C M Bradshaw, M-Y Ho, T-J Chiang, S Mobini and E Szabadi

Psychopharmacology Section, Division of Psychiatry, University of Nottingham

Schedules used to assess timing in animals include 'retrospective timing schedules', in which animals are trained to emit different responses following stimuli of different durations (temporal discrimination), and 'immediate timing schedules', in which behaviour is regulated during an ongoing interval (temporal differentiation). Observations that the phenomena of timing behaviour are similar in these two types of schedule

have encouraged the belief that (a) a common timing mechanism underlies temporal discrimination and temporal differentiation, and (b) quantitative indices of timing derived from either type of schedule may be used interchangeably to investigate the properties of this mechanism. However, these assumptions are challenged by evidence that neurobiological interventions can selectively alter timing indices in some schedules but not others. This paper discusses evidence from experiments in which central monoaminergic functions were manipulated by acute drug treatment and lesions; it is proposed that the findings are inconsistent with the concept of a unitary pacemaker-driven internal clock.

It's about time making sense, or perhaps about senses making time

Simon Grondin

Université Laval, Québec

Time judgments are often reported to be based on the output of a central clock. Such a view assumes that for whatever sensory-modality condition under investigation, sensory signals are temporally linked by the product of this central source of time. In this case, time in itself contributes to the making of the sensory organization. On the other hand, psychological time can be approached as an emergent property of the organization between sensory events within any given sensory modality. That is to say, the senses are what make time. Studies stemming from the clock perspective and involving sensory modality comparisons for duration discrimination are briefly reviewed. As well, the implications of adopting a "sense-making-time" approach are presented for one case, that of visual modality.

DMTS as JOR

Peter R Killeen

Arizona State University, USA

Forgetting curves in delayed matching-to-sample (DMTS) experiments are too steep to be credible evidence for rapid forgetting of stimuli that are so very-well known. Instead, animals are deciding whether the remembered stimulus occurred on this trial or on the previous one. This is judgement of recency (JOR). Several models of temporal confusion are reviewed; the simplest, scalar timing, makes parameter-free predictions that approximate DMTS data over various manipulations.

Infernal machines! Exploring internal clocks and other timing processes

J H Wearden

Manchester University

A persistent problem in understanding how the hypothetical internal clock underlying interval timing in humans might work is that the clock is usually supposed to be only the "front-end" of a complex timing system involving memory and decision processes in addition to the clock, where behaviour observed depends on the operation of the whole system. Two complementary approaches to research in this area are (i) to try to "isolate" parts of the system (e.g. the clock) leaving everything else intact, and (ii) to study the way in which the behaviour of the whole system varies across conditions. This paper illustrates both approaches using data from very recent work conducted at Manchester. Firstly,

attempts were made to alter clock processes alone by experiments which exploited (a) arousal manipulations and (b) modality effects, including effects of irrelevant stimuli. Secondly, a large-scale study of individual differences in timing behaviour is reported, where nearly 100 subjects each performed on 7 different timing tasks. These were temporal generalization with short and long standards, verbal estimation, and threshold determination [stimulus timing]; production, reproduction, and internal tempo [motor timing]. Correlations between performance indices from the different tasks offer us some insight into the way that the clock/memory/decision structure of the proposed timing system behaves under different conditions.

Session A - Thursday 20 July 11.20-1 pm

Symposium: "Role of knowledge, logic & normative standards in human inference" (continued)

Warnings and inducements as argument

Valerie Thompson¹, Jonathan Evans² and Simon Handley²

1. University of Saskatchewan
2. University of Plymouth

In natural contexts, conditional statements are often used as part of an argument, wherein the conditional premise is used to invite a conclusion. This study examined inferences invited by conditional warnings and inducements. For example, a conditional warning of the form "if tuition fees are raised, then students will no longer be able to afford a university education", appears to invite the inference that "tuition fees should not be raised". Several paradigms were used to examine the suppositions that support the invited inference (i.e., that it is undesirable for students to be unable to afford university education), as well as the chain of logic that supports the invited inference (i.e., if p, then q; want not-q, therefore should not-p). Reasoners were asked a) which inferences followed, b) to generate rebuttals to the invited inference, and c) to evaluate rebuttals that were provided by the experimenter.

Alternatives, falsification, and mental models theory

Steven Newstead¹, Simon Handley¹ and Valerie Thompson²

1. University of Plymouth
2. University of Saskatchewan

In this experiment, we tested Mental Model Theory's assumption that reasoners construct alternative models of the premises in order to falsify putative conclusions. Participants completed a task designed to measure their ability to construct alternative representations of premises, as well as a syllogistic reasoning task. For the latter task, reasoners were asked to evaluate four types of conclusions: valid conclusions, highly accessible but invalid conclusions (i.e., those that are likely to be considered first as putative conclusions), inaccessible conclusions (i.e., those that are unlikely to be considered as possible conclusions), and impossible conclusions. Reasoners who scored well on the alternative representations task were more likely: a) to correctly accept valid inferences, b) to correctly reject the highly accessible, but invalid

conclusions, and c) to correctly identify the inaccessible conclusions as being consistent with the premises. These findings are consistent with the assumption that falsify putative conclusions by searching for alternative representations of the premises.

(End of symposium)

The p-value fallacy: Why inferential statistics don't describe results

Peter Dixon

University of Alberta

The methods of statistical inference were originally proposed as a mechanical procedure for drawing conclusions from data, but they are rarely used in that way. Instead, inferential statistics are typically used to describe results and how well they match different possible interpretations; scientists draw their own conclusions. This mismatch of methods and goals underlies many of the well-known logical fallacies and interpretive problems in the standard hypothesis testing framework. A better approach is simply to articulate those different possible interpretations and then to describe the match of those interpretations to the data using likelihood ratios. Such an approach provides, in a direct and intuitive form, precisely the information that is conveyed by p values, but without the distracting and problematic rhetoric involved in testing null hypotheses.

Dual task co-ordination versus task difficulty: Evidence from Alzheimer patients and healthy adults

R H Logie¹, S Della Sala¹, G Cocchini¹ and A D Baddeley²

1. University of Aberdeen

2. University of Bristol

The ability of human beings to perform more than one thing at a time has long been a focus of study in the literature on human attention and on memory. However there is a continuing debate as to how the co-ordination of multiple tasks is accomplished, what kind of cognitive functions might be involved, and what determines success or failure in multiple task performance. Experiment 1 demonstrated that AD/pts, healthy elderly and young showed decrements in dual task performance even when each task constituted a very light cognitive load for the individual, but with much larger decrements shown for the patients. However patients were no more sensitive to increased task demand on single tasks than were healthy participants. These results might have arisen from the use of a memory task (span) together with a perceptuo-motor task (tracking). In Experiment 2, healthy adults performed either two memory tasks (visual pattern span and digit span), or a combination of each memory task with tracking. The largest dual task decrement was observed when visual pattern span was combined with tracking. The overall pattern is consistent with a multiple component working memory model, and an identifiable cognitive resource for dual task co-ordination that is insensitive to task difficulty.

A longitudinal study revealing age-related stability in dual-task performance

Margaret Crossley

University of Saskatchewan

Of 92 original participants in a dual-task study of normal aging, 40 were retested in 5-year and 10-year follow-up studies. Of these, 36 remained "healthy" and formed final samples of young ($n = 9$), middle-aged ($n = 11$), and older ($n = 16$) participants, with average ages of 40.6 (SD = 5.3), 63.1 (SD = 7.4) and 79.3 (SD = 4.6) years, respectively. At each study period, participants completed neuropsychological tests of memory and attention, and a dual-task study combining speeded finger-tapping with either "easy" (speech repetition) or "difficult" (letter generation verbal fluency) speaking tasks. Although the expected age group differences were evident, tests of memory remained remarkably stable across 10 years for the three age groups, while performance on measures of speeded visual attention declined for all of these healthy participants. Experimental data were analyzed in repeated measures ANOVA, with Age Group as the between- group measure and Study Period (original, 5-year, 10-year) and Task Difficulty ("easy" versus "difficult" speech tasks) as within group repeated measures. Single-task performance of speeded finger-tapping, speech repetition, and speech fluency declined across the 10-year study period for all age groups, and significant Study Period X Age Group interactions reflected greater loss across time for the older groups. As expected, interference during dual-task tapping (controlling for single-task performance) was greater for the oldest group at each test period, and was greater while concurrently performing the "difficult" speaking task compared to the "easy" speaking task. In contrast to expectations, interference did not increase across Study Period, and Age Group did not interact with Study Period or with Task Difficulty. These results suggest that speed of processing, but not attentional capacity, declines with age, at least as measured by these dual task data collected from healthy participants over a 10 year study period.

Session B - - Thursday 20 July 11.20-1 pm

Stimulus modality and the perception of empty time intervals in pigeons

Angelo Santi, Lori Ross and Andrew Miki

Wilfrid Laurier University, Ontario

Pigeons were trained to discriminate the duration (2 or 8 s) of an empty interval separated by two tone markers or by two light markers. Psychophysical testing indicated less sensitivity to empty intervals signalled by tone than by light. Pigeons judged the intervals marked by light to be longer than the same interval marked by tone. Training and psychophysical testing was carried out with empty intervals at target durations of 1 and 4 s, or 4 and 16 s. Pigeons continued to judge intervals marked by light to be longer than the same intervals marked by tone. The difference in the point of subjective equality for light and tone marked intervals was not constant across the different target duration sets. This suggests that the modality difference in the timing of empty intervals is not due to a difference in the latency to initiate timing.

Symposium: "Development of motion perception"

Organiser: Terri L Lewis

Processing of motion information in the primate cerebral cortex.

J Anthony Movshon

Howard Hughes Medical Institute at New York University, USA

A small group of areas in the primate cerebral cortex seems to be specialized for the processing of information about visual motion. Starting with signals from motion-sensitive cells in primary visual cortex, these areas contain a concentration of cells sensitive to motion. Motion-sensitive cells in V1 are primarily concerned with the representation of local first-order motion; this information is progressively elaborated by neurons in areas MT and MST into representations of global motion and optic flow. The outputs of MT and MST provide signals to areas responsible for perceptual judgements of motion and for the initiation of behavior dependent on motion information, such as pursuit eye movement.

While such key basic properties as directional selectivity appear very early in postnatal development and can be disrupted by some forms of visual deprivation, the maturation and sensitivity to environmental manipulation of more complex stages of motion analysis are not well understood at the neurophysiological level.

Interacting motion processing mechanisms in the developing infant.

Oliver Braddick, John Wattam-Bell, Alexandra Mason and Janette Atkinson

Visual Development Unit, University College London

We find no evidence from preferential looking (PL) of directionally selective processing before 7 weeks of age. However, directional mechanisms must underlie the newborn's optokinetic nystagmus (OKN) response. Parallel measurements of motion coherence thresholds, using OKN and PL, show that the two responses differ greatly in developmental course and sensitivity between 8-25 weeks of age.

These results are consistent with a model in which PL reveals the development of cortical motion processing, while neonatal OKN depends on a subcortical circuit, whose signature is temporal/nasal asymmetry in monocular OKN. Developmental changes in children with extensive unilateral lesions show that this initial subcortical asymmetry is modified by cortical-subcortical interactions.

Asymmetries also appear in evoked-potential (VEP) and PL responses. We find that the PL asymmetry follows the OKN asymmetry, while the VEP asymmetry is opposite. These relationships will only be understood in terms of developmental interactions between cortical motion processing and oculomotor mechanisms.

What does blindsight tell us about the functional architecture of motion perception?

Paul Azzopardi¹, Mazyar Fallah², Charles Gross², Hillary Rodman³ and Alan Cowey¹

1. University of Oxford

2. Princeton University, USA

3. Psychology Department and Yerkes RPRC, Emory University, USA

Patients rendered clinically blind as a result of striate cortex damage may nevertheless be able to discriminate stimuli presented in their field defects when forced-choice procedures are used. But there are conflicting reports as to whether or not the ability to discriminate motion is preserved. We recorded the responses to moving stimuli of neurons in areas MT and MST of monkeys with long-standing unilateral striate cortex lesions. Many neurons responded to the presence of movement in the scotoma, and some could discriminate the direction of single bars, but none could discriminate the direction of motion in random dot kinetograms depicting translation or motion-in-depth. Subsequently, we tested the ability of cortically-blind patients to discriminate the same stimuli, with the same results. Direction discrimination in the scotoma seems to be based solely on change in position, implying that motion processing per se is abolished. Blindsight therefore provides no evidence to support the proposed existence of a subcortical pathway to extrastriate cortex which bypasses striate cortex and which is specialised for analysing "fast" motion.

The perception of local and global motion after early pattern deprivation in humans.

Terri L Lewis^{1,2,3}, Dave Ellemberg², Daphne Maurer^{1,2}, Nancy Defina² and Henry P Brent^{1,3}

1. The Hospital for Sick Children, Toronto
2. McMaster University
3. University of Toronto

We assessed the perception of local and global motion in patients who had been deprived of early visual experience by dense central cataracts. Despite years of visual experience after treatment, patients showed deficits on both tasks. Like our previous findings for contrast sensitivity, the deficits in sensitivity to local motion were comparable after either monocular deprivation (n = 10) or binocular deprivation (n = 9). Surprisingly, for global motion tested with random-dot kinematograms, coherence thresholds were nearly normal (M = 8.5%, n = 24) after monocular deprivation (M = 14%, n = 14) and significantly worse after binocular deprivation (M = 44%, n = 8). The unexpectedly good results after monocular deprivation suggest that normal input to only one eye reduces the deleterious effects of deprivation on the higher cortical areas involved in the perception of global motion. Thus, after monocular deprivation, competitive interactions occurring in the primary visual cortex may give way to collaborative interactions at higher neural centres enabling a relative sparing of at least some visual functions.

(End of symposium)

Session A - Thursday 20 July 2-4.20 pm

Temporal jitter disrupts speech intelligibility: Simulations of auditory aging

M. Kathleen Pichora-Fuller¹, Bruce Schneider² and Hollis Pass¹

1. University of British Columbia
2. University of Toronto

Auditory temporal processing declines in aging adults may partially account for their difficulty understanding speech. To mimic such age-related declines, sentences were temporally jittered. Intact and jittered sentences were presented in babble to young listeners. For the signal $x(t)$, the internal representation $y(t)$ is modeled as a time-delayed version with delay d varying over time as $y(t)=x[t-d(t)]$. The first factor is the range of delays, modeled as the RMS of a band-limited noise. The second factor is rate of change of delays, modeled as the bandpass of a noise. Word recognition was unchanged when the second factor dominated (RMS = .05 ms, BW = 500 Hz), reduced slightly (10%) when the first dominated (RMS = .25 ms, BW = 100 Hz), and reduced greatly (50%) when both contributed (RMS = .25 ms, BW = 500 Hz). This is a first attempt to simulate temporal aspects of auditory aging.

Symposium: "Cognitive aging"

Organisers: Patrick Rabbitt and Fergus Craik

Age slows, and so sometimes obliterates consciousness of events.

Patrick Rabbitt

University of Toronto

After people make errors during simple continuous tasks they recognise them at some level because their sequent responses are slowed. People can correct nearly all of the errors that they make during simple continuous tasks by making the response that they should have made. Old age does not affect the efficiency of either of these forms of error detection and correction. However when people are asked to signal their errors by immediately making some other response they do so slowly and inaccurately, and the older they are the fewer responses they signal. When probed, they do not recall making errors. Nevertheless, even those errors that are not signalled are invariably followed by slow responses to sequent events. It seems that events that are not overtly acknowledged are still registered, but not remembered. Increasing the intervals between successive signals and responses improves performance, so that when these are as long as 2 sec error signalling is as efficient as error correction. The age difference in efficiency of error signalling disappears. We suggest that this means that simple events have successive, perhaps independent, representations which become serially available in time. During a fast paced task attention to new signals and responses prevents attention to later arriving representations. Because all cognitive processes are slowed by age older people need more time to become conscious that they have made an error and to do something about it. Self-monitoring, even in simple tasks, is slowed by age, and thus becomes more vulnerable to the pace of events.

Aging and visual marking: Selective deficits for moving stimuli.

Elizabeth A Maylor and Derrick G Watson

University of Warwick

Previous research has shown that new visual information can be selectively prioritized by the top-down inhibition of old stimuli already in the visual field (visual marking; Watson & Humphreys, 1997). Moreover, the method of visual marking depends upon the properties of the old

items such as their motion and the extent to which they can be grouped. We present three experiments to assess the effects of aging on visual marking. Experiment 1 examined performance with stationary items; Experiments 2 and 3 used moving stimuli. The results showed that visual marking was relatively unimpaired by aging for stationary stimuli. In contrast, there were age-related deficits in visual marking for moving stimuli, particularly when there was no feature difference between the old and new items. These differential effects of aging provide support for the deployment of different methods of visual marking depending upon the properties of the old (to-be-ignored) items.

Watson, D. G., & Humphreys, G. W. (1997). Visual marking: Prioritizing selection for new objects by top-down attentional inhibition of old objects. *Psychological Review*, 104, 90-122.

Adult-age differences in memory performance: Tests of an associative deficit hypothesis

Moshe Naveh-Benjamin

Ben-Gurion University of the Negev, Israel

An associative hypothesis to explain and predict older adults' deficient explicit episodic memory performance is outlined and tested. The hypothesis attributes a substantial part of older adults' deficient memory performance to their difficulty in merging unrelated attributes-units of an episode into a cohesive unit. While each of the components can be memorized to a reasonable degree, the associations which tie the attributes-units to each other grow weaker in old age. Four experiments are reported which provide: a) a converging validity to the hypothesis by demonstrating this associative deficit for both inter-item relationships and intra-item relationships, and b) a discriminant validity to the hypothesis, by contrasting and testing competing predictions made by the associative hypothesis and by alternative hypotheses. The implications of these results to older adults' episodic memory performance are discussed.

Retrieval induced forgetting in normal aging.

Tim Perfect¹, Chris Moulin² and Martin Conway³

1. University of Plymouth

2. University of Reading

3. University of Bristol

In the field of cognitive aging it has been suggested that the cognitive deficits experienced by older adults stem from a general deficit in inhibitory function. In memory research, the retrieval-induced-forgetting paradigm has been used to isolate inhibitory processes that occur during retrieval. In a series of studies we examine whether there are age-related reductions in inhibition during memory retrieval. Younger and older adults were tested on a series of explicit and implicit tasks using the retrieval induced forgetting paradigm. None of the studies provide evidence in support of our predictions. These data suggest either that inhibitory effects are universal across the age range, or inhibitory mechanisms are not involved in retrieval. These two possibilities will be discussed.

Adult aging and planning ability

Louise Phillips and Mairi MacLeod

Aberdeen University

The formulation and execution of efficient plans is dependent upon the prefrontal cortex of the brain. Normal adult aging causes changes in the structure and function of the frontal lobes, but relatively little is known of the nature of age effects on planning. The current experiment looked at the effects of aging on a multistage task of party organisation in 96 participants aged between 16 and 79. Older participants showed poorer planning, and tended to make more rule breaks such as trying to buy items with insufficient funds. There were no age effects on other types of error, such as interpretation failures or inefficiencies of task allocation. A qualitatively different pattern of errors was seen in young and older groups. These results can be contrasted with the pattern of age differences on a series of other tasks of planning (the Tower of London task, Multiple Errands test, and subtests from the Behavioural Assessment of Dysexecutive Syndrome). Overall, the results suggest that the nature and extent of age differences in planning vary considerably depending on such factors as: memory load, perceived importance of rules in the task, and planning complexity

(End of symposium)

Session B - Thursday 20 July 2-4.20 pm

Auditory attentional blink in the presence or absence of filler items

Sébastien Tremblay and Dylan M Jones

Cardiff University

Identification of the second of two targets in a rapidly presented sequence of stimuli is often incorrect when it falls within about 500 ms of the first target. Although the phenomenon of attentional blink (AB) is well-established in the visual modality, some claim that there is no AB for auditory sequences (Potter, Chun, Banks & Muckenhoupt, 1998) while others report a robust auditory AB (Arnell & Jolicoeur, 1999; Duncan, Ward & Shapiro, 1994). The present study provides more evidence that there is an effect of AB in the auditory modality. There was a significant deficit in target two report accuracy but it diminished as a function of the temporal lag between the two targets. The magnitude of the auditory AB was greater when there were filler items in between the targets but even in the absence of fillers the AB was significant. The auditory AB reported here was not due to task switching deficit as the same discrimination task applied for both targets.

Attention, occlusion, and previous experience

Jay Pratt and Allison B Sekuler

University of Toronto

There is considerable evidence indicating that cueing a specific portion of an object results in the entire object being attended to. One goal of

the present study was to determine whether attentional cueing effects act on objects defined only in terms of occlusion cues. The second goal was to determine whether previous experience with an object could halt perceptual (i.e., amodal) completion. In Experiment 1, two parallel rectangles were initially displayed and then the middle portions of these objects were occluded. Attentional cueing effects were found for both discrete portions of the completed rectangles. In Experiment 2, four discrete objects were initially displayed, followed by the same occluder used in the first experiment. The appearance of the occluder allowed the four discrete objects to be completed into two rectangles. Attentional cueing effects were found for the completed rectangles, indicating that previous experience may not be sufficient to halt the amodal completion of objects.

Spatial modulation of intramodal and crossmodal temporal processing deficits

S Soto-Faraco^{1,2}, C Spence², A Kingstone¹ and J Duncan³

1. University of British Columbia

2. University of Oxford

3. MRC Cognition and Brain Sciences Unit, Cambridge

The attentional blink (AB) and repetition blindness (RB) effects both reflect costs in the processing of the second of two targets presented in a rapid sequence. The AB is a decrease in detection or identification accuracy on any target following the selection of a previous stimulus in a time window of 200 ms and 500 ms. The time course of AB often takes the form of a u-shaped function (produced by the so called lag-1 sparing). The RB reflects the cost in processing the second of two identical targets and its time course is linear (accuracy is inversely proportional to the temporal separation between targets). Although these two temporal processing deficits are similar in many ways, Chun (1997) demonstrated that they could be dissociated in terms of their differential sensitivity to target-distractor and inter-target similarity. We report a series of experiments in which we attempted to dissociate these effects in terms of their sensitivity to spatial uncertainty, and spatial displacement of the target stimuli. Pairs of targets (either the same or different) were presented from the same or different spatial locations in the same or different modalities. We found both visual and auditory AB and RB effects. Additionally we show that temporal processing deficits are modulated by spatial displacement between target stimuli.

Is perception, attention or action inhibited following spatial reorienting?

Raymond Klein, Bruce Dick, Jason Ivanoff and Tracy Taylor

Dalhousie University, Halifax

Immediately following a peripheral event there is a facilitation for the processing of nearby events. When shifts of gaze are not made this is said to reflect exogenous orienting of attention toward the source of stimulation. After attention is removed from such a source, there is impaired processing of subsequent, nearby events. The name originally given to this processing impairment, inhibition of return (IOR), implies that it is caused by removal of attention from the cued location and that its effect is to discourage attention from reorienting to the originally

attended region of space. Despite this implication, whether perceptual, attentional or motor stages of processing are inhibited has been much debated. Recent evidence from our laboratory for effects of IOR on perception, attention and action will be used to illustrate the manifold nature of IOR.

A facilitatory effect does not contribute to the inhibition of return effect

Janice J Snyder¹, William C Schmidt² and Alan Kingstone³

1. University of Alberta
2. University at Buffalo, USA
3. University of British Columbia

It is well established that the "inhibition of return" (IOR) effect is found at a previously attended/cued location at long cue-target onset asynchronies. More recently, it has been reported (Pratt, Spalek, & Bradshaw, 1999) that in addition to the inhibitory effect at the cued location a co-occurring facilitatory effect occurs at the uncued location opposite to the attended/cued location. This finding led to the suggestion that facilitation at the uncued/opposite location may represent the primary component underlying IOR. In three experiments, we attempted to expand on these findings by defining the conditions necessary for observing the opposite facilitation effect. Our data revealed that unlike IOR, the opposite facilitation effect is fragile and weak, demonstrated by only a minority of subjects, and is statistically uncorrelated with the IOR effect. Together the data suggest that an opposite facilitation effect does not contribute significantly to the IOR effect.

Is task-set inhibition in set switching location specific?

Katherine Arbuthnott¹ and Todd Woodward²

1. University of Regina
2. University of British Columbia

Set-switching tasks are used to study executive control processes involved in shifting attention between different goals. Costs attributable to task-switching are greater for alternating switches (ABA) than for non-alternating switches (CBA), an effect that is observed for perceptual and semantic judgment tasks, with manual or verbal responses (Arbuthnott & Frank, 2000; Mayr & Keele, 2000). In these investigations, stimuli were presented at a consistent location and the relevant task for each trial was cued verbally. The present studies examined switch costs for alternating and non-alternating series when the tasks were cued by spatial location. When tasks were uniquely associated with widely separated locations, switch cost was greater than with verbal cues but additional task-alternation cost was not observed. This suggests that different processes may be involved when switching among goals that have distinct locations versus goals that must be completed at a single location.

Is egocentric space automatically encoded?

Sandra Pouliot and Sylvain Gagnon

University of Quebec

Parkin, Walter and Hunkin (1995) suggested that egocentric space is automatically encoded. Using the criteria defined by Hasher and Zacks (1979), Naveh-Benjamin (1988) demonstrated that spatial information encoding was not an automatic process. However his spatial memory task probably emphasized encoding of allocentric space. In the present study, we tested Parkin et al's hypothesis using a task that was specifically designed to assess encoding of egocentric space. Five studies analyzing the effects of intent of memorization, dual task interference, old age, practice and individual differences were carried out using a computerized egocentric spatial memory task. Results show that old age and dual task interference impair egocentric spatial memory. However intent of memorization, practice and individual differences did not influence performance. The findings demonstrate that encoding of egocentric space is not a pure automatic process and therefore requires some cognitive effort.

Session A – Friday 21 July 9-10.20 am

Symposium: "Neuroimaging of memory"

Organiser: Roberto Cabeza

The role of the left prefrontal cortex in encoding of episodic memory

Paul Fletcher

Research Department of Psychiatry, University of Cambridge

A growing number of functional neuroimaging studies provide evidence for the importance of left prefrontal cortex (PFC) in episodic memory. The specific role of this region, however, remains unclear. Nevertheless, a number of characteristic features have emerged to suggest that the left PFC shows greater levels of activation when the encoding results in subsequent successful retrieval and when encoding occurs in association with a task which emphasises the semantic processing of studied material. With regard to the involvement in semantic processing demands, three related views have been described. It has been suggested that the left PFC activation reflects (i) the generation of semantic attributes of study material, (ii) the holding of those semantic attributes in working memory and (iii) the selection from among different semantic attributes. Distinguishing between these possibilities is difficult but it is suggested that a number of recent studies favour the latter interpretation. These studies will be reviewed.

Involvement of prefrontal regions on episodic memory retrieval: Mode, success, effort, and GRAM

Roberto Cabeza

University of Alberta

One approach to investigate the role of the prefrontal cortex (PFC) in episodic memory retrieval is to determine whether PFC activity remains constant (retrieval mode), increases (retrieval success), or decreases (retrieval effort) as a function of recovery. In an event-related fMRI study, we associated bilateral dorsolateral PFC with retrieval success, and left ventrolateral PFC with retrieval effort. Left PFC activity during

episodic retrieval could reflect semantic processing. Since semantic processing is critical for the generation of candidate responses, left PFC activity should be more pronounced for recall, which requires generation, than for recognition, which does not. A PET study confirmed this prediction, and additionally revealed greater right PFC activity for recognition than for recall. To describe this pattern we propose a generate/recognize asymmetry model (GRAM): left PFC is differentially more involved in generation processes than is right PFC, whereas right PFC is differentially more involved in recognition processes than is left PFC.

The functional organisation of working memory processes within the lateral frontal cortex.

Adrian M Owen

MRC Cognition and Brain Sciences Unit, Cambridge

Evidence is now converging to suggest that, at the area level, working memory processes within the dorsolateral and ventrolateral frontal cortices are organized according to the type of processing required, rather than according to the nature (i.e. modality), of the information being processed, as has been widely assumed. In a recent study using fMRI, performance of visual spatial and visual non-spatial working memory tasks was shown to involve identical regions of the lateral prefrontal cortex when all factors unrelated to the type of stimulus material were appropriately controlled. Moreover, recent positron emission tomography studies have demonstrated that either, or both, the ventrolateral and dorsolateral frontal regions can be activated in spatial, visual or verbal working memory tasks, depending on the precise (non-modality specific) executive processes that are called upon by the task being performed. The results provide further evidence that the mid-dorsolateral and mid-ventrolateral frontal cortical areas make distinct functional contributions to memory and corresponds with a fractionation of working memory processes in psychological terms.

Age-related differences in brain activity during memory

Cheryl L Grady

Rotman Research Institute, University of Toronto

Neuroimaging experiments have shown that brain activity patterns in older adults during performance of cognitive tasks differ from those seen in younger adults, even if their ability to do the task is not markedly different. Older adults have activation in many of the same areas as do young adults, but also have greater activity in other brain regions, particularly in prefrontal cortex. Various interpretations could be made of this finding, including compensatory mechanisms, or lack of inhibitory processes. In order to distinguish among these possibilities we need to determine how these age-related changes in brain activity are related to behavior in old adults, e.g. whether increased activity in a specific brain region occurs when task performance is spared in an older group or whether increased activity is associated with better or worse performance on a specific task. Recent experiments that shed light on this issue will be reviewed.

(End of symposium)

Session B - Friday 21 July 9-10.20 am

The resource demands of semantic priming

Eric Richards and Jennifer Stolz

University of Waterloo

The resource demands of semantic priming were examined in a series of experiments using a modified dual task paradigm. A prime word preceded a target stimulus, which was temporally paired with a tone. Participants were required to categorize the pitch of the tone prior to making a decision about the target stimulus (i.e., semantic classification or lexical decision). Using the logic that the resources required to process the target would limit those available for tone processing (Becker, 1976; Herdman & Dobbs, 1989), tone RTs were compared in related versus unrelated priming conditions to examine whether resource benefits are associated with semantic priming. The results are discussed in terms of the general theories of word recognition and the capacity constraints of attentional processing.

Binding action to a source: Evidence from Stroop priming

Bruce Milliken¹, Juan Lupianez², Karmen Bleile¹ and Jason Leboe¹

1. McMaster University

2. Universidad de Granada, Spain

Stroop interference is widely presumed to occur because of the predominance of word reading over colour naming processes. Consequently, priming of the color dimension might reasonably be predicted to reduce Stroop interference. In contrast to this prediction, we report the results of several experiments which demonstrate that priming of the color dimension speeds Stroop performance under some conditions, but slows Stroop performance under others. Attentional factors implicated in this processing flexibility are the focus of the experiments reported. The results are consistent with the view that priming introduces a source of influence on performance that can be difficult to discriminate from the normally fluent processing of the word dimension of Stroop stimuli.

Searching for threat

Jason Tipples¹, Andy Young¹, Philip Quinlan¹, Paul Broks² and Andy Ellis¹

1. University Of York

2. University Of Sheffield

In a series of experiments, a modified version of the visual search task was used to test the idea that biologically-relevant threat stimuli might capture visuo-spatial attention. In Experiment 1, no overall reaction time or search rate advantage was found for angry faces compared to happy faces. In Experiment 2, however, there was evidence for both faster detection and search rates for threatening animals, compared to plants. Examination of the basis of this effect in Experiment 3, showed that it was not due to threat per se, since a detection and search rate advantage was also found for pleasant animals compared to plants. In Experiment 4, participants searched for the plants, pleasant and threatening animals

used in Experiments 2 and 3, among a fixed heterogeneous selection of distractor items. There was no search rate or detection advantage for threatening animals compared to pleasant animals or plants. The same targets and distractors used in Experiment 4 were also used in Experiment 5. However, in Experiment 5, participants kept their eyes fixed on a central cross while searching for targets either close or distant from the fixation cross. There was no evidence for a 'threat' detection advantage either close or distant from the cross. We conclude that the visual search paradigm does not readily reveal any attentional biases that might exist for threatening stimuli.

Modulation of specific processes in task switching

Michael E J Masson, Daniel N Bub, and Todd S Woodward

University of Victoria

Task switching is typically assumed to involve executive control in coordinating the change in procedures as a function of change in task demands. A number of studies have examined general switch costs incurred in the performance of the second task as a consequence of having just carried out the first task. In contrast, we describe a process-specific influence of task switching on the performance of the first task. Considerable slowing is observed in the first task when that task shares specific operations with the second task. We have analyzed this phenomenon in the following situation: Task 1 requires reading aloud a word printed in black; Task 2 requires naming the color of a subsequent stimulus immediately following Task 1. On one block of trials, the stimulus in Task 2 is a row of colored asterisks and in another block it is a colored word. We find that word reading in Task 1 is substantially slowed when Task 2 involves colored words as opposed to colored asterisks. This effect does not obtain, however, when Task 1 requires a lexical decision rather than reading aloud, indicating that this modulatory effect is process specific.

Session C - Friday 21 July 9-10.20 am

Assessing inhibitory control in children and adults with a picture choice task

Sandra A Wiebe and James M Clark

Institute of Child Development, University of Minnesota, USA

Inhibitory control develops relatively late in childhood relative to other cognitive functions. Analysis of the development of inhibition would be facilitated by examining change in performance on one task across a wide age range. We have developed a task that is suitable for use with participants ranging from preschool-age to adulthood. Participants are presented with pairs of pictures and are asked to choose the picture that is related to a cue word on one of two dimensions (semantic or phonological). On half of the trials the incorrect picture choice is related to the cue word on the other dimension, and thus the choice of this response must be inhibited. Children show evidence of poor inhibitory control, making fewer correct responses on trials requiring inhibition. Adults successfully make the correct choice, but reaction times are lengthened when inhibition is required. These findings also have implications for our understanding of picture processing.

Intervention in early word learning: An experimental approach

Graham Schafer (Introduced by Professor D C Berry)

University of Reading

A lively debate in language development concerns the existence of stages in lexical learning. It is hypothesised that, before the attainment of certain 'principles', word learning is slow and effortful. As a corollary, infants' first words will be those most afforded by their immediate environment, and modification of the early lexicon (by intervention) will be difficult.

This study investigated modification of the early lexicon by parental intervention. Parents of nine-month-olds were given photographs of objects and animals, and were instructed to use these with their children, for 10 minutes per day, three times per week, in simple tasks (naming, matching, and sorting). After 12 weeks, infants' receptive comprehension was tested in a preferential looking task. Infants were instructed to look at images, which depicted novel exemplars of words from the training set. Infants in the experimental group looked at the images as instructed, while infants in a non-intervention control group did not. It is concluded that small amounts of training can modify early vocabulary. The theoretical implications of this are discussed.

Mismatch negativity and auditory backward recognition masking performance in people with a specific language impairment.

G M McArthur and D V M Bishop

University of Oxford

An influential hypothesis attributes the verbal problems of children with a specific language impairment (SLI) to an impairment in processing rapid or brief sounds. However, some studies have failed to demonstrate such a deficit. The rapid auditory processing skills of 16 people with an SLI and 16 people with normal spoken language skills were assessed with a modified version of Winkler, Reinikainen and Naatanen's (1993) paradigm to determine whether the discrepancies in the literature reflect differences in the sample studied, or methodological factors. This paradigm integrated mismatch negativity (MMN) and auditory backward recognition masking (ABRM) in four conditions that presented trials composed of a standard (25-ms 600-Hz) or deviant (25-ms 700-Hz) test tone followed by a 55-ms 1000-Hz backward masking tone after an interstimulus interval (ISI) of 20, 50, 150, or 300 ms. A fifth condition assessed frequency discrimination by presenting the standard and deviant test tones alone (i.e., without a backward masking tone). We will present data relevant to the rapid auditory processing deficit hypothesis, which predicts that the MMN component and ABRM performance of people with an SLI will be impaired in the short ISI conditions (i.e., 20 and 50 ms), but not the long ISI (150 and 300 ms) or frequency discrimination conditions.

"Yesterday I stroke a horse": Can children's problems with verb morphology be explained in terms of a low-level auditory deficit?

Dorothy Bishop, Courtenay Frazier Norbury and Josie Briscoe

University of Oxford

Children with specific language impairment (SLI) have disproportionate difficulty with certain aspects of verb morphology. For instance, they frequently omit past tense -ed endings, though when they do produce such inflections they are used appropriately. Debate has centred on

whether poor mastery of inflections is a secondary consequence of low-level auditory perceptual impairment, whether it reflects specific impairment in a specialised syntactic module, or whether the computational demands of inflectional morphology overload a limited processing capacity. The first of these possibilities is hard to accommodate with data we shall present comparing the performance of 19 children (aged 5; 9 – 10; 7) with mild–moderate sensorineural hearing impairment (SNH), 20 children with SLI (aged 7; 2 – 13; 0), and age-matched and language-matched groups of control children. On average the SNH group outperformed the SLI group and were comparable to controls. However, a minority of the SNH children were impaired on these tasks. These children were significantly younger than the rest of the SNH group, suggesting that acquisition of finite verb morphology may be delayed in children with hearing impairments, but they appear to catch up over time and do not show the persisting difficulties seen in SLI. Children with SLI demonstrated some ability to use past tense and 3rd person singular inflections correctly, and properties of verbs such as verb frequency and phonological complexity affected their ability to produce appropriate inflections, suggesting that their problems were not solely explicable in terms of syntactic factors, but may be influenced by other processing demands.

Session A - Friday 21 July 11-1 pm

Symposium: "Temporal lobe function in episodic and semantic memory"

Organisers: Karalyn Patterson and Kim Graham

Perceptual-mnemonic functions of the perirhinal cortex in macaques

Elisabeth A Murray

National Institute of Mental Health, Bethesda, MD, USA

The perirhinal cortex, a strip of cortex located in the ventromedial temporal lobe in macaques, plays a critical role in certain types of memory. The talk focuses on three aspects of the mnemonic contributions of the perirhinal cortex. First, the perirhinal cortex has been found to be essential for object recognition and for relating together the different sensory features of objects, thereby facilitating object identification. It carries out these functions even in the absence of the amygdala/hippocampus. Second, the perirhinal cortex serves as the final stage in a ventral visual cortical processing stream, known as the "what" pathway, that is devoted to the perception and identification of environmental stimuli. Its special contribution to this type of processing is held to be in the representation of complex conjunctions of features. Thus, the perirhinal cortex participates in acquisition, retrieval, and long-term storage of knowledge about objects, and, together with other cortical fields, also serves as a site of long-term storage of such knowledge. Third, the perirhinal cortex conveys already-processed information about objects to the hippocampus and amygdala, thereby allowing these structures to make different, secondary contributions to object memory, associating objects with events and affective valences, respectively.

Remote memory and the hippocampal complex in humans

Morris Moscovitch

University of Toronto at Mississauga

The studies address the question of whether the role of the hippocampal complex in memory is temporally-limited, needed only until memories are consolidated elsewhere, or whether it continues to contribute to storage and retrieval even of remote memories. Evidence will be presented from studies of people with hippocampal complex lesions, from a person with semantic dementia, and from neuroimaging studies in normal people that indicates that the hippocampal complex is needed for recollection of details of remote autobiographical episodes, public events, and even spatial memories, but not of semantic memories. The results call for a modification of traditional consolidation theory. A multiple-trace theory of memory (Nadel and Moscovitch, 1997) provides a viable alternative.

Semantic dementia: A challenge to the multiple-trace model of memory consolidation?

Kim S Graham

MRC Cognition and Brain Sciences Unit, Cambridge

For many years, it has been thought that the hippocampal complex is only involved in the retrieval of recently experienced episodic memories. Evidence to support this view comes from patients with bilateral hippocampal damage who show better recall of distant memories compared to more recent personal events. An alternative theory proposes, however, that the hippocampus is important for the retrieval of all personal event memories, regardless of their age (Nadel and Moscovitch, 1997). Here, these two models of memory consolidation will be evaluated by reviewing neuropsychological data from semantic dementia: these patients, who have focal atrophy of the temporal neocortex with relative sparing of the hippocampal complex, have a relatively selective, yet progressive, loss of semantic memory. In support of a temporary role of the hippocampus in episodic recall, patients with semantic dementia show better retrieval of recent autobiographical memories compared to those from the more distant past. To account for these contradictory results, Moscovitch and Nadel (1999) have proposed a number of possible explanations: (1) too few replications of the data; (2) impaired strategic retrieval due to concomitant frontal damage; and (3) preserved non-verbal access to autobiographical memory. Further data from semantic dementia will be considered in order to address the possibility that one or other of these factors explains the observed advantage for recent personal events.

Moscovitch, M. and Nadel, L. (1999). Multiple-trace theory and semantic dementia: Response to K.S. Graham (1999). *Trends in Cognitive Sciences*. 3, 85-122.

Nadel, L. and Moscovitch, M. (1997). Memory consolidation, retrograde amnesia and the hippocampal complex. *Current Opinion in Neurobiology*. 7, 217-227.

Dissociations in cognitive memory: The syndrome of developmental amnesia.

Faraneh Vargha-Khadem¹, David G Gadian¹ and Mortimer Mishkin²

1. Institute of Child Health, University College London

2. National Institute of Mental Health, Bethesda, USA

The dearth of studies on amnesia in children has led to the assumption that when damage to the medial temporal lobe system occurs early in life, the compensatory capacity of the immature brain rescues memory functions. An alternative view is that such damage so interferes with the development of learning and memory that it results not in selective cognitive impairments but in general mental retardation. Data will be presented to counter both of these arguments. Results obtained from a series of 12 amnesic patients with a history of hypoxic ischaemic damage sustained perinatally or during childhood indicate that regardless of age at onset of hippocampal pathology, there is a pronounced dissociation between episodic memory, which is severely impaired, and semantic memory, which is relatively preserved. A second dissociation in these patients is characterized by impaired recall and preserved recognition. These findings are discussed in terms of the neuropathology associated with hypoxic ischaemic damage and a hierarchical model of cognitive memory.

(End of symposium)

Session B - Friday 21 July 11-1 pm

Crossmodal links in covert endogenous spatial attention between audition and touch

Donna M Lloyd

University of Manchester

Three experiments were designed to investigate crossmodal links in endogenous spatial attention between audition and touch, using the orthogonal spatial cuing paradigm. Participants discriminated the elevation (up vs. down) of auditory or tactile targets presented to either the left or right. Experiment 1, in which targets were expected on a particular side in just one modality, demonstrated that people could shift their attention around independently in either audition or touch. Experiment 2 demonstrated that when people were informed that targets were more likely on one side for both modalities, elevation judgments were faster on that side in both audition and touch. However, it was possible to 'split' auditory and tactile attention, when targets in the two modalities were expected on constant but opposite sides throughout a block. A final study with crossed hands suggests that audiotactile links in spatial attention apply to common external locations, rather than simply being determined by the hemisphere to which information initially projects. These results are discussed in relation to previous findings regarding audiovisual and visuotactile links in attention, and to their possible neural substrates.

Symposium: "Confidence in human judgement"

Organisers: Joseph V Baranski and Nigel Harvey

Moderation of base rate neglect by group discussion and range specification: A calibration study

Tim Rakow, Sarah Finer and Nigel Harvey

University College London

Medical students judged the likelihood that an applicant to medical school would receive an offer of a place on the basis of 8 cues. Participants were naïve to the task, though familiar with its context. In experiment 1 participants made individual judgements before and after group discussion. Consistent with the literature on lay judgement, participants were poorly calibrated and far less accurate than a logistic regression model. Poor calibration was largely attributable to considerable 'bias', with 'discrimination' being comparable to the statistical model. The simple provision of base rate information (the proportion of applicants receiving offers) had minimal impact upon the magnitude of bias of individual judgements. Bias was significantly reduced by group discussion when base rate information was provided (with no detriment to discrimination), but remained unaltered in the absence of base rate information. In experiment 2 some participants were provided either information concerning the distribution of probability estimates or the range of estimates generated by the statistical model. The participants receiving this information were well calibrated, and their accuracy was close to that of the logistic regression model. Results suggest our participants could identify and use appropriate cues, but needed assistance in the scaling of their response. Specifying a 'plausible range' for responses was sufficient to foster well-calibrated judgement. Extensive feedback or instruction in cue utilisation was not necessary in this instance.

The hard-easy effect in the calibration of subjective probabilities: The effect of defining 'difficulty' in terms of absolute difference rather than familiarity

Alastair McClelland, John Haynes and Zhuo Jia Sun

University College London

Juslin (1993) obtained good calibration at different levels of performance when items were segregated on the basis of rated familiarity, rather than solution probability. In the present study, we report a partial replication and extension of Juslin's work. In the first experiment, participants were presented with a list of country names, and rated each country for familiarity. They were then given pairs of country names (selected at random) and had to decide which country had the bigger land area. For each pair, a half-scale confidence rating was also requested. The items in each domain were then split into two categories on the basis of either average familiarity (following Juslin) or absolute difference in land area. With familiarity, the hard-easy effect was abolished, but with absolute difference a hard-easy effect was still observed. In a second study, we explicitly presented participants with the absolute difference information for each pair of countries to investigate whether or not this would abolish the hard-easy effect. The results are discussed with respect to ecological and cognitive-bias accounts of calibration performance.

Judging confidence influences decision processing

William M Petrusic¹ and Joseph V Baranski²

1. Carleton University, Ottawa

2. DCIEM, Toronto

We examined the effects of rendering confidence judgments on the properties of the decision process in sensory-perceptual and general

knowledge tasks. The requirement of confidence judgments substantially increases decisional response times and, generally, the increase is inversely related to the difficulty of the judgement. When confidence is rendered, discriminative accuracy may also be impaired; although these effects are small in absolute terms, the relative decreases in accuracy are large and are an inverse function of decision difficulty. Finally, in a sensory detection task, we found that decision times increased with the number of confidence categories used (two, four, or six) and the increases in decision time were the largest when detection was easiest. Taken together, these experiments implicate both decisional and post-decisional loci for the basis of confidence and they permit rejection of the view that the confidence-based increases in decision time arise as a consequence of a slowed rate of evidence accumulation due to dual-task processing.

Explaining extreme overconfidence on interval questions

Jack B Soll¹ and Joshua Klayman²

1. INSEAD, Fontainebleau, France
2. University of Chicago, USA

Overconfidence depends significantly on how questions are asked. For example, people are only mildly overconfident on binary choice questions, but they are tremendously overconfident on interval questions (Klayman, Soll, González-Vallejo & Barlas, 1999). In our current research, we develop a random error model for intervals to help explain this extreme overconfidence. The basic idea is that if people are unreliable in how they set interval limits, that should translate to greater uncertainty and wider intervals. People will be overconfident to the extent that they fail to account for variation in the way that they set the limits. In addition, we hypothesize that interval questions are more susceptible to confirmation biases, because the alternative hypothesis is not as salient as in binary choice questions. We use models, simulations, and experiments to illustrate and test these propositions.

Subjective probability in the assessment of threat: Comparing expert vs. novice use of inconclusive information

Joseph V Baranski¹ and William M Petrusic²

1. DCIEM, Toronto
2. Carleton University, Ottawa

This study examined how people use inconclusive information when forming subjective probability assessments using a medium fidelity Naval threat assessment simulation. In the present context, inconclusive information refers to data that is relevant but does not clearly support a decision alternative. On each of 36 trials, subjects interrogated 10 pieces of information (e.g., speed, direction, bearing) about 'targets' in a radar space. The amount of hostile (n(H)), peaceful (n(P)), and 'inconclusive (n(I)) information was factorially varied across targets. For novices (i.e., civilian university students), inconclusive information "dilutes" threat assessments; i.e., when in doubt, civilians conservatively err on the side of "friendly". For experts (i.e., senior OPs room officers), inconclusive information is ignored, except when the difference between n(H) and n(P) is small; i.e., when in doubt, military experts conservatively err on the side of "foe". Subjective probabilities in the assessment of threat are

best fit by a model that includes a component based on the 'balance of evidence' [i.e., $n(H) - n(P)$] and a component based on the scaling of doubtful evidence [i.e., $n(I)$].

(End of symposium)

Session C - Friday 21 July 11-1 pm

The spatial tuning of human auditory perceptual channels under binaural and monaural conditions

Susan E Boehnke and Dennis P Phillips

Dalhousie University, Halifax

Human sound localization is acute for frontal locations and poorer in the lateral hemifields. The tuning of the perceptual channels for auditory space that underlie this acuity has not previously been examined. We have measured this tuning by exploiting a "between-channel" gap-detection paradigm in which detection thresholds for a silent interval (gap) were obtained when the leading and trailing noise markers of the gap were disposed at various absolute locations and separations throughout 360 degrees of azimuth, under binaural and monaural conditions. The binaural results indicate there are two, broadly-tuned hemifield channels whose medial borders overlap through the midline. The monaural results were systematically different, confirming the spatial channels were due to binaural processes. These results are compatible with data on the spatial receptive fields of cortical auditory neurons, and they provide a framework which may explain the localization acuity of human listeners, as well as some spatial masking and attentional phenomena.

The effect of spectral slope on infants' discrimination of timbre

C D Tsang and L J Trainor

McMaster University

Different speech sounds, voices, and musical instruments differ in spectral slope (the rate at which intensity falls off with frequency), and their spectral slopes cluster around -6 dB/octave. If spectral slope is important in timbre perception, enhanced sensitivity would be expected for spectral slopes near -6 dB/octave in comparison to spectral slopes very different from this value. Spectral slope discrimination was tested in 8-month-old infants across a range of spectral slopes (-16 vs. -10; -10 vs. -4; -3 vs. +3; +4 vs. +10; and +4 vs. +16 dB/octave) using a conditioned head turn procedure. Infants only showed discrimination between -10 and -4 dB/octave. This suggests that the auditory system is tuned to sounds in the range of real-world spectral slopes very early in life.

Hierarchical processing in the auditory cortex? fMRI mapping of responses to spectral and temporal complexity

D A Hall¹, I S Johnsrude², M S Gonçalves¹, M P Haggard¹, A R Palmer¹, A Q Summerfield¹, M A Akeroyd¹ and R S J Frackowiak²

1. MRC Institute of Hearing Research, Nottingham

2. Wellcome Department of Cognitive Neurology, London

The present study tested the hypothesis that processing in primary and secondary auditory areas is hierarchical: complex acoustic stimuli should activate secondary auditory regions more strongly than do simple stimuli. We used a 2x2 factorial design created by crossing spectral complexity (harmonic complex with F0=186 Hz vs single tone at 500 Hz) and temporal complexity (frequency modulated at 5 Hz vs static signal). Signals were presented diotically through electrostatic headphones to 6 normally-hearing volunteers. Functional and structural images were acquired using a 2T Magnetom VISION MRI system. The 4 conditions were analysed using a fixed-effects multi-subject model (SPM99).

There were significant main effects of both spectral and temporal complexity ($P < 0.05$). Both modulation vs static and complex vs single tone contrasts produced activation bilaterally in the primary auditory area and immediately adjacent secondary auditory areas: activation was largely additive (no significant areas of interaction). These main effects broadly co-localised, but the region responsive to temporal complexity was the more extensive. Responses to temporal complexity alone were found in additional areas bilaterally in the superior temporal sulcus (STS) and in a region anterior to the primary auditory area on the supratemporal plane (AA). Additivity may suggest an increasing auditory response to complexity. However, support for hierarchical processing is limited because effects of spectral and temporal complexity occurred in both primary and secondary areas. The specificity of the response in STS and AA to temporal complexity merits further investigation.

Subsystems in the human auditory cortex - evidence from functional neuroimaging studies

Sophie K Scott¹, Stuart Rosen², Catrin Blank³ and Richard J S Wise³ (Introduced by James Blair)

1. Institute of Cognitive Neuroscience, University College London
2. Department of Phonetics, University College London
3. MRC Cyclotron Unit, Hammersmith Hospital

Work in visual neuroscience has identified at least two possible functional subsystems in visual processing, a ventral 'what' pathway passing from visual cortex to the ventral temporal lobes and a dorsal 'where/how' pathway passing from visual cortex to the parietal lobes. Work in non-human primates has revealed analogous pathways in the auditory system. Using speech stimuli of varying intelligibility but equivalent structural complexity, and functional neuroimaging (PET) we demonstrate a stream of processing in the human left temporal lobe associated with the intelligibility of speech. The left superior temporal sulcus responds to the presence of phonetic information, but its anterior part only responds if the stimulus is also intelligible. This novel observation demonstrates a left-lateralised anterior temporal pathway for speech comprehension. We propose that this forms part of a verbal 'what' pathway in human auditory perception. The right temporal lobe, in contrast, showed selective activation for stimuli that contained dynamic pitch variation, regardless of intelligibility.

Multisensory coding: Implications of findings on tactile illusions

Susanna Millar and Zainab Al-Attar

University of Oxford

The similarity of errors in touch to 'optical' illusions for T-shapes and Müller-Lyer figures presents a paradox that is not resolved by modality-

specific nor by cognitive mediation theories. Tactile shape perception depends on inputs from touch, movement and body posture cues, in the absence of vision. Nevertheless, the vertical line is overestimated in inverted T-shapes and underestimated in rotated T-shapes, as in vision. Similarly, the shaft of figures with converging fins is perceived as smaller by touch than in divergent fin figures. We argue that the illusions can be explained by disparities in spatial reference cues from all sources, which normally converge (coincide) in accurate perception. We show that vertical errors in T - shapes are predicted by the locations of the additional junction point on segmented lines, and that the illusion is reduced significantly by two-handed scanning relative to an external frame and to egocentric cues. The Müller-Lyer illusion is explained by disparities between cues to shape and length from the fin and shaft elements within the shapes. Instructions to ignore the fins had no effect in vision in the presence of allocentric cues, but no movements relative to egocentric cues. The tactual illusion was almost eliminated by instructions to relate scanning movements to egocentric cues and to ignore the fins. The hypothesis, that length illusions in touch and vision depend on disparities in current spatial reference information, accounts for similarities and differences between the visual and tactual illusions by assuming that accurate perception in both modalities depends on congruent reference cues from all sources.

How does the brain solve the crossmodal binding problem? Insights from fMRI studies of audio-visual and visuo-tactile integration.

Gemma Calvert

University of Oxford

The integration of information from different sensory channels markedly enhances the detection and identification of objects and events in the environment. Semantically and/or spatially congruent multisensory inputs speed discriminations and improve reaction times compared to the response to any single modality in isolation. Incongruent inputs have the opposite effect, hampering classification and slowing responsiveness so that erroneous binding is prevented. These behavioural features of crossmodal processing appear to have parallels in the response properties of multisensory integrative cells in the superior colliculus in lower mammals. Spatially concordant multisensory inputs result in a substantial, often multiplicative (i.e. greater than the sum of the individual inputs) response enhancement; discordant inputs can produce a profound response depression. At present, it is not known whether a similar method of intersensory integration onto multisensory neurons applies to humans, or for the integration of complex inputs relating to stimulus identity, as well as stimulus location. This question has now been addressed in a series of experiments using fMRI. In the first series of experiments, subjects were exposed to alternating epochs of congruent and incongruent audio-visual (speech and non-speech) inputs and to each modality in isolation. In a second series of experiments, subjects were scanned whilst presented with spatially concordant or discordant visuo-tactile inputs (vibro-tactile stimulation and LED's) whilst attention to one or modality was manipulated by the response instructions. The results of these studies provide clear neurophysiological evidence of crossmodal binding by convergence onto multisensory cells in human heteromodal cortex. They further suggest that response enhancement and depression may be a general property of multisensory integration operating at different levels of the neuroaxis and irrespective of the purpose for which sensory inputs are combined.

Session A - Friday 21 July 2-3.20 pm

Symposium: "Parietal lobe in vision and visuomotor control"

Organisers: Melvyn A Goodale and A David Milner

Frames of reference and timing in the visual control of skilled actions.

Melvyn A Goodale and Yaoping Hu

MRC Group on Action and Perception, University of Western Ontario

We recently examined the frames of reference used by normal subjects to scale their grasp when picking up objects of different sizes. When faced with a target object and a distractor that was either larger or smaller than the target, it did not matter which distractor the target was paired with: the grasp was scaled to the real size of the target object and was not affected by the presence of the other object. When subjects picked up the target after a 5-s delay during and after which the target was no longer visible, a significantly larger grip aperture was observed when the target had been paired with a smaller object, than when the same target had been paired with a larger object. Exactly the same effect was observed when subjects simply gave a 'perceptual' estimate of the target's size – even when the target was visible. These results suggest that normal (real-time) visuomotor control relies on real-world metrics whereas delayed grasping utilizes the same relative (scene-based) metrics used by conscious perception. This result converges nicely with previous experiments on the visual-form agnostic patient D.F. who shows completely normal scaling of her grasp in real time but loses all scaling when a 2 s delay is introduced between viewing the object and making the movement. D.F. presumably can use visuomotor networks in her intact parietal cortex to program real-time actions but cannot use stored perceptual representations to drive a grasp 'off-line'.

Two routes from vision to action: Effects of bilateral posterior parietal damage.

A David Milner¹ and H Chris Dijkerman²

1. University of Durham

2. University of Utrecht, Netherlands

Goodale and colleagues showed some years ago that the visual-form agnostic patient D.F. was quite unable to retain the visual dimensions of objects when required to withhold response for a few seconds in order then to make a 'pantomimed' response in the absence of the object. We later found that D.F. even has difficulties in directing her eyes or hand to the location of an LED after a few seconds of delay. These observations fit with the idea that making a pantomimed response requires that explicit perceptual representations be used to guide action 'off-line', a capacity that D.F. no longer possesses because of her brain damage. We have recently studied two patients with Balint-Holmes syndrome, resulting from bilateral posterior parietal damage, to seek complementary evidence for this 'indirect' route from vision to action. These patients show 'optic ataxia'; that is they are impaired in the direct visuomotor control of actions such as reaching and grasping. We have found, however, that they show paradoxical improvements in their visuomotor control when making pantomimed rather than direct responses to target objects, in both the spatial and size domains. This is consistent with the idea that they can use a relatively well-preserved 'perceptual'

route to action. We also found evidence that one of the patients spontaneously developed a 'perceptual' strategy to overcome her visuomotor difficulties.

How does the posterior parietal cortex control visually guided actions?

Michel Desmurget.

Psychophysique et Neuropsychologie Espace et Action, INSERM Unité 94, Bron, France.

Numerous studies have indicated that the posterior parietal cortex (PPC) is critically involved in the execution of visually-directed movements. Although PPC involvement in planning processes has been emphasized in the past, it was often suggested that this area may also be involved in on-line movement control. In this talk I shall provide direct evidence supporting this view. Based on recent studies involving neuroimaging, transcranial magnetic stimulation, and brain damaged patients, I shall defend the idea that PPC (1) generates an internal representation of the instantaneous hand location by integrating the motor outflow and sensory inflow (forward model), (2) computes a dynamic motor error by comparing the estimated state of the hand location with the location of the target.

Visually guided grasping produces fMRI activation in human anterior intraparietal sulcus.

Jody C Culham¹, Rieko Osu¹, A David Milner², Joseph S Gati¹, Ravi S Menon¹, and Melvyn A Goodale¹.

1. MRC Group on Action and Perception, University of Western Ontario.
2. University of Durham

We used functional magnetic resonance imaging (fMRI) to examine the human neural substrates of visually-guided grasping. Within the relatively wide bore of a 4 Tesla magnet, subjects directly viewed (without mirrors) a rotating drum, which presented rectangular plexiglas blocks of varying length and orientation. On each trial, a single target was illuminated and the subject reached towards the object and grasped its edges with a precision grip (using the index finger and thumb). In a control condition, subjects reached and touched but did not grasp the target object. Event-related single trials took advantage of the haemodynamic delay to dissociate true grasping activation from motion artifacts. Grasping produced higher activation levels than reaching in a region of anterior intraparietal (AIP) cortex. This area is a likely human homologue of monkey AIP, an area containing neurons which fire in preparation for grasping. In addition, several other parietal and occipito-temporal regions showed grasp-related activation. Thus we have found a reliable paradigm which allows us to identify human AIP and other grasping-related regions. This will allow us to conduct future experiments comparing grasping to other tasks such as object perception (with no motor component), grasping imagery, and delayed grasping.

Session B - Friday 21 July 2-3.20 pm

Symposium: "New research on human motivations for alcohol use"

Organiser: S H Stewart

Adolescents' motives for cigarette smoking and marijuana use: Factor structure and relations to motives for alcohol use

N Comeau, S H Stewart, P Loba, E Rhyno and H L Loughlin

Dalhousie University, Halifax

The present study was designed to test the utility of extending Cooper's (1994) 2 x 2 (valence x source) drinking motives model to adolescents' use of cigarettes and marijuana, and to examine the degree of correspondence of specific substance use motives across three different drugs (i.e., alcohol, cigarettes, and marijuana). Of a sample of 508 adolescents (239 females, 269 males; M age = 15.1 years), 312 (61.4%) reported alcohol use (M = 6.7 drinks/week), 192 (37.8%) reported smoking (M = 40.3 cigarettes/week), and 154 (30.3%) reported use of marijuana (M = 6.1 marijuana cigarettes/week). Factor analytic and multiple regression results support Cooper's four-factor model of drinking motives, and suggest that this model may also be applied to adolescents' reasons for smoking and marijuana use. The results further suggest that there are some similarities in adolescents' specific motives for substance use across different drugs, particularly between motives for alcohol and marijuana.

Relations of drinking motives to promotion- and prevention-focus in other behavioral domains

S H Stewart¹, C J Roney², D R Lehman³, L Chung³, N Lawson³ and A Mueller³

1. Dalhousie University, Halifax
2. Kings College, Ontario
3. University of British Columbia

We examined whether positive (Enhancement; Social) and negative (Coping; Conformity) drinking motives (Cooper, 1994) relate to promotion- or prevention-focused self-regulation (Higgins, 1997) in the domains of social interaction and academic achievement. In four multiple regressions, we used 158 undergraduates' drinking motives scores to predict levels of promotion- and prevention-focus in social and academic domains, respectively. Positive and negative emotional drinking motives in Cooper's model (cf. Cox & Klinger, 1990) related more broadly to promotion- and prevention-focus, respectively, in domains other than drinking. Those who drink to increase positive emotions report a promotion-focus in their orientation toward social interactions and academic achievement (striving to increase affiliation/success). Those who drink to avoid negative emotions report a prevention-focus in their orientations toward social interactions and academic achievement (striving to avoid rejection/failure). Results suggest that people differ in their general proclivities to either approach pleasure or avoid pain across a variety of behavioral domains.

Relations between four personality risk factors for alcohol abuse and reinforcement-specific motives for drinking in non-alcoholic and substance abusing samples

P J Conrod¹, P Woicik¹, S H Stewart² and R O Pihl³

1. State University of New York at Stony Brook, USA
2. Dalhousie University, Halifax
3. McGill University

Four personality characteristics (anxiety sensitivity; introversion/hopelessness; sensation seeking; impulsivity) discriminate between subtypes of substance abusers who demonstrate patterns of dependence on drugs that possess specific reinforcing effects (Conrod et al., in press). Since alcohol possesses a number of different reinforcing properties, we hypothesized that these personality risk factors should also be associated with self-reported reasons for alcohol use that are reinforcement-specific. 300 substance abusing women and 450 male and female undergraduates completed the Drug Abuse Subtyping Scale (Woicik & Conrod, 1999) and Drinking Motives Questionnaire (Cooper et al., 1992). Results were almost identical across the clinical and non-clinical samples. Anxiety sensitivity and hopelessness were specifically related to drinking motives involving coping with negative emotion. Sensation seeking was associated with drinking for social and enhancement effects. Impulsivity was associated with drinking for both positive and negative reinforcement. Results are discussed within the context of a four-factor model of drug abuse vulnerability.

Motivational patterns as predictors of alcohol use and the likelihood of change

W M Cox

University of Wales, Bangor

In a series of three studies, the Motivational Structure Questionnaire (MSQ) was used to predict alcohol consumption and motivation for change. The MSQ identifies respondents' salient concerns in various life areas, and the characteristic manner in which they strive for goals to resolve their concerns (i.e., their motivational structure). Participants in the three studies were college students or patients with alcohol abuse. Across the three studies, respondents with high scores on an "adaptive" motivational factor felt committed to goal pursuits from which they expected to derive emotional satisfaction, and they felt optimistic about succeeding. The adaptive factor was a significant negative predictor of (a) the amount of alcohol that the college students habitually consumed, (b) alcohol abusers' denial of a problem, and (c) the amount of alcohol that alcohol abusers drank one year following treatment. The adaptive factor was also a significant positive predictor of alcohol abusers' readiness for change.

(End of symposium)

Session C - Friday 21 July 2-3.20 pm

PCA network models of memory and perceptual processes: A matter of style

John R Vokey¹, Jason M Tangen² and Kevin Eva²

1. University of Lethbridge

2. McMaster University

The ability of people and animals to demonstrate tacit sensitivity to the structure of the environment around them is explored in terms of a simple PCA network model applied to pixel-maps of natural and artificial images. The eigenvectors obtained from the singular value decomposition of sets of these pixel-maps provide for descriptions of the stimuli in terms of visual "macro-features". These macro-features provide a simple basis not only for recognising previously-experienced images, but for the successful discrimination of novel images into various natural and artificial structural categories. A summary of simulations of the performance in various focal domains of humans (e.g., face categorisation/recognition, artificial grammar learning, EKG diagnoses), pigeons (natural categories, artists' paintings), and chimpanzees (kin recognition) is provided. The results suggest both that the eigen-decomposition is a necessary first-step, and that the discrimination is best seen as a judgement of the "style" of family-resemblance structures.

Categorization and the "Ratio Rule"

A J Wills (Introduced by I P L McLaren)

Cambridge University

Many modern theories of categorization are based on the production of magnitude terms which represent the subjective level of evidence for a presented stimulus being a member of a particular category. Almost universal amongst such theories is the assumption that magnitude terms may be translated into response probabilities by the Ratio Rule (a.k.a. the Choice Axiom - Luce, 1959). Through the presentation of a number of categorization experiments, a case is made that the Ratio Rule is an inappropriate formulation. It is suggested that theorists should employ a different type of Thurstonian choice process.

Luce, R. D. (1959). Individual Choice Behavior. New York: John Wiley & Sons

Relation between perceptual and informational learning of family resemblance structures

Lee R Brooks and Sam D Hannah

McMaster University

In the learning of both medical and artificial materials, explicit rules commonly function to name the objects of perceptual learning rather than to give sufficient conditions for identification. Subjects in experiments with artificial materials search for informational commonalities even when the identification task is incidental to the apparent main purpose of the experiment. However, the rules so generated do not describe their dependence on particular perceptual manifestations. A comparable phenomenon is observed in learning to apply medical rules. The standard, authoritative rules are clearly useful in learning to identify medical disorders in visual areas (ECG, patient appearance, dermatology), but they do not describe the dependence on particular perceptual manifestations that is acquired during the course of learning. The influence on these phenomena of family resemblance structure, featural ambiguity and confidence in rule application will be discussed.

The under-weighting of implicitly generated alternatives

Kevin W Eva and Lee R Brooks

McMaster University

A highly robust finding in the study of subjective probability judgments is that the rated likelihood of a hypothesis depends on the other hypotheses suggested (called the unpacking effect by Tversky and Koehler, 1994). For example, the rated probability that a randomly selected person might die of cancer tends to be greater when cancer is considered by itself than when presented in a list of potential diagnoses. Our previous work has shown, somewhat counter-intuitively, that the alternative diagnoses that have the greatest influence on the probability rating of a focal diagnosis are those that were most likely to have been considered implicitly (Eva, Brooks, Cunnington, and Norman, Submitted). This result suggests that participants under-appreciated diagnostic alternatives that they themselves generated relative to those that were explicitly presented. The current study was designed to demonstrate this same result for alternatives the participants themselves claim to have actually considered. We used clinical cases previously shown to have two highly likely and roughly equiprobable diagnoses. Second year medical students viewed either one or both of these diagnoses and were asked to rate them. They were then asked whether they had been considering a diagnosis that was not presented and if so what it was. A week later they were shown the original cases and asked to rate the original alternative(s) together with the alternative they had generated. The unpacking effect was found even when the diagnostic alternative that is unpacked is one that they claim to have considered while originally viewing that case. That is, they rated the originally presented diagnosis as less probable when the alternative they had claimed to be considering implicitly was explicitly presented. Furthermore, patient management strategies, such as requesting diagnostic tests, were affected in addition to pure probability ratings. Possible reasons for this under-appreciation of self-generated diagnoses will be discussed.

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Session A - Friday 21 July 4-5.20 pm

An associative learning model of the illusory correlation effect

Robin A Murphy and Stefanie Schmeer

University of Hertfordshire Hatfield

Social psychologists have offered several hypotheses to explain the formation of stereotypes. One perspective is that they are the consequence of a perceived illusory correlation between group membership and certain behaviours. Hamilton and Gifford (1976) proposed that the infrequency of minority groups make them distinctive, thereby distorting people's perception of the relationship between group membership and behaviour. A modification to the Rescorla-Wagner (1972) model can also predict this effect by simply assuming that stimuli 1) acquire associations when presented together 2) associations representing stimuli that are not present on a given trial are also updated (Van-Hamme & Wasserman, 1994). One of its unique predictions is that the distorted perception should emerge preasymptotically before eventually diminishing. We report an experiment in which subjects were presented with vignettes describing members of either Group A or Group B performing either 'good' or 'bad' behaviours. The ratio of good/bad behaviours was always equivalent for members of both groups, but subjects experienced twice as many instances of group A members. The strength of the illusory correlation between group membership and good behaviour was assessed after either 18, 36, 54, or 72 trials. Results supported the predictions of the modified Rescorla-Wagner model.

Hamilton, D.L. & Gifford, R.K. (1976). Illusory correlation in interpersonal perception: A cognitive basis of stereotypic judgements. *Journal of Experimental Social Psychology*, 48, 5-17.

Rescorla, R.A. & Wagner, A.R. (1972). A theory of Pavlovian conditioning: Variations in the effectiveness of reinforcement and nonreinforcement. In A.H.Black & W.F. Prokasy (Eds.), *Classical conditioning II: Current theory and research* (pp. 64-99). New York: Appleton-Century-Crofts.

Van-Hamme, L.J. & Wasserman, E.A. (1994). Cue competition and causality judgment: The role of the nonpresentation of compound stimulus elements. *Learning and Motivation*, 25, 127-151.

Associatively mediated anti-generalisation in memory

I P L McLaren

University of Cambridge

Consider two stimuli, A and B, whose representations are associatively linked such that presentation of one stimulus retrieves a representation of the other. If we now present A what happens to the representation of B after retrieval? A straightforward analysis might have it that whatever happens to the representation for A (perhaps association with some outcome) will also happen to B, though perhaps to a lesser extent. This would constitute a form of generalisation between A and B mediated by the associations between them. Another analysis, suggested by recent research on retrospective revaluation effects in humans and infra-humans (e.g. Dickinson and Burke, 1996), would predict that whatever happened to the representation of A the opposite might be expected for the representation of B. Thus, if an association between the representation for A and some outcome were strengthened, then it should be weakened in the case of B. We might term this associatively mediated anti-generalisation.

The research reported here focuses on the latter phenomenon, but in memory rather than learning. Using a same / different recognition task with human subjects, I first demonstrate that, under certain circumstances, the effect of associatively retrieving a stimulus representation is the opposite to that which occurs on presentation of the stimulus. Then I consider to what extent this effect aligns with the retrospective revaluation literature referred to earlier.

Dickinson, A. & Burke, J. (1996). Within-compound associations mediate the retrospective revaluation of causality judgements. *Quarterly Journal of Experimental Psychology*, 49B, 60-80.

Two new forms of retrospective revaluation in human contingency learning.

Jan De Houwer (Introduced by Dr David Shanks)

University of Southampton

When a compound cue AT is followed by an outcome (AT+), human participants will judge the relation between cue T and the outcome to be less strong if A alone was previously paired with the outcome (A+). According to the probabilistic contrast model, such blocking effect is due to the fact that the A+ trials allow one to infer that A on its own is sufficient to explain the occurrence of the outcome on the AT+ trials. However, this conclusion is only justified if (a) A+ trials are treated as trials on which A and the outcome are present but T is absent and if (b) A is not accompanied by another predictive cue on the A+ trials. I report the results of two experiments which support the hypothesis that retrospective inferences about the status of T and other alternative cues on the A+ trials influence the contingency judgements for cue T. These findings support the probabilistic contrast model but are incompatible with the (revised) Rescorla-Wagner and SOP models.

Normative and descriptive accounts of the influence of power and contingency on causal judgment

David R Shanks¹ and J Perales²

1. University College London

2. University of Granada, Spain

The Power PC theory (Cheng, 1997) predicts that causal judgments are based on causal power p of a potential cause, where p is the cause-effect contingency normalized by the base rate of the effect. Previous reports have demonstrated that both cause-effect contingency and effect base-rate independently affect estimates in causal learning tasks. In the present work these effects are replicated in three experiments. In Experiment 1, causal strength judgments were directly related to power p in a task in which the effect base-rate was manipulated across two positive and two negative contingency conditions. However, in Experiments 2 and 3 contingency manipulations affected causal estimates in several situations in which power p was held constant, contrary to the Power PC theory's predictions. This effect cannot be explained by participants' conflation of reliability and causal strength, as Experiment 3 demonstrated independence of causal judgments and confidence. Neither the Power PC theory nor the Rescorla-Wagner model can account for the entire pattern of results. However, the data are compatible with Pearce's (1987) model, as well as with the Belief Adjustment model (Catena, Maldonado, & Cándido, 1998).

Session B - Friday 21 July 4-5.20 pm

Motor activation and inhibition elicited by masked primes: A threshold model and experimental evidence

Friederike Schlaghecken and Martin Eimer

Birkbeck College, London

Inhibitory processes play an important role in information processing and motor control. They are usually observed under conditions of supra-threshold stimulation. Near-threshold stimuli generally produce facilitation rather than inhibition. Recently, however, evidence for 'near-threshold inhibition' has been obtained (Eimer & Schlaghecken, 1998; Schlaghecken & Eimer, in press): Visual target stimuli were preceded by masked primes mapped to the same response as the target ('compatible'), or to the opposite response ('incompatible'). When primes were presented at fixation, responses in compatible trials were delayed, presumably reflecting an inhibition of the motor response corresponding to the prime. In contrast, with prime stimuli presented peripherally, responses were faster in compatible trials. We present evidence that this "central/peripheral asymmetry" reflects a threshold mechanism in motor control. Strong partial response activations (as elicited by foveal primes) are actively inhibited once the masking procedure removes the sensory evidence for the respective response tendency. In contrast, the weaker activations elicited by peripheral primes remain below the 'inhibition threshold,'

and thus do not receive active inhibition. The finding that lowering the perceptual quality of central primes and enhancing the perceptual quality of peripheral primes reverses the central/peripheral asymmetry supports this idea.

Eimer, M. & Schlaghecken, F. (1998). Effects of masked stimuli on motor activation: Behavioral and electrophysiological evidence. *Journal of Experimental Psychology: Human Perception and Performance*, 24, 1737-1747.

Schlaghecken, F. & Eimer, M. (in press). A central/peripheral asymmetry in masked priming. *Perception & Psychophysics*.

Selection-for-action: Evidence from bimanual reach-to-grasp movements directed toward single and multiple 'objects'

Georgina M Jackson and Stephen R Jackson

University of Nottingham

According to the integrated competition hypothesis (Duncan, Humphreys, and Ward, 1997) visual information from a single object requires less processing resources than visual information from two separate objects. Here we report four experiments which investigated this distinction in relation to planning and control of visually guided, bimanual, reach-to-grasp movements. We found that different patterns of interference were observed dependent upon whether two target objects were perceived as separate objects, or were unified, either perceptually or functionally, to form a single object. We observed that when participants executed bimanual reach-to-grasp movements toward two differently-sized cylindrical dowels (incongruent reaches) that were not connected to one another, the maximum grip apertures for each hand were significantly larger than when reaching for two unconnected dowels of the same size (congruent reaches). In contrast, when participants executed bimanual reach-to-grasp movements toward the same dowels which were now unified, either perceptually or functionally, a different pattern of effects on grip aperture were observed. In the latter case, during incongruent reaches, the maximum grip apertures of each hand became more similar (i.e. maximum grip aperture to the large target item was reduced while that to the small target item increased). These results suggest that the processing demands required by bimanual movements can vary as a function of the perceived unity of the target items.

Duncan J, Humphreys GW, and Ward R. (1997) Competitive brain activity in visual attention. *Current Opinion in Neurobiology*, 7, 255-261.

Understanding projectile acceleration

Marco Bertamini¹ and Heiko Hecht²

1. University of Liverpool

2. Man-Vehicle Lab, MIT, Cambridge, MA, USA

Throwing and catching balls or other objects is a generally highly practiced skill for young adults, however, conceptual as well as perceptual understanding of the mechanics that underlie this skill is surprisingly poor. In 5 experiments, we investigated conceptual and perceptual understanding of simple ballistic motion. Paper-and-pencil tests revealed that up to half of all participants mistakenly believed that a ball will continue to accelerate after it has left the thrower's hand. Observers also showed a remarkable tolerance for anomalous trajectory shapes. Perceptual judgments based on graphics animations replicated these erroneous beliefs for shallow release angles. Observers' tolerance for anomalies tended to decrease with their distance from the actor.

These findings are not consistent with claims in the naïve physics literature that liken intuitive beliefs to Aristotelian or medieval physics theories. Instead, observers seem to project their intentions to the ball itself (externalization) or even feel that some power is still exerted on the ball when still close.

Implicit knowledge and motor skills: What people who can catch a ball do not know

Peter McLeod¹, Nick Reed¹ and Zoltan Dienes²

1. Oxford University

2. Sussex University

Ball catching, like many motor skills, is under the control of implicit knowledge. That is, people are unable to describe how they choose an appropriate speed to run at to intercept a ball before it hits the ground. People are not only unable to describe their interception strategy, they cannot describe the sensory information which controls this strategy. Given a description of this information, recognition is better than free recall. But even if the recognition judgement is made just after catching a ball, and the subjects have been primed that they will be asked to make the judgement, it is still far from perfect. The experiments described will give those members of the EPS who are in denial about the existence of implicit knowledge the grounds to make a graceful exit from this implausible state.

Session C - Friday 21 July 4-5.20 pm

The role of androgens and estrogens in the Bruce effect

Denys deCatanzaro

McMaster University

Novel males can disrupt early pregnancy in previously inseminated female mice. Castrated males lose this ability. Through ELISA

procedures, we have measured levels of testosterone and 17-beta estradiol in the excretions of intact and castrated novel males while they are housed near pregnant females. Significant levels of both of these steroids are found in the urine and feces of intact males. Novel intact males become exceptionally agitated in their behaviour while near inseminated females, and actively direct their urine at these females. When 17-beta estradiol is painted directly on the nasal area of inseminated females, pregnancy reliably fails. Apart from male urine, no other chemical, including testosterone, produces such a pregnancy loss. It is established that excessive levels of 17-beta estradiol can act at the uterus and fallopian tubes to disrupt intrauterine implantation of fertilized ova. Furthermore, actions of 17-beta estradiol at the hypothalamus can interfere with pregnancy by stimulating estrus.

Effects of the benzodiazepine receptor agonist chlordiazepoxide & the 5-HT1A antagonist WAY100635 on behaviour in the rat elevated zero maze are not influenced by the light/dark cycle

Lianne Stanford¹, Scott M Weiss² and Kelly J Stanhope²

1. Department of Psychology and Neuroscience, Dalhousie University, Halifax
2. Department of Neuropharmacology, Cerebrus Ltd., Wokingham

The rat elevated zero maze is a validated model of anxiety (Shepherd et al. 1994 Psychopharm 116:56-64). In this test, rats administered anxiolytic drugs typically show a behavioural profile of increased exploratory activity (line crosses & head dips), increased time in the open areas, and less risk assessment (stretch-attends). In mice, 5-HT1A receptor antagonists have altered profiles on the elevated plus-maze when tested during different portions of the light/dark cycle (Rodgers et al., 1998 J Psychopharm 12:A32). To investigate this further, rats housed under normal or reversed light/dark cycles were tested with chlordiazepoxide (CDP), a benzodiazepine receptor agonist or with WAY100635, a 5-HT1A receptor antagonist. CDP (4 mg/kg) treated rats showed a similar anxiolytic profile in both housing groups. WAY100635 (0.01 to 0.3 mg/kg, sc: 30min) was without effect on rats from either housing group. These data show that the time of testing relative to the diurnal cycle does not alter the profiles of either CDP or WAY100635, and question the assumption that time of testing is a critical determinant of the anxiolytic properties of 5-HT1A receptor antagonists.

The effect of long-term amygdala kindling on emotional behavior may be related to receptor regulation within the dentate gyrus.

Lisa E Kalynchuk¹, Janet Menard² and Michael J Meaney²

1. Dalhousie University
2. Douglas Hospital Research Center, McGill University.

Long-term amygdala kindling in rats produces dramatic increases in emotional behavior. For example, rats subjected to 100 amygdala

stimulations display extreme resistance to capture, escape behavior in an elevated plus maze, and active defensive behavior in a resident-intruder paradigm (Kalynchuk et al., 1997; Kalynchuk et al., 1999). In this paper, we present evidence that kindled rats also display heightened acoustic startle, altered patterns of open-field exploration, and significant weight gain. We also summarize the results of our recent studies investigating changes in receptor expression that may underlie the development of kindling-induced emotionality. Remarkably, most of the receptor subtypes we have investigated (i.e., 5-HT, GABA/BZ, glucocorticoid, NMDA) are changed specifically in the dentate gyrus. The dentate gyrus is an important mediator of seizure activity, contextual memory, and stress sensitivity. Because kindling-induced emotionality is triggered by exposure to novel situations, we propose that abnormal functioning within the dentate gyrus may interfere with the kindled rats' ability to cope with stress (e.g., novelty), thus leading to overly-emotional responses. (Supported by research grants from NSERC and MRC).

Session A – Saturday 22 July 9-10.40

Objects look larger with the left eye than the right eye

Chris McManus and Julia Tomlinson

University College London

Very little research has compared perception in the right and left eyes, although much has compared the right and left visual fields of the two eyes. An intriguing exception (S. Coren and C. Porac. *Nature* 260:257-258, 1976) suggested that objects appeared larger in the right eye of right-eyed individuals and in the left eye of left-eyed individuals. The present study tried to replicate that result using a tachistoscope which allowed presentation of images separately to right and left eyes. Each stimulus consisted of a pair of solid circles which appeared in two of four locations diagonally above or below and left or right of the fixation point. Subjects' task was to report which circle appeared larger. The design therefore allowed eye effects to be distinguished from visual field effects. 43 subjects were tested, 19 of whom were left-eyed and 10 of whom were left-handed. Overall, circles appeared about 1.6% greater in diameter in the left eye (3.2% difference in area). There was no effect of visual field, suggesting the effects were not due to conventional cerebral lateralisation. No evidence was found for Coren and Porac's correlation with sighting eye dominance. There were however very significant individual differences which correlated most strongly with writing hand preference (rather than throwing hand). The mechanism of these eye differences raises interesting questions for theories of lateralisation and for theories of binocular vision, where, as a part of 'eye signature', they may be important for disambiguating input from the two eyes.

The medial forebrain bundle must interact with the cortex for normal object recognition memory

Alex Easton (Introduced by Dr D Gaffan)

University of Oxford

In monkeys, lesions of the temporal stem, amygdala and fornix produce a severe impairment in recognition memory performance. To test the hypothesis that this impairment was due to isolating the inferior temporal cortex from the basal forebrain, we tested animals with asymmetric lesions of the medial forebrain bundle in one hemisphere (to disrupt basal forebrain activity) and of the inferior temporal cortex in the opposite hemisphere. A similar level of impairment was seen in these animals in object recognition memory as in animals with sections of the temporal stem, amygdala and fornix. This supports the hypothesis that the basal forebrain is essential for normal memory in the primate. A similar effect from asymmetric lesions of the medial forebrain bundle and the frontal cortex suggests that the basal forebrain acts as a route of subcortical communication between the frontal and inferior temporal cortices in learning.

Response reversal impairment in psychopathic individuals

R J R Blair

Institute of Cognitive Neuroscience, University College London

Psychopathy is a severe developmental disorder involving an emotional impairment, characterized by a lack of guilt and empathy, and extremely antisocial behaviour (Hare, 1991). While many of the impairments of psychopathic individuals appear to be explainable in terms of amygdala dysfunction, there is also a suggestion of dysfunction in some of the functions mediated by orbitofrontal cortex. This paper reports on the performance of psychopathic individuals on two measures of orbitofrontal cortex functioning: the ID-ED task (Dias et al., 1996) and the four pack card playing task (Bechara et al., 1997). 14 psychopaths and 14 age and IQ matched, incarcerated controls, identified using the Revised Psychopathy Checklist (Hare, 1991), were presented with the two measures. The psychopathic individuals showed striking selective deficits. On the ID-ED task, the psychopathic individuals showed a selective deficit in response reversal but no impairment in attentional set shifting. On the four pack card playing task, the psychopathic individuals were as likely as the controls to shift from the high reward but net loss packs to the low reward but net gain packs. However, the psychopathic individuals were significantly less likely than the controls to shift their pack choice following punishment (point loss). The results are interpreted with reference to dysfunction within the connections between the amygdala and orbitofrontal cortex.

A combined neuropsychological and structural MRI study of high functioning autism

Jill Boucher¹, Patty Cowell², Paul Brooks², Neil Roberts³, Matthew Howard³ and Andrew Mayes²

1. University of Warwick

2. University of Sheffield

3. University of Liverpool

A study was carried out assessing the hypotheses that autism is associated with pathology of the medial temporal lobes (MTL) and/or the prefrontal cortex (PFC) (Robbins, 1997), using a combination of neuropsychological tests and sMRI. The sMRI investigations are described more fully in a related paper/poster.

Ten males with high functioning autism (HFA) aged 16 – 40 years, with verbal IQ's between 86 – 150, and 10 normal controls individually matched for sex, age, and verbal IQ were tested. The HFA diagnoses were confirmed using a diagnostic checklist (Wing, 1996). The neuropsychological tests assessed executive functions (Zoo map, Brixton, Haylings, FAS), social cognition (Benton, Ekman, Eye Direction Detection, Point-Light Movement Interpretation, Face Recognition), and memory (Face and Word Recognition, Picture Recognition, Story Recall, Figure Copying and Recall), these tests being sensitive to pathology affecting the PFC, the amygdala, and hippocampal-related regions, respectively.

There were significant between group differences on the Zoo Map and Haylings; the Ekman (especially fear), Face Recognition, Eye Direction and Point Light tests. The MRI scans showed autism-specific effects in the MTL, especially the amygdala; and PFC asymmetry similar to that which occurs in other neurodevelopmental disorders. These findings support a MTL (amygdala) hypothesis, and give qualified support to a PFC hypothesis.

A selective impairment in the recognition of facial and vocal signals of disgust following brain injury.

Andrew J Calder¹ , Jill Keane¹ and Andy Young²

1. MRC Cognition and Brain Sciences Unit, Cambridge

2. University of York

Patient studies and brain-imaging work have shown that the recognition of facial signals of disgust may be linked to a distinct neural substrate; two areas that have been suggested are the fronto-striatal regions and the insula. (Phillips et al., 1997; Sprengelmeyer et al., 1996). Central to our interpretation of these studies is whether they have identified a brain system that is involved specifically in the perception facial signals of disgust, or one that underlies the perception disgust signals from all sensory modalities. We address this issue in a case study of NK, a 25 year old male with damage to left basal ganglia and sub-insula.

NK's ability to identify facial expressions was examined using two tests. The first contained ten examples of each of six facial expressions (happy, sad, anger, fear, disgust, and surprise) from the Ekman and Friesen (1976) series. The second included eight

examples of each of seven facial expressions (the six listed above plus contempt) from the Matsumoto and Ekman (1988) set. On each test, NK showed a selective impairment in recognising facial expressions of disgust.

NK's recognition of emotion from vocal expressions was also assessed using two separate tests. The first used emotional vocalisations (e.g., laughter for happiness, retching for disgust, etc.) and contained ten examples of each of the six emotions listed above. The second comprised individual lists of five random digits, with each list spoken with intonations intended to convey particular emotional prosodies (happy, sad, anger, fear, or disgust). For both vocal tests, NK showed a significant impairment for recognising vocal signals of disgust. With the exception of a mild deficit for surprise on the first test, none of the other emotions was impaired significantly.

NK's results are consistent with damage to a brain system geared to interpret signals of disgust regardless of their modality.

Phillips, M. L., Young, A. W., Senior, C., Brammer, M., Andrew, C., Calder, A. J., Bullmore, E. T., Perrett, D. I., Rowland, D., Williams, S. C. R., Gray, J. A., & David, A. S. (1997). A specific neural substrate for perceiving facial expression of disgust. *Nature*, 389 (2 October), 495-498.

Sprengelmeyer, R., Young, A. W., Calder, A. J., Karnat, A., Herwig, L., Homberg, V., Perrett, D. I., & Rowland, D. (1996). Loss of disgust in Huntington's disease: Perception of faces and emotions. *Brain*, 119, 1647-1665.

Session B - Saturday 22 July 9-10.40

Performance as a function of number and spatial arrangement of food locations on a large radial maze

Mark R Cole

Huron College, University of Western Ontario

Cole (1999) showed that when 8, 16, 24, 32, 40 and 48 baited arms were added successively in random locations to a large radial maze, performance by rats declined only when the final set of eight arms was added. The present research was designed to assess whether this decline was primarily due to number of food locations or to configuration of food locations. In successive phases, each lasting 20 sessions, 8, 16, 24, or 48 baited arms were added to a large radial maze. Rats were tested twice daily on the maze. In one daily trial, the arms were spread out as far apart as possible, while in the other daily trial, the arms were located as tightly together as possible. Location of arms proved to be more important than number of arms when the percentage of novel entries in the first N opportunities was examined. In the Spread Condition, performance was nearly perfect with only eight arms attached, but declined as the number of arms increased to 16, 24 and 48. In the Tight Condition, performance was poor even with only eight arms attached, and declined only marginally as further arms were added. The results were interpreted as demonstrating that performance on a radial maze

is more dependent upon the angular separation between adjacent arms than on the number of arms.

Symposium: "Spatial cognition in animals"

Organiser: Ron Weisman

Visual Scene Analysis in Pigeons

Marcia Spetch

University of Alberta

The world consists of a complex array of global and local visual cues that might be used to identify and remember a particular location, such as a place where food is found. Pigeons can find hidden goals using any of a variety of spatial cues, including single landmarks, arrays of landmarks, distance from an edge, and geometric shape of the environment. Pigeons' use of spatial information is remarkably general across tasks conducted on computer screens or the laboratory floor, despite drastic differences in scale of space and type response. Comparative studies have revealed interesting similarities and differences between how pigeons and other species use of spatial information.

Seasonality and spatial memory in birds

Sue Healy and Robert Biegler

University of Edinburgh

Seasonal variation in song is related to volume changes in brain regions associated with song learning. Recent evidence suggests that hippocampal volumes also vary through the year: they are large in autumn/winter and small in spring/summer. This variation appears to correlate with changes in food-storing behaviour (and thus memory for locations of stored food). We tested food-storing and non-storing tits on spatial and nonspatial memory tasks using birds caught in autumn and spring. We found seasonal differences in memory performance but, counter to prediction, in both species. It is not clear, whether there are correlated neuroanatomical changes.

Place finding in insects: Stereotypical servomechanisms

Ken Cheng

Macquarie University, Australia

Insects use a series of stereotypical place-finding servomechanisms to return to a place. Use of path integration gives way to use of landmarks close to the target location. Sun-compass and large landmarks provide directional cues. Visual flow provides an estimate of

distance traveled. Landmark-based servomechanisms include beaconing: heading towards a recognized landmark, based on multiple stored views of the landmark, sensory-motor vectors: motor trajectories triggered by particular (sensory) views of a landmark, and image matching: positioning landmarks at correct retinal coordinates while facing a stereotypical direction. A 'simple-minded' sequence of servomechanisms, while not 'map-like', does the job.

Auditory Distance Perception in Black-Capped Chickadees

Leslie Phillmore, Chris Sturdy and Ron Weisman

Queen's University

In the wild, songbirds can use auditory cues to determine spatial distance to conspecifics and to identify individual conspecifics. We have been conducting perceptual experiments in the laboratory to study the auditory cues black-capped chickadees use to determine distance. Chickadees can use the amplitude of a vocalization to estimate the distance to the signal. Chickadees reared in isolation from conspecifics are not deficient in the use of auditory cues to judge distance to a vocal signal. It appears that the ability to use auditory spatial cues is not appreciably effected by experience with conspecific vocalizations at a distance.

(End of symposium)

Session C - Saturday 22 July 9-10.40

A Practical Metric for the Complexity of Graphic Displays

D C Donderi

McGill University, Montreal

A practical and effective complexity measure for character-based displays was developed by Tullis in 1983, and a comparable measure for graphical displays would be very useful. A possible measure of graphical image complexity is the change in file size after a bitmap image has been compressed. The most informationally redundant image can be compressed into the smallest file, while the least informationally redundant image can be compressed the least. Magnitude estimation scaling (MES) ratings of the subjective complexity of three different sets of 50 graphics bitmap images were made by three different groups of 10 observers each. For all three groups, the file size resulting from from JPEG image compression was highly correlated with MES judgments of subjective complexity of the original bitmap files. The relationships were $r = 0.73$ for a set of 50 electronic radar displays, $r = 0.65$ for a set of 50 electronic chart displays, and $r = 0.57$ for a set of 50 overlay displays containing both radar and electronic chart imagery. Work is in progress to investigate the

properties of other compression algorithms.

Mechanisms for detecting texture gradients

Frederick A A Kingdom and Anthony Hayes

McGill Vision Research Unit, Montréal

Texture gradients arise in the retinal-image projection of any non-coplanar textured surface, and provide important monocular cues to surface shape. A widely held view is that texture gradients are detected by a cortical mechanism that can be approximated by a Filter-Rectify-Filter (FRF) model, where local features are picked up by 1st stage¹ filters (such as simple-cells) and, after conversion to energy responses via rectification (or squaring), are pooled by 2nd-stage¹ filters that detect variations in response energy across space. Because an FRF mechanism deals only with filter-response energy, it is sensitive to a variety of texture gradients (e.g., contrast, size, orientation), and subthreshold amounts of different texture gradients can be predicted to summate to detection threshold. We tested this prediction with stimuli that consisted of dense arrays of Gabor elements (windowed sinusoids), whose orientations, spatial frequencies, and contrasts, were modulated sinusoidally across space. Using a conventional test-threshold-versus-mask-amplitude paradigm, we found no instances of subthreshold summation between different texture gradients. We conclude that rather than using FRF mechanisms to indiscriminately detect a variety of different texture gradients, the visual system employs separate mechanisms for detecting different types of texture gradient.

Motion of drifting "isoluminant" chromatic gratings is mediated by a luminance mechanism.

Kathy T Mullen, Tatsuya Yoshizawa and Curtis L Baker.

McGill Vision Research, Department of Ophthalmology, McGill University

In previous work using random gabor kinematograms we found that there was no linear motion for red-green color vision (Yoshizawa, Mullen & Baker, Vis. Res, in press). Depending on the conditions, the motion of these isoluminant stimuli was supported either by a luminance "artifact" or by a chromatic nonlinear motion mechanism. We now ask what type of mechanism supports the motion of drifting chromatic gratings.

We measure the masking of drifting isoluminant red-green gratings (1.5cpd) by dynamic broad spectrum luminance and chromatic noise. Our results show that luminance noise masks direction discrimination thresholds of chromatic gratings but not detection thresholds over a wide range of drift rates (0.75-9Hz). On the other hand, chromatic noise masks chromatic detection thresholds, but has much less effect on direction discrimination, and at high drift rates chromatic noise has very little effect on either chromatic

threshold.

The double dissociation of the effects of color and luminance noise masking suggests that the motion of drifting "isoluminant" chromatic gratings is mediated solely by a luminance mechanism.

A colour concept in male marmoset monkeys

Andrew M Derrington, Amanda Parker and Greg G Goodson

University of Nottingham

The colour vision of the male marmoset monkey (*Callithrix Jacchus*) is a primitive dichromatic (two-receptor) system[1]. Dichromatic colour vision may not support an innate concept of colour: it discriminates between monochromatic colours but confuses white light with monochromatic light that produces the same ratio of excitations in the two receptor types[2]. Here we show that male marmosets learn rapidly to distinguish between pairs of abstract patterns that differ only in that one member of each pair is grey-scale and the other coloured. The discrimination is not affected by manipulating the lightness of the grey-scale pattern elements and transfers to new pairs of patterns that contain only colours not included in the training patterns. We conclude that dichromatic colour vision supports an innate concept of colour and that marmosets are aware of using colour to solve perceptual problems. This may be the first demonstration that a non-human species has a concept of colour.

1. Travis, D.S., J.K. Bowmaker, and J.D. Mollon, Polymorphism of visual pigments in a callitrichid monkey. *Vision Research*, 1988. 28(4): p. 481-490.
2. Cornsweet, T.N., *Visual Perception*. 1970, San Diego: Harcourt Brace Jovanovich.

Impoverished second-order input to global linking in human vision

Robert F Hess, Tim Ledgeway and Steven Dakin

McGill Vision Research, McGill University

Department of Visual Science, University of London

Recent evidence points to the importance of global operations across spatial regions larger than individual cortical receptive fields. Studies of contour integration and motion trajectory detection suggest that network operations between local detectors underlies the encoding of extended contours in space and extended trajectories in motion. Here we ask whether such network operations also occur between second-order-detectors known to exist in visual cortex. We compared performance for stimuli composed of either first-order or

second-order elements equated for visibility, and we show that unlike the first-order case, there is little or no linking interaction between local second-order detectors. This implies that the network operations thought to underlie the integration of contour information across space and direction information over space and time receive, at best, an impoverished input from local detectors that encode second-order image attributes.

Session A – Saturday 22 July 11.20-1 pm

Symposium: "Neuropsychology of human long-term spatial memory"

Organisers: R G Morris and A R Mayes

Path integration following unilateral temporal lobectomy

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2. Institute of Cognitive Neuroscience, University College London
3. Academic Neurosurgery Unit, The King's Neuroscience Centre
4. New Jersey Institute of Technology, Newark, USA.

Path integration, a component of spatial navigation, is the process used to determine position information on the basis of information about distance and direction travelled derived from self-motion cues. Following on from studies in the animal literature that seem to support the role of the hippocampal formation in path integration, this facility was investigated in humans with focal brain lesions. Thirty-three neurosurgical patients (17 left temporal lobectomy, LTL; 16 right temporal lobectomy, RTL) and sixteen controls were tested on a number of blindfolded tasks designed to investigate path integration, and on a number of additional control tasks (assessing mental rotation and left-right orientation). In a test of the ability to compute a homing vector, the subjects had to return to the start after being led along a route consisting of two distances and one turn. Patients with RTL only were impaired at estimating the turn required to return to the start. On a second task, route reproduction was tested by requiring the subjects to reproduce a route consisting of two distances and one turn; the RTL group only were also impaired at reproducing the turn but this impairment did not correlate with the homing vector deficit. There were no group differences on tasks where subjects were required to reproduce a single distance or a single turn. The results suggest that path integration is impaired patients with RTL only and suggest that the right temporal lobe plays a role in idiothetic spatial memory.

The temporal lobes, navigation and memory in large-scale virtual space

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2. Wellcome Department of Cognitive Neurology, Institute of Neurology, University College London
3. National Hospital for Neurology and Neurosurgery, London

Unilateral damage to the right medial temporal region is known to cause impairments on a number of spatial memory tasks, whereas bilateral damage involving both hippocampi results in substantial episodic memory deficits. In the present study we used a large-scale virtual reality town to test topographical and episodic memory in patients with unilateral medial temporal lobe damage. Sixteen left and 16 right temporal lobectomy patients were compared with 16 healthy matched control subjects. Having explored the town at length, topographical memory was then assessed by requiring subjects to navigate in, recognise scenes from and draw maps of the virtual town. Following this, subjects collected objects from two different characters in two different locations within the town. Episodic memory of these events was then assessed by a paired forced choice recognition test. Right temporal lobectomy patients were impaired on navigation, scene recognition and computer aided map drawing relative to control subjects. They were also mildly impaired on recognition of objects in the episodic memory task. The left temporal lobectomy patients were impaired relative to control subjects on their ability to remember who gave them the objects and the order in which they received the objects in the episodic memory task. Both patient groups were at chance on their ability to remember where they received the objects. These results suggest that topographical memory is largely mediated by the right medial temporal lobe, whereas some associative aspects of episodic memory are more dependent on the left medial temporal lobe.

Spatial memory and the hippocampal region: A structural MRI analysis of patients with unilateral mesial temporal lobe sclerosis

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1. Institute of Psychiatry
2. Academic Neurosurgery Unit, The King's Neuroscience Centre
3. St. George's Hospital Medical School, London,

The Nine-Box Maze, (Abrahams et al. 1997) was designed to compare spatial mapping and working memory theories of the functions of the hippocampus. The task provides separate measures of spatial, object, working and reference memory, and is analogous to the

radial arm maze, encouraging the formation of allocentric rather than egocentric spatial representations. In the current investigation 47 patients with unilateral temporal lobe epilepsy (TLE) were investigated. Spatial memory deficits across both working and reference memory conditions were found in patients with a right epileptogenic focus. There was no evidence of an object working memory deficit, but a non-lateralised impairment in object reference memory was revealed. These results extend our previous findings in a larger group of patients. Moreover, the pattern of results was confirmed in a subgroup of 33 patients with unilateral atrophy localised to the mesial temporal lobe structures as revealed by volumetric analysis of magnetic resonance images. The structural analysis revealed evidence of unilateral sclerosis in the hippocampus and parahippocampal gyrus, but which did not extend into the remaining temporal cortex. In addition, spatial memory errors significantly correlated with volumetric measures of the mesial temporal lobe structures. In contrast object reference memory errors correlated with volumetric measures of the temporal cortex and not with mesial temporal lobe structures. These findings support a specialised role for the right hippocampal and parahippocampal region in spatial memory.

Spatial memory dissociations following lesions to the hippocampus and other medial temporal lobe regions

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1. University of Liverpool
2. Department of Clinical Neurology, University of Sheffield
3. Cardiff University
4. Magnetic Resonance and Image Analysis Research Centre, University of Liverpool

The spatial memory of a patient (YR) with relatively selective bilateral hippocampal damage was investigated. Location memory was tested under conditions which encouraged the use of either an allocentric (identification of a location by its position relative to an array of external landmarks) or egocentric (identification of a location by its position relative to the observer) frame of reference. The task required subjects to remember the position of a single light presented on a board. In the allocentric condition subjects moved to a different place around the board before making a mnemonic response. In the egocentric condition stimuli were presented in darkness, which eliminated allocentric cues. YR was found to be more impaired at recalling allocentric than egocentric information after a sixty second filled interval with a tendency for the impairment to increase up to this delay. Recognition of allocentric spatial information was also impaired at the sixty second delay. More extensive medial temporal lobe damage which included the parahippocampal, perirhinal and entorhinal cortices in addition to the hippocampus (patient NM) also resulted in a deficit in allocentric but not egocentric spatial recall and this was of equivalent severity to that seen in YR. The results suggest that the human hippocampus has greater involvement

in allocentric than egocentric spatial memory and that this most likely concerns the consolidation rather than initial encoding of allocentric information into long-term memory. However, a further task showed that YR's recall and recognition of the positions of specific pictures arranged on a table top was impaired even though an egocentric frame of reference could have been used. This result leads us to consider whether the allocentric spatial memory deficit reflects a more general problem of storing or retrieving certain kinds of associative information.

Right medial-temporal contributions to human episodic memory for object location and object identity in visual scenes: Evidence from functional neuroimaging

S Köhler, B. Milner and J. Crane

Montreal Neurological Institute, McGill University, Canada

Previous neuroimaging research has implicated the hippocampus and the posterior parahippocampal gyrus in encoding novel visual scenes. In the present PET study, we investigated whether these structures are also involved in recognition of spatial or object information from previously encountered scenes. Healthy participants were scanned while encoding photographs of novel scenes and while performing three different forced-choice recognition memory tests. These tests required the discrimination of familiar from altered scenes, which differed from each other either in the identity of one of the objects, the spatial configuration the objects formed, or specific object-place associations within identical configurations. Participants were also scanned in two visual baseline tasks and during encoding of individual objects presented without a scene context. Encoding of novel scenes, as compared to baseline, activated anterior portions of the hippocampus and posterior aspects of the parahippocampal gyrus bilaterally. A comparison of scene encoding with encoding of individual objects showed that the parahippocampal activation extended into a right-sided region previously described as parahippocampal place area (PPA). Recognition of scenes, as compared to baseline, activated the PPA but not the hippocampus, irrespective of whether the recognition task required retrieval of spatial or object information. Our data suggest that the anterior hippocampus is involved in forming memory representations of novel environments whereas the PPA plays a broader role in scene processing that is not limited to encoding.

(End of symposium)

Session B - Saturday 22 July 11.20-1 pm

Where is the word length effect? Right here! A reply to Bachaud-Levi et al. (1998).

Antje S Meyer¹, Ardi Roelofs², and Pim Levelt²

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2. Max Planck Institute for Psycholinguistics, The Netherlands

The model of word production proposed by Levelt, Roelofs, and Meyer (e.g., BBS, 1999) predicts that it should take speakers longer to initiate long words than shorter ones. This is because the model assumes that successive syllables of a word are generated in sequence and that speakers usually generate all syllables of a word before speech onset. In several earlier studies this prediction was borne out, but Bachoud-Levi et al. (JML, 1998) failed to obtain any evidence for a word length effect on speech onset latencies. They concluded that the model had to be modified.

In our experiments, Dutch and English speakers named objects with monosyllabic or disyllabic names, which were equally easy to recognize. When mono- and disyllabic targets were presented in mixed blocks, there was no length effect. However, when the materials were blocked for length, or when the participants were strongly encouraged to react fast, length effects were obtained. We argue that these results are consistent with our model's assumptions about the time course of phonological encoding and that processing time difference can easily be concealed (in mixed blocks and when no speed instruction is given) because of the participants' setting of a response deadline.

A critical test of the changing routes versus changing deadlines debate in print to sound translation

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1. Middlesex University

2. University of Waterloo

The word frequency effect in speeded naming of single words can be eliminated by mixing nonwords together with the words (e.g., Baluch & Besner, 1991; Hudson & Bergman, 1985). Two different accounts have been proposed. In one account, the reader shifts from relying on the addressed routine (which produces a word frequency effect) when only words are present to relying on the assembled routine (sublexical spelling-sound correspondences which do not produce a word frequency effect) when nonwords are mixed in with the words (Baluch & Besner, 1991). A different account proposes that the reader does not shift routes, but instead tries to homogenize the point in time at which an articulation is released, thus pulling the release point for high frequency words towards the release point for nonwords, consequently eliminating the word frequency effect (Lupker, Brown & Columbo, 1997).

These two different accounts are pitted against each other in a series of single-word naming experiments utilising the transparent Turkish orthography in which a robust frequency effect was previously reported (Raman, Baluch & Sneddon, 1996). The critical

manipulation involves mixing words together with nonwords which are as fast as words to name, since the "changing routes" account predicts that the word frequency effect will be eliminated whereas the "changing deadlines" account predicts that a word frequency effect will be preserved. The results are inconsistent with the "changing routes" account but consistent with the "changing deadlines" account insofar as naming in a transparent script is concerned. The implications of these findings for understanding reading at the single word level in various writing systems are discussed.

Baluch, B. & Besner, D. (1991). Visual word recognition: Evidence for strategic control of lexical and nonlexical routines in oral reading. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 17 (4), 644-652.

Hudson, P.T.W. & Bergman, M.W. (1985) Lexical knowledge in word recognition: word length in naming and lexical decision tasks. *Journal of Memory and Language*, 24, 46-58.

Lupker, S. J., Brown, P. & Colombo, L. (1997). Strategic control in a naming task: Changing routes or changing deadlines? *Journal of Experimental Psychology: Learning, Memory and Cognition*, 23 (3), 570-590.

Raman, I., Baluch, B. & Sneddon, P. (1996). What is the cognitive system's preferred route for deriving phonology from print? *European Psychologist*, 1 (3), 221-227.

Instantiating counter-intuitive frequency effects within a distributed memory model of naming

Thomas M Spalek. and Steve Joordens,

University of Toronto

Masson has proposed a distributed memory model as an account of the memory retrieval process underlying word recognition (1991,1995). Piercey & Joordens (1999) augmented this model with a random walk decision process in an attempt to map this general word process onto lexical decision performance. The current work examines whether a modified version of this model can also explain performance in a naming context. We will first begin by briefly summarizing some of the naming results and our modified deadline model that we presented at last year's CSBBCS meeting. Specifically, we emphasize the counter-intuitive frequency effects found when you mix monosyllabic and trisyllabic items. We then describe the results of simulations designed to instantiate our deadline assumptions within Masson's distributed framework.

Repetition blindness for words but not non-words

Jamie I D Campbell and Vanessa Hernberg

University of Saskatchewan

Repetition blindness (RB) is the failure to recognize repetition of an item in a rapid visual series of stimuli. We examined RB for English words and pronounceable non-words. Sixty undergraduates each received 192 trials. For each trial, 6-13 items (mean = 9) appeared for 86 ms sequentially in the same location. Half were randomized sequences and half formed meaningful sentences. Each sequence contained two word targets or two non-word targets separated by one to three items. Targets were brighter than the non-target words. Following the sequence, three response items appeared. For repetition trials these included the repeated target and two not-presented fillers; for non-repetition trials these included the two targets and one filler (Arnell & Jolicoeur, 1997). Participants indicated whether there were had been 0, 1 or 2 occurrences of each response item. Analysis of a-prime, percentage correct, and hits-false alarms all indicated RB for words, but no RB for non-words.

Putting automaticity in context: Reducing the Stroop effect

Colin M. MacLeod

University of Toronto at Scarborough

In a recent series of papers, Besner and Stolz have argued that "simply coloring a single letter instead of the whole word eliminated the Stroop effect." They have used this outcome to argue against the concept of universal automaticity of word reading, claiming that reading cannot be automatic if it can be prevented. I will report experiments demonstrating that the Stroop effect is not generally eliminated by this manipulation, although it is reliably decreased across both manual and vocal response modes, and relative to different types of control items. The word definitely is read in the single-letter-colored condition, but its impact on color naming is reduced. Although not diagnostic of a change in automatic reading, this reduction is an important clue to understanding the source(s) of Stroop interference.

Session C - Saturday 22 July 11.20-1 pm

An oblique effect in aesthetics: Homage to Mondrian (1872-1944)

Richard Latto, Douglas Brain and Brian Kelly

University of Liverpool

The effect of the orientation of Mondrian's paintings on their aesthetic appeal was examined. Eight paintings, four with horizontal/vertical frames in the original and four with oblique frames, were presented in eight different orientations and rated for aesthetic appeal on a 7-

point scale.

There was a stronger preference for pictures presented so that their component lines were horizontal and vertical than for pictures presented with their component lines in an oblique orientation. In addition, subjects showed a preference for the original orientation, perhaps because rotation changes the lateral balance of the paintings as well as the orientation of the component lines. There was no overall preference for one frame orientation over another, but there was an interaction between frame orientation and component orientation, resulting in a preference for paintings where the components were parallel to the surrounding frame.

It is suggested that the aesthetic oblique effect reported here is related to the oblique effect in orientation perception and the privileged access which horizontal and vertical lines have to the visual system. This offers support for one possible mechanism underlying aesthetic judgements of abstract patterns: we find pleasing those stimuli which are closely tuned to the properties of the human visual system (Latto, 1995).

Latto, R. (1995). The brain of the beholder. In R. L. Gregory, J. Harris, P. Heard & D. Rose (Eds.), *The Artful Eye* (pp. 66-94). Oxford, U.K.: Oxford University Press.

Five plus two equals yellow: Concept-driven photisms in digit - colour synaesthesia

Mike J Dixon, Daniel Smilek, Cera Cudahy and Philip M Merikle

University of Waterloo

When the synaesthete C views black digits, each number elicits a photism - a visual experience of a specific colour. Cytowic (1993; 1997) has claimed that photisms differ from imagery in their automaticity and their reliance on an external stimulus to elicit them. To assess the automaticity of C's photisms, digits were displayed in colours incongruent or congruent with her photism colours. Despite attempts to ignore digits, C's colour naming reaction times were significantly slower for incongruent trials than congruent trials. Finally, we triggered automatic photisms without ever physically presenting an inducing stimulus. C was shown arithmetic problems (e.g. $5 + 2$) followed by a colour patch that she had to name. Naming times were significantly slower when colours were incongruent with C's photisms for the answers to problems than when colour patches were congruent. We conclude that C's photisms are automatic, but can be induced by activating the concept of digits.

Repetition priming for moving faces.

K Lander and V Bruce

University of Stirling

Recent experiments suggest that seeing a familiar face move adds additional 'dynamic' information for the viewer, useful in the recognition of identity (see Knight & Johnston, 1997; Lander, Bruce & Hill, 1999 in press; Lander, Christie & Bruce, 1999). This finding is consistent with the idea that familiar movement patterns – either of faces generally, or specific faces, help in their recognition. It is unclear, however, how such information may be stored in memory. One possibility is that the movement patterns are quite distinct from the static form-based representation. Alternatively, the visual representations of familiar faces may intrinsically incorporate dynamic information (cf. dynamic representations, Freyd, 1993).

Here we describe a number of experiments which aim to explore these theoretical possibilities, using a repetition priming technique. Repetition priming is the advantage demonstrated at test when a to-be-recognised item (in this case a face) is encountered earlier, at some time prior to the test event. Results suggest that a moving image primes more effectively than a static image (Experiment 1), even when the same static image is shown in the prime and test phases of the experiment (Experiment 2). This robust priming effect is not simply due to the structured sequence of images contained in a moving sequence (Experiment 3). Results are discussed within the framework of current models of face recognition.

Freyd, J.J. (1993). Five hunches about perceptual processes and dynamic representations. In Meyer, D. & Kornblum, S. (Eds), *Attention and Performance, XIV: Synergies in Experimental Psychology, Artificial Intelligence and Cognitive Neuroscience - A Silver Jubilee*, 99-120. Cambridge, MA: MIT Press,

Knight, B. & Johnston, A. (1997). The role of movement in face recognition. *Visual Cognition*, **4(3)**, 265-273.

Lander, K., Christie, F. & Bruce, V. (1999). The role of movement in the recognition of famous faces. *Memory & Cognition*, **27(6)**, 974-985.

Lander, K., Bruce, V. & Hill, H. (1999, in press). Evaluating the effectiveness of pixelation and blurring on masking the identity of familiar faces. *Applied Cognitive Psychology*.

Getting to know you...how we learn new faces

Vicki Bruce and Zoe Henderson

University of Stirling

Recent research has highlighted the differences between the visual representations of familiar and unfamiliar faces. Unfamiliar faces are stored in an image-specific way, allowing only limited generalisation to different viewpoints, expressions or lighting conditions.

Familiar face recognition, in contrast, is robust over many such variations in viewing conditions. Representations for familiar faces are weighted more towards internal features compared with unfamiliar faces. Angeli, Bruce and H. Ellis (ECVP, 1999) described preliminary results demonstrating that the shift in processing from external to internal face features can be used as an index of familiarisation as participants learn a series of individuals on video over several days, and at a recent EPS meeting, O'Donnell and Bruce described experiments suggesting that it was particularly the eyes which benefit from familiarisation. In this paper we describe the results of a new experiment where we examine the process of familiarisation when participants learn new facial identities from moving compared with multiple static images.

Individual differences in the development of face recognition: Support for a maturational change at age eight.

P A McMullen, P Dunham, and F Dunham

Dalhousie University, Halifax

Carey & Diamond (1977) suggested that before the age of 8, children recognize a face by its individual features. After this age, a whole-face (holistic) strategy has developed. Boys and girls aged 7 and 11 performed tests of Mooney faces (a test of holistic processing), Embedded figures (a test of feature-based processing) and upright and inverted face recognition. Children aged 7, successfully recognized upright faces but were at chance at the recognition of inverted faces. More importantly, upright face recognition correlated with Embedded figures performance ($r = 0.56$, $p < 0.01$) and not with Mooney face performance. Children aged 11, recognized upright and inverted faces above chance levels. Notably, their results showed the opposite pattern to those of the younger children. Upright face recognition now correlated with Mooney face performance ($r = 0.45$, $p < 0.05$) and not with Embedded figures performance. The maturational hypothesis of face recognition was tested from an individual differences approach and supported.

Session A - Saturday 22 July 2-4 pm

Correlation, consistency, and age of acquisition effects in adult lexical processing

Andy Ellis¹, Antonina Scarna¹, Josephine Monaghan¹ and Matt Lambon Ralph²

1. University of York
2. MRC Cognition and Brain Sciences Unit, Cambridge

Ellis and Lambon Ralph (in press) have proposed an explanation of age of acquisition effects in adult word recognition and production in terms of the behaviour of distributed memory networks trained by backpropagation. Such networks are widely used to simulate aspects of adult lexical processing. Ellis and Lambon Ralph showed that if a network is trained from the outset on one set of "early"

patterns, then later patterns are added, with all of the patterns now being trained in a cumulative and interleaved fashion, then performance of the network remains superior on early compare with late patterns, even after extensive further training. This effect cannot be explained in terms of simple differences in the cumulative frequency of presentation of the patterns. Age of acquisition effects, like frequency effects, are a natural and probably inescapable property of these networks. We present new simulations which show that the age of acquisition is modulated by the similarity or correlation between early and late patterns. When they have low correlations, network structure built up during training on the early patterns is unhelpful for the assimilation of later patterns which fail to attain representations comparable to those of the early patterns. In contrast, when the correlation between early and late patterns is high, the late patterns can take advantage of the network structure established by the early patterns and age of acquisition effects are reduced. We present old and new data showing that age of acquisition effects are larger when the correlation between early and late items is low (naming objects in English and Italian; reading Japanese kanji; reading aloud exception words in English) and smaller or nonexistent when the correlation is high (reading aloud consistent words in English, and reading aloud in Italian).

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

Homophone effects in lexical decision: An examination of a feedback account

Penny M Pexman¹ and Stephen J Lupker²

1. University of Calgary

2. University of Western Ontario

Pexman, Lupker, and Jared (in review) observed the standard finding of longer response times in lexical decision tasks (LDT) to homophones (e.g., MAID/MADE) than to non-homophonic control words. Pexman et al. attributed this homophone effect to the nature of the feedback from phonology to orthography for homophones (i.e., one phonological code feeds back to two orthographic codes). In these experiments we tested three predictions of this feedback account: (a) although homophone effects are observed in LDT, regularity and homograph effects should not be, since most exception words (e.g., HAVE) and homographs (e.g., WIND) do not create the same feedback problems, (b) using pseudohomophones as the nonwords should affect only the size of the homophone effect and (c) in a phonological LDT ("does it sound like a real word?") regularity and homograph effects should be observed but homophone effects should not. The results supported our predictions for all but a subset of our (poorer) readers.

Lexical and relation-based influences on the interpretation of noun-noun phrases

Christina L Gagne

University of Western Ontario

Recent exposure to a similar combination influences the interpretation of a noun-noun phrase by increasing the availability of the phrase's lexical entries and (in some cases) the availability of the relation used to interpret the combination. The data show that the amount of lexical and relation priming obtained depends on whether the modifier or head noun is in common between the prime and target. The head noun prime yields more lexical priming than does the modifier prime. In contrast, relation priming is only obtained from the modifier prime. For example, oil treatment is easier to interpret when it has been preceded by a combination (e.g., oil moisturizer) using the same relation than when preceded by a combination (e.g., oil accident) using a different relation. The data are used to evaluate current theories of conceptual combination.

Phonological mediation in a semantic discrimination task: Evidence from French

Isabelle Gonthier, Alain Desrochers and Dominique Landry

University of Ottawa

Lexical phonology and semantic was investigated in word recognition. Word triplets were presented to readers who were asked to decide which of the first two words, a target word (e.g., SABLE) or a distractor, was semantically related to a test word (e.g., PLAGÉ). The distractor was either homophonic with a semantically related word (e.g., MÈRE which can evoke MER) or a visually similar control stimulus (e.g., MOIS). The imagery value of word triplets was manipulated. The results indicated that a) response latencies were slower when the distractor evoked a semantically related homophone than a visually similar control; b) responses to high-imagery stimuli were faster than those to low-imagery stimuli; c) no interaction was detected between the homophonic and imagery effects. These results suggest that evoked imagery does affect word meaning processing but does not constrain phonological mediation in this task.

Separating form and semantics from morphology: Evidence from cross modal masked priming.

William Marslen-Wilson and Mike Ford

MRC Cognition and Brain Sciences Unit, Cambridge

A recurring issue in the study of the English mental lexicon is to separate out evidence for morphological structure in underlying representation from the effects of form overlap (orthographic or phonological) and semantic overlap between morphologically related

items (e.g., darkness/dark, rebuild/build). A partial solution to this is provided by masked priming, which can show robust morphological effects in the absence of semantic effects. However, conventional masked priming is strongly affected by orthographic overlap between primes and targets. Here we report a new masked priming paradigm, where a masked visual prime is followed not by a visual target but by an auditory target. Here there is no direct form overlap between prime and target. In two experiments we find significant identity priming (where prime and target are the same word), and significant priming between morphologically related prime/target pairs, such as adaptable/adapt. This has implications both for claims about the role of morphology in the mental lexicon, and for our understanding of the underlying mechanisms of masked priming.

The rise and fall of frequency and imageability: Noun and verb production in semantic dementia

Helen Bird¹, Matthew A Lambon Ralph¹, Karalyn Patterson¹ and John R Hodges^{1,2}

1. MRC Cognition and Brain Sciences Unit, Cambridge

2. University Neurology Unit, Addenbrooke's Hospital, Cambridge

This study examines the impact of progressive degeneration of conceptual knowledge on the content words used in connected speech elicited using the Cookie Theft picture description (Goodglass & Kaplan 1983). We began with an analysis of control subjects' descriptions with regard to word types and their frequency and imageability. Because the impairment of conceptual knowledge in semantic dementia is graded by concept familiarity, we created a model of a standardised normal Cookie Theft description that was then progressively degraded by the systematic removal of lower bands of word frequency. We drew two main predictions from this model: reduced availability of the lower bands of word frequency should result in (a) an apparent deficit for noun retrieval in relation to verb retrieval, and (b) an apparent reverse imageability effect. Results from a longitudinal study, in which three patients with semantic dementia each described the Cookie Theft picture on three occasions during the progression of their disease, confirmed these predictions. An additional cross-sectional analysis, adding narratives from a larger number of cases, demonstrated that the decline in ability to produce suitable words for the picture description is closely related to the extent of semantic impairment as measured in tests of word comprehension and production. Both verbs and nouns are affected by the degradation of semantic memory; the fact that the impairment to noun production is manifested earlier and more catastrophically may be attributed to the relatively lower frequency of these terms.

Goodglass, H. & Kaplan, E. (1983). *The Assessment of Aphasia and Related Disorders*. (2nd edition). Lea & Febiger, Philadelphia.

Session B – Saturday 22 July 2-4 pm

The name game: Using retrieval practice to learn the names of group members.

Peter E Morris¹ and Catherine O Fritz²

1. Lancaster University

2. Bolton Institute

In medium sized groups such as classes it is often desirable that the members become acquainted with one another. To this end various methods of introducing group members are used with questionable degrees of success. One method of introduction, the Name Game, is based upon the principles of retrieval practice and anecdotal evidence supports its effectiveness. We compared Simple and Elaborate versions of the Name Game with a widely used method - Pairwise Introductions - and found that the Name Game participants were much better at remembering the full names of the members of their groups after 30 minutes, 2 weeks and 11 months. The effectiveness of the two Name Game methods did not differ. In a second experiment, we tested the contribution of retrieval practice by comparing the two versions of the Name Game with a procedure that matched them in number of repetitions and time spent on the task. Again, the Name Games were much superior, illustrating the benefits of retrieval practice in general and the Name Game technique in particular.

Interrupting recognition memory: Tests of the increment-to-familiarity account of the revelation effect

Marty W Niewiadomski and William E Hockley (Presenter: William E. Hockley)

Wilfrid Laurier University

The revelation effect is a puzzling phenomenon in which items on a recognition test are more likely to be judged old when they are immediately preceded by a problem solving task such as anagram solution. We evaluated Westerman and Greene's (1998) increment-to-familiarity account of this phenomenon in a series of experiments designed to examine the temporal and cumulative effects of the preceding task on the recognition probe. We found comparable revelation effects when the probe was preceded by (a) a single anagram versus two anagrams, (b) either combination of a single anagram and an arithmetic task sequence, and (c) one versus two arithmetic tasks. The results do not support the increment-to-familiarity account of the revelation effect, but are consistent with Hicks and Marsh's (1998) decision-based interpretation, in which it is assumed that the preceding task adds noise to working memory leading subjects to adopt a more liberal recognition decision criterion.

Feature frequency in recognition from short-term memory: A challenge for current theory

D J K Mewhort and E E Johns

Queen's University

Current global models of recognition memory assume a fundamental role for frequency at the feature level: The more often the constituent features of a test item have occurred during study, the easier it is to call OLD and the harder it is to call NEW. We manipulated the featural composition of artificial stimuli in a short-term recognition memory task. Performance on distractor items deteriorated with the number of constituent features studied, but, contrary to prediction, did not vary with the number of times a presented feature had occurred in the study set. Conversely, performance on targets improved when constituent features had occurred in other items within the study set. We conclude that different kinds of evidence underlie OLD and NEW responses and that recognition decisions are not correctly modelled with a signal-detection mechanism. Note that the mirror effect is not a source of difficulty for our position.

Estimating monitoring, bias and retrieval

Philip A Higham

University of Northern BC

Research is described in which a Type 2 signal detection model (SDM) is applied to data from various memory tests, yielding estimates of report bias (the tendency to offer answers to questions on a memory test or the tendency to offer information during a memory interview), monitoring (a meta-memory parameter indexed by the tendency to offer correct information and withhold incorrect information) and retrieval (the proportion of correct information on a memory test once all information is obtained). The research indicates that the estimates are affected, and sometimes dissociated, by variables (e.g., a target word's strength-of-association to a retrieval cue) in logical and sensible ways that are consistent with current models of memory. The research also indicates that the SDM model can be applied to real-world memory problems as well, such as how best to enhance performance on aptitude tests (e.g., SAT) or on multiple-choice exams.

The role of source memory in setting the criteria for signal decision processes

C A G Hayman¹, J Fugelsang², J Cofell³ and R P Cribbie⁴

1. Lakehead University

2. University of Saskatchewan

3. University of Western Ontario

4. University of Manitoba

In a series of experiments testing both words and pictures as to-be-remembered material, we found that subjects recall more about the source of a memory event when they gave a "REMEMBER" rather than "KNOW" response in a prior test of recognition. Such a finding is inconsistent with the assumption of a unidimensional vector of memory strength required in signal detection based reinterpretations (Donaldson, 1996; Hirshman & Master, 1997) of dual-process views of recognition memory (Gardiner & Java, 1993; Jacoby & Dallas, 1981; Mandler, 1980). Because increase in source memory requires increases in the multidimensionality of memory, we suggest that the unidimensional vector of memory strength hypothesized in these signal detection models is at best an approximation of a multidimensional memory signal, and that criteria used in signal detection models of "REMEMBER" and "KNOW" response may be set relative to the availability of memory information for source.

Implicit/explicit memory versus analytic/nonanalytic processing: Re-thinking the mere exposure effect

Bruce W A Whittlesea and John R Price

Simon Fraser University

In studies of the mere exposure effect, rapid presentation of training items can increase liking without producing accurate recognition. The effect on liking has been explained as a misattribution of fluency caused by prior presentation. However, fluency is also a source of feelings of familiarity. It is therefore surprising that prior experience can produce liking without also causing familiarity-based recognition. We suggest that when study opportunities are minimal and test items are perceptually similar, people adopt an analytic approach, attempting to recognize distinctive features. That strategy fails because rapid presentation prevents effective encoding of such features; but it also prevents people from experiencing fluency and a consequent feeling of familiarity. We suggest that the liking-without-recognition effect results from using an effective (nonanalytic) strategy in the pleasantness task, but an ineffective (analytic) strategy in the recognition task. We suggest that explanations of the mere exposure effect based on a distinction between implicit and explicit memory are unnecessary.

Session C – Saturday 22 July 2-4 pm

Unlearned and learned behaviour of bumble bees in the absence of reward

V Simonds and C M S Plowright

University of Ottawa

This work features the development of a unique methodology to test unlearned and learned behaviour of bumble bees in the absence of reward. Two questions were asked: What attracts newly emerged bees to flowers? Does the attraction habituate over time? Two experiments were designed to test these questions. 1A: Bees made choices in a 12-arm maze between four colours and preferred yellow or blue over white or red. 1B: Choices for yellow decreased from the first to the second and third testing sessions. 2A: Bees preferred a radial pattern over a concentric pattern or a plain disc. 2B: Choice frequencies for radial decreased over the first two sessions, but increased for a novel stimulus in the third session. Results support previous findings in unlearned responses to pattern and colour, and support the previously neglected notion that bumble bees learn in the absence of reward.

The discrimination of structure

David N George and John M Pearce

Cardiff University

The solution of certain, configural, discriminations depends upon learning about the significance of combinations of stimuli, rather than of individual stimuli. According to elemental theories of conditioning (e.g., Wagner & Rescorla, 1972) mastery of a configural discrimination depends upon associations involving unique cues that are created by the combination of two or more stimuli. Configural theories of conditioning (Pearce, 1994), on the other hand, explain the solution of these discriminations by allowing the features of a pattern of stimulation collectively to signal the outcome of a trial. The experiment to be described demonstrates that pigeons can solve a complex configural discrimination which both the Wagner-Rescorla (1972) theory, and the theory of Pearce (1994), predict will be insoluble. The discrimination depends upon an appreciation of the structure of the signals for reward and nonreward. Various ways in which elemental and configural theories of conditioning might be modified to explain our results will be considered.

Pearce, J. M. (1994). Similarity and discrimination: A selective review and a connectionist model. *Psychological Review*, 101, 587-607.

Wagner, A. R., & Rescorla, R. A. (1972). Inhibition in Pavlovian conditioning: Application of a theory. In M. S. Halliday & R. A. Boakes (Eds.), *Inhibition and Learning*. San Diego, CA: Academic Press.

Losing a conditioned aversion to a taste: Extinction or counter-conditioning?

Bob Boakes and Paul Whitfield

University of Sydney, Australia

Recent findings from human evaluative conditioning and from flavour preference conditioning in rats prompted re-examination of Garcia's original claim that conditioned taste aversions are unusually resistant to extinction. Evidence against this claim has been based on giving repeated single-bottle exposure to an averted taste to thirsty rats, a procedure that typically leads to loss of the aversion. However, it also involves pairing the taste with relief of fluid deprivation and such pairing could produce counter-conditioning of the aversion. This possibility was examined by orally perfusing rats with the averted taste either just before (Thirsty condition) or just after (Sated condition) they received their daily period of access to water. Repeated exposure to the taste using this method was found to produce more rapid loss of the taste aversion in the Thirsty than in the Sated condition. The results suggest that counter-conditioning does play a role in the loss of a conditioned aversion and that, in the absence of this factor, Garcia's claim might well be correct.

The anti-emetic drug, ondansetron, interferes with lithium-induced conditioned rejection reactions, but not lithium-induced taste avoidance.

Cheryl L Limebeer and Linda A Parker

Wilfrid Laurier University

Conditioned rejection reactions displayed in the taste reactivity test are exclusively by treatments that elicit nausea. The present experiments demonstrated that pretreatment with the anti-nausea agent, ondansetron, interfered with both the establishment and the expression of conditioned rejection reactions. Ondansetron did not interfere with lithium-induced taste avoidance in either a one-bottle or a two-bottle test. In fact, when rejection reactions were measured during a consumption test, ondansetron selectively attenuated rejection reactions without modifying consumption. These results suggest that conditioned rejection reactions, but not conditioned taste avoidance, reflect nausea in rats that can be attenuated by ondansetron pretreatment.

Do squid make a visual language on their skin? The case of the Zebra display.

Jennifer A Mather

Department of Psychology & Neuroscience, University of Lethbridge

In the 1980s, Martin Moynihan suggested that the production of a combination of local components of skin pattern changes on the skin of the squid indicated an ability to form a visual language. But production of a range of components, no matter how wide or how flexible in combination, does not prove a language. The present study focuses on the variation in one display, the dark-and-pale striped Zebra. Observations of over 1200 instances of Zebra displays of *Sepioteuthis sepioidea* in the waters off the coast of Bonaire confirmed a huge variation in this display. Zebra could be produced on part or all of the body surface, by males or females, in different intensities

and to a variety of targets. Despite the variety, the display appeared to be essentially an agonistic signal of internal state. A quantitative score of signal intensity could be calculated and was often correlated with success in intraspecific interactions. Nevertheless, the intensity was not always correlated with dominance, the signal was often directional and it was also modified to a ritualized Formal Zebra contests between adult males. This display, while of a sophistication and range of use that fulfils Moynihan's prediction of communicative sophistication, does not yet appear to suggest a visual language.

The relation between stress and the social organization of wolves and other wild canids

Peter J McLeod, Simon Gadbois and Will Moger

Acadia University, Nova Scotia

We have been relating detailed data on social behaviour of a captive wolf pack to their levels of the stress responsive hormone cortisol, assayed non-invasively from urine-contaminated snow. These data show significant differences among individuals that could be due to social rank and/or challenges to their rank. Adrenal pathology due to a tumour is a possible explanation in one case as well.

Inconsistent correlations between cortisol and rank have been reported across a variety of wild canids and other social mammals. We can account for some of these differences by relating them to differences in social organization and reproductive strategies. Theoretical considerations of the degree to which species are monogamous and cooperative breeders are particularly relevant in accounting for existing data.

END OF MEETING

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2000 - July 20/22 University of Cambridge Poster Program

Thursday 20 July 4.30-6.30, King's College

Presenters are asked to be at their posters for at least one hour. We suggest that odd-numbered poster presenters be available from 16:30-17:30, and even-numbered poster presenters from 17:30-18:30.

Pharmacology & neuroscience

1 Heather M Schellinck, Allison Clarke, Richard E Brown and Michael Wilkinson (Dept of Psychology and Dept of Obstetrics and Gynecology, Dalhousie Univ, Halifax)

The identification of pheromonal components in male mouse urine which initiate puberty acceleration in female mice

2 M P McFadyen, N Carrey and R E Brown (Depts of Psychology and Psychiatry, Dalhousie Univ, Halifax)

Behavioural and cognitive response to chronic ritalin administration during prepubertal development in mice.

3 M R Penner, M McFadyen, R E Brown and N Carrey (Dalhousie Univ, Halifax)

Effects of chronic and acute ritalin treatment on mouse pup development

4 R A M Brown, S G Walling and C W Harley (Memorial Univ of Newfoundland)

Synaptic release of norepinephrine from the locus coeruleus in vivo increases epsp slope in putative late-phase potentiation in the dentate gyrus.

5 Soyon Ahn, Stan B Floresco and Anthony G Phillips (Univ of British Columbia)

Dopamine efflux in the rat nucleus accumbens during exploratory foraging on a radial-arm maze

6 Tod E Kippin, Veneta Sotiropoulos and James G Pfaus (Center for Studies in Behavioral Neurobiology, Concordia Univ, Montreal)

The influence of lesions of the nucleus accumbens and lateral hypothalamus on anxiety and reactivity in the male rat.

7 Steven J Barnes, John P J Pinel, Lee H Francis and Gagan S Wig (Univ of British Columbia)

Conditioning of interictal behaviors by amygdala kindling.

8 P J Blundell and A S Killcross (Univ of York and Cardiff Univ)

The basolateral amygdala (BLA) is involved in sensory and not motivational representations of outcomes.

9 J M Barry, G M Martin, C W Harley and D T Laidley (Departments. of Biopsychology and Psychology, Memorial University of Newfoundland)

Examination of conditional control of place fields by black/white discrimination

Animal behaviour & cognition

10 V M Afonso and R Eikelboom. (Wilfrid Laurier Univ)

Wheel running, feeding, and weight in weanling and adult male rats

11 Dana Church and C M S Plowright (Univ of Ottawa)

How well do boys do? Colour and pattern recognition by male bumblebees

12 Catherine A Forestell and Vincent M LoLordo (Dalhousie Univ, Halifax)

Why do orally consumed calories fail to condition preferences for relatively unacceptable tastes?

13 J S Cohen, Ann-Marie Simpson, Kim Westlake and Michelle Pepin (Univ of Windsor)

Representations of serial reward patterns in the T-maze by rats

14 Debbie M Kelly and Marcia L Spetch (Univ of Alberta)

Use of geometric and featural cues in a touch-screen environment

Vision & face processing

15 K E Jaskie and P A McMullen (Dalhousie Univ, Halifax)

One or multiple mechanisms underlying orientation-invariant object identification?

16 M E Large, P A McMullen and J Hamm (Dalhousie Univ, Halifax)

A strong test of the role of axes of elongation and symmetry in rotated object identification.

17 Philip Servos, Rieko Osu and Mitsuo Kawato (Wilfrid Laurier Univ, Waterloo, Canada, Kawato Dynamic Brain Project, JST, Kyoto, Japan and ATR Human Information Processing Research Labs, Kyoto, Japan)

The neural substrates of biological motion perception: An fMRI study

18 Jules Davidoff and Elizabeth Warrington (Goldsmiths College, Univ of London and National Hospital, London)

Particular difficulties with mirror images

19 Adam Cooper (Univ of Birmingham)

When two is less than one: A new, object-based visual illusion

20 Robert McIntosh, Chris Dijkerman, Mark Mon-Williams and A David Milner (Univ of Durham, Univ of Utrecht and Univ of St

Andrews)

Visuomotor processing of spatial layout in visual form agnosia

21 Daniel Saumier and Martin Arguin (Univ de Montréal & Centre de Recherche and Institut Universitaire de Gériatrie de Montréal)

Local and global visual processing in normal and impaired face recognition.

22 Chris Kelland Friesen, Walter F. Bischof and Alan Kingstone (Univ of Alberta and Univ of British Columbia)

The effects of face inversion on reflexive attention to gaze direction

Space & time representation

23 Tamsen E Taylor, Christina L Gagné and Roy Eagleson (Univ of Western Ontario)

Producing spatial descriptions: The effect of functional relations and orientation

24 Patricia Boechler and Michael R W Dawson (Univ of Alberta)

How might an artificial neural network represent metric space?

25 M-Y Ho, T-J Chiang, A S A Al-Ruwaitea, S Mobini, C M Bradshaw and E Szabadi (Division of Psychiatry, Univ of Nottingham)

Effects of the 5-HT_{1A} receptor agonist 8-hydroxy-DPAT on performance on two operant timing schedules

26 Laura Mihaita and Robert Rousseau (Univ of Laval, Quebec)

Temporal discrimination and effect of marker duration

Attention

27 Chris Olivers and Glyn Humphreys (Univ of Birmingham)

Visual marking is affected by the attentional blink

28 E S Olds, W B Cowan and P Jolicoeur (Wilfrid Laurier Univ)

Visual search keeps track of where the target is not

29 Tracy L Taylor-Helmick and Michael M P W Donnelly (Dalhousie Univ and Vanderbilt Univ, USA)

IOR and the repetition of location, identity, and response

30 Mark J Fenske and Jennifer A Stolz (Univ of Waterloo)

Exogenous and endogenous selection in partial report

31 Juan Lupiáñez, Bruce Milliken and M Jesús Funes (Universidad de Granada, Spain and McMaster Univ)

Strategic influences on the time course of exogenous attentional orienting effects

32 Robert J Houghton, William J Macken and Dylan M Jones (Cardiff Univ)

The influence of non-visual attentional tasks upon the visual motion aftereffect

33 Jason Chan, Alex Simm and Charles Spence (Oxford Univ)

Crossmodal attention and the perceptual load hypothesis

34 Daryl E Wilson, Miya Muroi and Colin M MacLeod (Univ of Toronto at Scarborough)

Allocation of spare capacity: Opposite effects of search load and perceptual load

35 Matthew Brown, Martha Anne Roberts and Derek Besner (Univ of Waterloo)

Is semantic activation in visual word recognition capacity free?

36 Bill Macken and Dylan Jones (Cardiff Univ)

The fate of unattended auditory information

37 Amelia Hunt, Jason Ivanoff and Raymond Klein (Dalhousie Univ, Halifax)

Switch costs without task-switching?

38 Leigh Riby, Tim Perfect and Brian Stollery (Univ of Bristol and Univ of Plymouth)

Dual task performance in older adults

39 Helen Johnson and Patrick Haggard (Inst of Cognitive Neuroscience, Dept of Psychology, Univ College London)

Conscious awareness of stimulus and response in a Posner task.

40 L A McWilliams, S H Stewart, R M Klein, J R Blackburn and R M McInerney (Univ of Manitoba)

Effects of a mildly intoxicating dose of alcohol on various components of attention.

Short-term/working memory

41 Marie Poirier, Josée Turcotte, Gerry Tehan and Kevin Allen (Bolton Inst, Univ of Laval and Univ of Southern Queensland, Australia)

The effect of set size and task on error patterns in immediate memory performance

42 Katy J Loble, Susan E Gathercole and Alan D Baddeley (Univ of Bristol)

Do phonological short term memory and episodic memory contribute to performance on complex working memory span tests?

43 Claudette Fortin, Julie Champagne and Marie Poirier (Université Laval, Québec)

Effect of processing temporal or spatial order in short-term memory on concurrent time estimation

44 Elizabeth A Maylor and Richard N A Henson (Univ of Warwick and Inst of Cognitive Neuroscience, Univ College London)

Aging and the ranschburg effect: No evidence of reduced response suppression in old age.

Long-term memory

45 Josée Turcotte, Sylvain Gagnon and Marie Poirier (Université Laval, Québec, Univ du Québec à Trois-Rivières and Bolton Inst)

Is inhibition induced by the retrieval-practice paradigm?

46 Erin D Sheard and Colin M MacLeod (Univ of Toronto at Scarborough)

Robust false memory effects under conditions of paired-associate learning

47 A D Hughes and R Cabeza (Univ of Alberta)

Effects of interference in an AB-AC paradigm: Event-related potentials of associative recall

48 Carole Peterson and Nikki Whalen (Memorial Univ of Newfoundland)

Five years later: Children's memory for stressful experiences

49 Alison L Chasteen, Denise C Park and Norbert Schwarz (Univ of Toronto and Univ of Michigan, USA)

Aging and goal pursuit: The effects of implementation intentions on prospective memory in older adults.

Causal learning, association & categorisation

50 M E Le Pelley and I P L McLaren (Univ of Cambridge)

Retrospective revaluation in humans.

51 F J Lopez, P L Cobos, A Caño and David Shanks (Univ of Malaga, Spain and Univ College London)

Mechanisms of predictive and diagnostic causal inferences

52 Margo C Watt and Peter J McLeod (Dalhousie Univ and Acadia Univ)

A developmental study of contingency perception and its relation to negative affect

53 R Spiegel (Univ of Cambridge)

Human sequence learning: Evidence for an underlying associative and/or cognitive process

54 F W Jones and I P L McLaren (Univ of Cambridge)

A qualitative dissociation in sequence learning.

55 Mark Suret and I P L McLaren (Univ of Cambridge)

Category creation - association or competition?

56 Jason M Tangen, John R Vokey and Lorraine G Allan (McMaster Univ)

What's in a fingerprint? A PCA approach to fingerprint identification and categorisation

Word recognition and priming

57 John Logan and David Ridgeway (Carleton University)

The effect of phonotactics and neighbourhood density on spoken word recognition in preschoolers

58 William J Owen and Ron Borowsky (Univ of Saskatchewan)

Pseudohomophone base-word frequency and lexicality effects

59 Bahman Baluch and Derek Besner (Middlesex Univ and Univ of Waterloo)

Basic processes in reading: Semantics affects speeded naming of high frequency words in an alphabetic script

60 Martha Anne Roberts, Kathleen Rastle, Max Coltheart and Derek Besner (Univ of Waterloo)

When parallel processing in visual word recognition is not enough: New evidence from naming

61 Glen E Bodner and Michael E J Masson (Univ of Victoria)

Prime validity modulates masked priming

62 Penny A MacDonald, Colin M MacLeod and Ken N Seergobin (McMaster Univ and Univ of Toronto at Scarborough)

Negative priming for homophone and pseudohomophone pairs: Further support for a retrieval-based account of negative priming.

Language, reading, learning disability

63 Chris Fennell and Janet Werker (Univ of British Columbia)

Do "bilingual" infants use fine phonetic detail in word learning tasks?

64 Adam McCrimmon, Andrea N Welder and Susan A Graham (Univ of Calgary)

Preschoolers' and adults' interpretations of familiar and novel adjectives

65 Alice Spooner, Sue Gathercole and Alan Baddeley (Univ of Bristol)

Poor comprehenders can integrate and retain semantic information from heard text

67 Catherine G Penney (Memorial Univ, St. John's)

Case studies in dyslexia

68 Sandra Martin-Chang and Annalena Venneri (McMaster Univ and Univ of Aberdeen)

Dissociating performance in written and oral calculation: Evidence from right hemisphere developmental learning disability

Emotion, autism, individual differences

69 F Dolcos and R Cabeza (Univ of Alberta)

Electrophysiology of emotional memory: Evidence for the valence hypothesis

70 Suzanne Hala, Penny Pexman and Christa Leibel (Univ of Calgary)

Priming the meaning of homographs in children with autism

71 Patricia Cowell, Matthew Howard, Jill Boucher, Neil Roberts, Andrew Mayes and Paul Broks (Dept of Human Communication Sciences, Univ of Sheffield, Magnetic Resonance and Image Analysis Research Centre, Univ of Liverpool and Univ of Warwick)

Multiple neuroanatomical features of high functioning autism: A structural MRI study.

72 Carrie E Sniderman and Louis A Schmidt (McMaster Univ)

Stability of frontal electroencephalogram (EEG) measures and cognitive and affective development in children

73 Antonia Mantonakis and Douglas A Bors (Univ of Toronto at Scarborough)

Differences in reported test anxiety of native vs. non-native english speakers

74 Philip A Murphy, Jeremy M Barry and Peter G Henke (St. Francis Xavier Univ, Antigonish)

Temporolimbic functions: Anxiety, depression and cognitive flexibility in University students

75 Tonya L Stokes and Douglas A Bors (Univ of Toronto at Scarborough)

Raven's advanced progressive matrices test is a measure of 'G': Evidence in support of a single factor model

76 Alick Elithorn, David Jones and Mary Norrish (Children's Hope Foundation, Birkbeck, PRIME)

Motor priming and the cross modality problem

2000 - July 20/22 University of Cambridge Posters Abstracts

1 The identification of pheromonal components in male mouse urine which initiate puberty acceleration in female mice

Heather M Schellinck¹, Allison Clarke¹, Richard E Brown¹ and Michael Wilkinson²

1. Department of Psychology' Dalhousie University, Halifax

2. Department of Obstetrics and Gynecology, Dalhousie University, Halifax

The pheromonal components of male mouse urine which accelerate puberty in female mice have not been clearly identified. To clarify this issue, we examined the effect of a number of compounds on puberty acceleration and neural activation of the accessory olfactory bulb (AOB). During postnatal days 21-28, juvenile female mice, were exposed to male urine, major urinary proteins (MUPs), MUPs+ligands attached (2-sec-butyl-dihydrothiazole:SBT and 2,3-dehydro-exo-brevicommin:DHB), SBT/DHB alone or saline. Puberty acceleration occurred in mice exposed to male urine or MUPS+ligands but not in mice exposed to SBT/DHB alone or MUPS alone or saline. Immediate early gene expression (c-fos) was significantly higher in the AOB of mice exposed to male urine orMUPS+ligands than in those mice exposed to saline, SBT/DHB or MUPS alone. These results indicate that exposure to specific components of male mouse urine not only induces puberty acceleration but also activates the neural pathway which initiates such an effect.

2 Behavioural and cognitive response to chronic ritalin administration during prepubertal development in mice.

M P McFadyen¹, N Carrey² and R E Brown¹

1. Department of Psychology¹, Dalhousie University, Halifax

2. Department of Psychiatry², Dalhousie University, Halifax

Methylphenidate hydrochloride (Ritalin, MPH) is frequently prescribed as a treatment for children with attention deficit hyperactivity disorder (ADHD); however, little research has been conducted to determine its potential long-term neurobehavioural effects. We assessed the effects of chronic MPH administration on male CD-1 mice treated from 26-32 days of age. When tested at 33 days of age in the open field and elevated plus maze, there were no significant differences in spontaneous locomotion, exploratory, fear-, or anxiety-related behaviours. When tested from 34 to 37 days of age in the Morris water maze, we found no significant effects of any dose of MPH on learning or memory in the mice. While it is difficult to extrapolate directly from these results to clinical effects in humans, our results indicate that pre-exposure to MPH late in the developmental period of mice does not appear to alter later behaviour. Studies that probe further into the potential effects of MPH administration during development are needed to replicate these findings, and to examine other contributing factors, such as developmental stage or duration of MPH administration.

3 Effects of chronic and acute ritalin treatment on mouse pup development

M R Penner¹, M McFadyen¹, R E Brown¹ and N Carrey²

1. Department of Psychology¹, Dalhousie University, Halifax

2. Department of Psychiatry², Dalhousie University, Halifax

Methylphenidate hydrochloride (MPH, Ritalin) is a psychostimulant used to treat children with Attention Deficit Hyperactivity Disorder (ADHD). Despite its widespread use, the consequences of MPH treatment is not well documented in the developing nervous system. This study examined the effects of chronic and acute MPH treatment on isolation-induced ultrasonic vocalizations (UVs), spontaneous locomotor activity, and other aspects of neuromotor development in 3-11 day old outbred CD-1 mouse pups. In experiment 1, pups received daily injections (sc) of either 5mg/kg or 20mg/kg of MPH, saline, or no injection. Testing took place on postnatal days 3, 5, 7, 9, and 11. MPH treatment had no significant effect on body weight, neuromotor development or the number or duration of UVs emitted. However, both doses of MPH resulted in significant increases in locomotor activity. In experiment 2, pups were given a single dose of MPH (5mg/kg or 20mg/kg) or an equivalent amount of saline on one of PND 5, 7, 9, or 11. This acute MPH treatment increased locomotor activity but had no significant effects on neuromotor development or isolation-induced UVs. These results suggest that neither acute nor chronic MPH treatment have short-term effects on the developing nervous system.

4 Synaptic release of norepinephrine from the locus coeruleus in vivo

increases epsp slope in putative late-phase potentiation in the dentate gyrus.

R A M Brown, S G Walling and C W Harley

Memorial University of Newfoundland

Norepinephrine (NE) modulates learning in a variety of tasks. Tetanic long-term potentiation (tLTP) is a model of cellular learning that has distinct early and late phases. In dentate gyrus tLTP facilitates the population spike (Pop spike), a measure of postsynaptic cell firing, and the excitatory postsynaptic potential (EPSP) slope, a measure of synaptic drive. NE depletion, or blockade of α -adrenoreceptors, reduces the probability that tLTP will be elicited in the dentate gyrus. Synaptically released NE can induce an LTP independent of tetanic stimulation in vivo (NE-LTP). Previous work with synaptically released NE has determined that NE-LTP potentiates the Pop spike for at least 30 minutes, but NE-LTP has not been investigated at later time-points. Here we report that NE-LTP can last at least 3 hours, a time-point consistent with late-phase tLTP in in vitro preparations. In addition, Pop spikes that are potentiated at 3 hours are associated with increased EPSP slopes.

5 Dopamine efflux in the rat nucleus accumbens during exploratory foraging on a radial-arm maze

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University of British Columbia

Searching for food in an unpredictable environment on a radial arm maze is dependent on a neural circuit linking the hippocampus and the nucleus accumbens (NAc; Floresco et al., 1997). In addition, mesoaccumbens dopamine (DA) transmission plays an essential role in this behavior (Floresco and Phillips, 1999). In the present study, DA efflux in the NAc was measured in vivo with brain microdialysis while rats searched for 4 pieces of food placed at random on 4 of the 8 arms of a radial maze. Rats that were permitted to explore the maze for food displayed a significant increase (~50%) in DA extracellular levels in the NAc, which remained elevated during a 5 min period of exploration, and for another 5 min while the rats were confined to the center of the maze. These data, in addition to our previous findings suggest that increased mesoaccumbens DA transmission is an important component of exploratory behaviors which are mediated by hippocampal-ventral striatal circuitries. Future experiments will assess the effect of reward omission on the changes in mesoaccumbens DA release during exploratory foraging.

6 The influence of lesions of the nucleus accumbens and lateral hypothalamus on anxiety and reactivity in the male rat.

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The role of nucleus accumbens and lateral hypothalamus in emotional behavior was examined by assessing the effects of lesions of these structures on the elevated-plus maze and the resistance-to-capture tests. Male Long-Evans rats received either 1.0 ul injections of NMDA (20 ug/ul) or vehicle into the nucleus accumbens or lateral hypothalamus. Rats were allowed to recover until feeding and body weight stabilized then were subjected to behavioral tests. Rats receiving either lesion displayed more resistance to capture than did controls with the nucleus accumbens lesioned rats displaying the highest reactivity. On the elevated-plus maze test, rats receiving either lesion spent more time in the closed arms and made fewer crosses than did controls. These results indicate that disruption of the nucleus accumbens or lateral hypothalamus alter the expression of emotional behaviors.

7 Conditioning of Interictal Behaviors by Amygdala Kindling

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We assessed the ability of contextual conditional stimuli that are normally present during the course of kindling to modulate interictal behavior. Rats received 53 stimulations to the left basolateral amygdala in one context (CS+) and 53 sham stimulations (lead was attached but no current was delivered) in another context (CS-), quasirandomly over 53 days. We observed 2 kinds of conditional effects. First, after several stimulations, less ambulatory activity, more freezing, and less rearing reliably occurred in the CS+ context than in the CS- context. Second, after 45 stimulations, all of the rats chose the CS- context over the CS+ context in a conditioned place preference test. Thus, the conditional effects on interictal behavior appear to be an integral, but unrecognized component, of the kindling phenomenon.

8 The basolateral amygdala (BLA) is involved in sensory and not motivational representations of outcomes

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We have shown previously that rats with BLA lesions fail to show a benefit of training with differential outcomes in discrimination learning, and proposed that the BLA modulates the development of representations of the sensory properties of reinforcers (US). We

have used a Pavlovian-instrumental transfer task to confirm that BLA-lesioned rats can access the affective, but not sensory, properties of USs. Rats were trained to press one lever to obtain sucrose solution, and another to obtain a food pellet. In separate sessions they also received Pavlovian conditioning with one CS predicting pellet delivery, and a second CS, sucrose. In an extinction test, lever pressing was measured in the presence of each CS, and in their absence. Sham-lesioned rats made more lever presses during the CSs than in their absence, and this effect was more marked on the lever that had produced the reinforcer predicted by each CS. BLA-lesioned rats also responded more during the CSs, indicating that the arousing properties of the appetitive CSs were intact. However, this increase in responding was not greater on the lever matched to the CS outcome, indicating the failure of BLA-lesioned rats to represent the specific characteristics of the US.

9 Examination of conditional control of place fields by black/white discrimination

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We examined the influence of discrimination learning on the formation of cognitive maps in the rat. We determined whether or not learners of a black/white discrimination would treat goal and delay areas of the test apparatus as different places conditional upon their performance. Lawrence and Hommel (1961) showed that rats would learn a black/white discrimination over a delay when the goal boxes were of different color. The rats could not learn a black/white discrimination over a delay when the goal boxes were of the same color. These results suggested that the experience of reward and non-reward in different environments improves the learning of black/white discrimination. Rats did not demonstrate learning of the discrimination unless a delay at the choice point was imposed. Preliminary data from hippocampal pyramidal cells suggests that rats which exhibit the same cognitive maps in reward and non-reward environments show poor discrimination learning.

10 Wheel running, feeding, and weight in weanling and adult male rats

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The effects of running wheel introduction on running, feeding, and body weight were investigated in 21- (weanling, n=21) and 50- (adult, n=16) day old male Sprague-Dawley rats. Body weight was measured daily while feeding, and wheel running was measured every 5 sec. After a 4 day baseline, 12 weanling and 8 adult rats were given access to wheels for 32 days. Wheel running was similar in weanlings and adults, averaging over 5000 wheel turns a day by the end of the experiment. Only in adults did wheel access suppress

feeding for the initial 5 days. After 7 days, wheel access had no effect on feeding. At both ages, wheel access initially suppressed weight by about 5%, but only in adults was the weight suppression maintained throughout the experiment. This suggests that the rat's age at wheel introduction is a critical variable in the wheel's effects on feeding and weight.

11 How well do boys do? Colour and pattern recognition by male bumblebees

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Male bumblebees have been well-studied in such areas as mating and territoriality, however the area of male bumblebee cognition has been neglected. This study explored colour and pattern discrimination by male bumblebees: two critical abilities as males must forage for themselves once they leave the colony. Males were removed from a colony of *Bombus impatiens* and trained to forage from: (a) blue and yellow artificial flowers, where one colour was rewarding and the other colour unrewarding; or (b) artificial flowers bearing one of two patterns, one rewarding and the other unrewarding. Results from testing sessions (where no flowers were rewarding) showed that males could discriminate well between yellow and blue flowers but could not discriminate between the two patterns.

12 Why do orally consumed calories fail to condition preferences for relatively unacceptable tastes?

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A reverse-order differential conditioning procedure was employed to condition taste preferences in rats. During training, one taste solution (CS+) was presented 3 min after glucose, and another taste solution (CS-) was presented 3 min after water. For one group of animals (Group Sacc), the CS solutions were sucrose octaacetate (SOA) and citric acid (CA) mixed in saccharin, whereas for another group (Group No Sacc) SOA and CA were mixed in water. Subsequently in 2-bottle tests, only Group Sacc expressed a conditioned taste preference for the stimulus paired with glucose. To determine whether low consumption of the taste cues during conditioning prevented the No Sacc Group from acquiring a conditioned taste preference, a second experiment was conducted in which training consumption of the taste cues in Group Sacc was yoked to that of Group No Sacc. Results will be discussed.

13 Representations of serial reward patterns in the T-maze by rats

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We report two experiments in which rats acquired two serial reward patterns over three massed trials in a T-maze: RRN and RNR. One group of rats experienced each pattern paired to a specific arm, e.g., RNR on left arm and RRN on right arm (Arm Associated group) while the other group experienced each pattern equally on each arm (Nonassociated group). Rats were first run on the same pattern over successive three-trial sequences within a session and then received each sequence in a random order within each session. Following these two training phases, rats received test phases with free-choice trials either on the last two or on all three trials within each sequence. Running speeds during the first forced-choice training phase indicated that all rats learned to anticipate the N-trial within each sequence by running slower on that trial (trial tracking). Running speeds on the second training phase, showed that the Arm Associated rats were able to develop accurate track trialing within each pattern but the Nonassociated group was only able to track the RRN pattern. How well the latter rats were able to accomplish this partial trial tracking was based on the general shaping procedures used prior to introduction of the three-trial sequences (Experiments 1 vs 2). Of greater interest were the results of the partial and complete free-choice tests. The pattern of arm alternations indicated that the Arm Associated group may have developed an ordinal position representation of reward sequences to each arm while the Nonassociated group were only able to use a rule based representation in determining which arm to select on its last choice.

14 Use of geometric and featural cues in a touch-screen environment

Debbie M Kelly and Marcia L Spetch

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Many spatial cues may be used to develop a spatial representation of one's environment. In previous studies, pigeons showed use of geometric and featural information to find food located in one corner of a rectangular enclosure. We investigated pigeons' relative use of geometric and featural cues in a 2-dimensional environment. Using a touch screen mounted to a computer monitor, pigeons were presented with images of a rectangular environment. One corner of the rectangle was defined as the target area. Only pecks directed to the target corner were reinforced. The rectangle's orientation on the screen varied across trials. In a Geometric condition, corners could be distinguished only by the rectangle's metric properties, whereas in a Feature condition, distinct features were provided in each corner so that either geometric or featural information could be used. The pigeons were tested with transformations altering the metric or featural properties of the environment.

15 One or multiple mechanisms underlying orientation-invariant object identification?

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Is there a single or multiple mechanisms by which rotated objects are identified independently of orientation? Orientation-invariant identification of objects occurs at the basic and superordinate levels of identity, as well as after practice with naming objects. The underlying mechanism(s) might be based upon the extraction of orientation-invariant features, and/or the global attributes (requiring intact spatial arrangement of the features) of objects. We presented four blocks of feature-scrambled objects followed by a block of intact, rotated objects, in a word-picture verification task that allowed for control of the level at which the objects were identified. If a single, feature-based mechanism underlies orientation-invariant identification then, superordinate- and basic-level identification of scrambled objects should be faster than subordinate-level. Furthermore, practice at identifying scrambled objects should diminish orientation effects in the final block. A global-based mechanism would not produce these effects. Alternatively, one effect may be feature-based and the other not.

16 A strong test of the role of axes of elongation and symmetry in rotated object identification.

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Many theorists have postulated that object axes of elongation and/or symmetry play a role in the recognition of objects. Previous studies have demonstrated that these variables influence decisions about the primary axis of objects. However, these studies did not explicitly investigate effects of elongation and symmetry on object identification. In this study, Experiment 1 assessed the effect of the axis elongation (wide vs. tall) on the time to name common objects rotated in the plane. Similarly, Experiment 2 assessed the effect of the axis of symmetry (symmetric vs. asymmetric). The variables of elongation or symmetry did not interact with orientation. In a stronger test of this hypothesis, Experiment 3 orthogonally controlled both of these variables, manipulated the aspect ratio of elongation and used completely symmetric or asymmetric objects. Additional blocks were run to determine whether these variables influenced the diminishment of orientation effects.

17 The neural substrates of biological motion perception: An fMRI study

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fMRI was used to identify the brain areas related to the perception of biological motion (4T EPI Varian scanner; whole brain; TR=5s). Ten subjects viewed biological motion (a human figure jumping up and down, composed of 22 dots), alternating with a control stimulus created by applying autoregressive models to the biological motion stimulus (such that the dots' speeds and amplitudes were preserved whereas their linking structure was not). By using stimulus bouts of varying lengths the transitions between biological motion and control stimuli were unpredictable. Subjects had to indicate with a button press when these transitions occurred and also performed a task in which they detected short (1s) disturbances within the displays.

To identify shape- and motion-sensitive regions, subjects viewed a series of common objects alternating with band-limited white noise patterns, and linear motion of dots alternating with static dots. Finally, subjects generated imagery of their own arm movements (e.g., scratch back with left hand) alternating with visual imagery of objects (e.g., which larger: airplane or truck). Biological motion specific BOLD signal was found within regions of the lingual and fusiform gyri (generally Brodmann's areas 18, 19, and 37), showing little overlap with object recognition, linear motion, or motion imagery areas.

18 Particular Difficulties with Mirror Images

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We report two case studies of patients who presented with dramatic impairments for discriminating between mirror images. The first patient (FH) showed impaired discrimination of mirror images in the context of impaired spatial perception but with very good recognition of objects when presented in conventional views. Despite her generally poor spatial abilities, FH was able to discriminate between inverted and upright versions of stimuli. The marked deficit for mirror images applied to all stimuli though it was more marked for meaningful objects. The second patient (JBA) also demonstrated poor spatial skills and was unable to recognise half of objects even when presented in a conventional view. The ability of JBA to recognise an object was related to her ability to discriminate the object from its mirror image. Paradoxically, an inability to recognise an object was related to good mirror-image discrimination. In consequence, JBA's superior discrimination of mirror-images over inverted/upright discriminations was restricted to meaningful objects.

19 When two is less than one: A new, object-based visual illusion

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Visual illusions of linear spatial extent (e.g. the Müller-Lyer illusion) have generally been accounted for in terms of contrast or assimilation effects (see Jaeger, 1999 for a summary). While these effects may sometimes depend on the presence or absence of grouping between elements, there has been no demonstration of an illusion which seems to be induced by the nature of grouping and segmentation between target elements. In this paper we present 5 experiments demonstrating the presence of an illusion that is induced by perceptual organisation factors. When elements grouped to form a single perceptual object, distances between target elements were reported as wider than the same physical distances between elements which did not group. The data are consistent with an account based on separate and parallel encoding of spatial relations within single perceptual objects and between multiple perceptual objects, as first suggested by Humphreys and Riddoch (1994; 1995).

Humphreys, G. W., & Riddoch, M. J. (1994). Attention to within-object and between-object spatial representations: Multiple sites for visual selection. Special Issue: The cognitive neuropsychology of attention. *Cognitive Neuropsychology*, 11(2), 207-241.

Humphreys, G. W., & Riddoch, M. J. (1995). Separate coding of space within and between perceptual objects: Evidence from unilateral visual neglect. *Cognitive Neuropsychology*, 12(3), 283-311.

Jaeger, T. B. (1999). Assimilation and contrast in geometrical illusions: A theoretical analysis. *Perceptual and Motor Skills*, 89(1), 249-261.

20 Visuomotor processing of spatial layout in visual form agnosia

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Patient D.F. suffers from visual form agnosia, a profound deficit of visual recognition consequent on bilateral interruption of the ventral visual pathway. Nonetheless, she can use visual information about a target object (its shape, size and orientation, and its location within the environment) to control her actions. These visuomotor abilities are believed to reflect the intact capacities of the dorsal visual stream which, in D.F., is presumed to operate in relative independence from ventral mechanisms of visual processing. We have now studied D.F.'s performance on two slightly more complex visually guided prehension tasks requiring her to take account of the spatial layout of the workspace. The results of the first experiment showed that D.F. is sensitive to the spatial separation between two objects when

opening the thumb and index finger in order to grasp them as a pair. The second experiment demonstrated that D.F. modifies her reaching behaviour, in an anticipatory manner, to take account of potential obstacles to reaching within the workspace. These data extend the known abilities of this much studied patient and suggest that the dorsal stream can incorporate some aspects of spatial layout within its visuomotor control capabilities.

21 Local and global visual processing in normal and impaired face recognition.

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Priming studies involving neurologically intact observers and a prosopagnosic patient (AR) investigated the issue of whether the processing of holistic facial information relies on the prior extraction of local facial parts. Neurologically intact subjects show significant priming from single facial parts (i.e., eyes, nose, mouth or contour) only when they are shown within a facial configuration, and a magnitude of priming effects that increase exponentially as the number of face parts presented as primes increases. Patient AR, however, shows both a lack of priming with single natural face parts and a linear priming function with the number of face parts in the prime. Overall, these findings indicate that face recognition normally involves the segmentation of faces into discrete parts, which interact with one another in the construction of global face representations. It is proposed that AR's prosopagnosia is due to a deficit of this integration process.

22 The effects of face inversion on reflexive attention to gaze direction

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Previous studies of attentional orienting triggered by nonpredictive gaze direction have typically presented a gazing face as a nonpredictive cue, and then a single sudden onset in the periphery as the target. The standard finding is shorter response time (RT) for a target at the gazed-at location compared to the nongazed-at location at short to intermediate cue-to-target stimulus onset asynchronies, or SOAs (Driver et al., 1999; Friesen & Kingstone, 1998; Langton & Bruce, 1999). In three very different studies, this attentional effect of gaze direction was abolished (Kingstone, Friesen, & Gazzaniga, 2000), reduced (Langton & Bruce, 1999), or delayed (Henderson, Friesen, & Kingstone, 1999) when the gazing face was inverted. These results suggest that face processing

interacts with gaze processing. However, in the present study, inverted schematic faces gazing nonpredictively to the left or right produced early and robust orienting, indicating that under some circumstances reflexive attention to gaze direction is not necessarily hampered by face inversion. Possible reasons for these different findings, the relationship between face processing and attention to gaze direction, and likely brain mechanisms will be discussed.

23 Producing spatial descriptions: The effect of functional relations and orientation

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Before a spatial description can be interpreted unambiguously, the reference frame on which it is based must be determined. This poses a problem, because the viewer-centred and object-centred reference frames share spatial terms (e.g. `right`, `front`). Usually the reference frame is not indicated overtly, however, spatial descriptions are usually understood quickly and effortlessly. How is this possible? There is evidence to suggest that people make inferences based on experience with common objects (default assumptions) when producing and interpreting spatial descriptions. This study extends this idea by examining how background knowledge and visual cues interact. Specifically, if the orientation of objects facilitates the functional relationship between the objects, will this affect reference frame choice? In fact, when describing the spatial relationship between functionally related object pairs (e.g., a teapot and a teacup), participants were more likely to use an object-based reference frame when the spatial relationship facilitated the shared function, while a viewer-based reference frame was preferred when the functional relationship was not facilitated by the spatial relationship

24 How might an artificial neural network represent metric space?

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One important representational concept in cognitive psychology is a metric space. In this kind of representation, different entities (e.g., concepts) are represented as points in a multidimensional space. Relations among the objects (e.g., similarity between pairs of concepts) are represented in terms of the distance between objects in the space. In a metric space, there are certain constraints placed upon these distance relationships: minimality (the distance from an entity to itself is 0), symmetry (the distance from entity A to entity B is the same as the distance from entity B to entity A), and the triangle inequality (the shortest distance between two entities in the space is a straight line). While the notion of a metric space has a long history in cognition, it is difficult to reconcile with newer, biologically motivated representations, called PDP networks. How might a metric space be represented in such a network? To answer this question,

we trained a PDP network of value units to rate the distance between pairs of cities in Alberta. Thirteen different cities were used, and the network was trained to generate a rating from 0 to 10 for each pair. The ratings were constrained in such a way that the network's judgements obeyed the three principles of a metric space. The network required 7 hidden units to learn this task. We analyzed the network to determine its underlying representation. We found evidence for a unique metric representation. Essentially, each hidden unit can be viewed as representing a map of Alberta in 4 dimensional space. The connection weights represented the projections of the 13 cities in the map onto a 1 dimensional axis projected through the 4D space at a particular orientation. The hidden unit responded to distance measures taken along this axis. The combination of responses to 7 different axes allowed the network to determine correct responses to this rating task. These results are discussed in terms of contributing a novel notion of metric space representation. They are also discussed in terms of how this kind of metric representation can be easily manipulated to mediate nonmetric responses (e.g., asymmetric responses of the type often seen in similarity judgement tasks).

25 Effects of the 5-HT_{1A} receptor agonist 8-hydroxy-DPAT on performance on two operant timing schedules

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Previous experiments have shown that central 5-hydroxytryptamine (5-HT) depletion disrupts behaviour in some, but not all, timing schedules. We examined the effects of the 5-HT_{1A} receptor agonist 8-hydroxy-2-(di-n-propylamino)tetralin (8-OH-DPAT: 25-200 mcg/kg) on performance on two timing schedules. In Experiment 1, rats were trained to respond on two levers (A and B) in 50-s trials in which reinforcement was provided intermittently for responding on A in the first half, and B in the second half, of the trial (free-operant psychophysical procedure). In Experiment 2, rats were trained to press lever A after a 2-s stimulus and lever B after an 8-s stimulus, and were then tested with stimuli of intermediate durations (interval bisection task). In both experiments, quantitative timing indices were derived from the psychophysical functions (%B responding vs time). In Experiment 1, 8-OH-DPAT displaced the psychophysical curve to the left. In Experiment 2, d-amphetamine increased the Weber fraction without displacing the curve. The results of Experiment 1 are consistent with the proposal that 5-HTergic mechanisms help to regulate pacemaker period. However, the results of Experiment 2 do not support this suggestion. Taken together, the results suggest that different neural mechanisms are involved in timing tasks involving temporal distribution of responding and discrimination of the durations of exteroceptive stimuli.

26 Temporal discrimination and effect of marker duration

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Temporal discrimination was investigated with filled intervals, empty intervals and a gap within a continuous tone. The effect of marker duration on temporal discrimination was evaluated with empty auditory intervals bounded by markers ranging from 20 ms to 300 ms (E 20 ms, E 100 ms, E 200 ms, E 300 ms). The signals were presented at two base durations (50 ms, 1000 ms) in a single stimulus method. The analysis of the results showed that (1) the empty intervals were better discriminated than filled and gap intervals; (2) the performance decreased with marker duration; (3) the base duration has an important effect on temporal discrimination. This indicated that increasing the marker duration from 20 ms to 300 ms affects temporal discrimination of empty auditory intervals with a base duration of 50 ms and 1000 ms.

27 Visual marking is affected by the attentional blink

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We can successfully ignore old, irrelevant visual distractors, by inhibiting them before new, relevant information appears. This mechanism has been termed visual marking (Watson & Humphreys, 1997). We present an experiment showing that a secondary task creating a so-called attentional blink (e.g. Raymond, Shapiro, & Arnell, 1992) severely disrupts visual marking. A second and third experiment explore how the attentional blink affects visual marking. We found evidence for a reduction in spatial memory, as well as for reduced inhibitory power. The results support the idea that visual marking is a top-down mechanism, demanding attentional resources. Furthermore, they suggest that the attentional blink disrupts a wide range of processes in the visual system.

Watson, D. G., & Humphreys, G. W. (1997). Visual marking: Prioritizing selection for new objects by top-down attentional inhibition of old objects. *Psychological Review*, 104, 90-122.

Raymond, J. E., Shapiro, K. L., & Arnell, K. M. (1992). Temporary suppression of visual processing in an RSVP task: An attentional blink? *Journal of Experimental Psychology: Human Perception and Performance*, 18, 849-860.

28 Visual search keeps track of where the target is not

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Previously, we interrupted pop-out search before it produced a detection response by adding especially chosen additional distractors to

the search display. When pop-out for a colour target is interrupted, it nevertheless provides useful information and assists the processes responsible for difficult search. In another experiment, we moved the target when the extra distractors were added to the display, and the assistance disappeared, suggesting that assistance could be based on information about where the target IS located. New analyses of new RT distributions for target-absent trials indicate that the assistance of difficult search by partial pop-out is based, at least in part, on information about where the target IS NOT located. We relate these results to work on "visual marking" by Watson & Humphreys (Psychological Review, 104, 90-122). We also investigate the effect of set-size and target eccentricity on the assistance.

29 IOR and the repetition of location, identity, and response

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Inhibition of return (IOR) refers to slowed responses when a target appears in the same location as a preceding stimulus. In four experiments (E1-E4), we examined the interaction of location repetition with the repetition of non-spatial stimulus dimensions (shape, orientation, response-mapping). We presented two stimuli, S1 and S2, which were horizontally or vertically oriented ovals or rectangles. In E1 and E2, two of the four stimuli mapped onto a speeded left button-press to report the shape (or orientation); the other two mapped onto a right button-press. In E3 and E4, S1 and S2 were presented to one of the four quadrants around fixation. Participants localized S1 and S2 (E3) or just S2 (E4) to the left or right. We observed that IOR is tagged predominantly to a repeated spatial location but that its effects can be modulated by the repetition of other, non-spatial, stimulus dimensions.

30 Exogenous and endogenous selection in partial report

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Previous research (Dixon et al., 1997) has shown that bar-probe partial report performance decreases as the duration of the cue increases with peripheral cues, but not with central cues. Five experiments examined the dependence of this effect on processes of exogenous vs. endogenous attention. Experiments 1-3 demonstrated that cue-duration has the same magnitude of effect for peripheral cues when cuing conditions are presented in either a blocked or a mixed design, or when participants are instructed to treat peripheral cues "endogenously". Experiments 4 and 5 demonstrated that the cue-duration effect is reduced, but not eliminated, when stimulus configurations are changed to encourage or require peripheral cues to be used endogenously. Additionally, Experiment 5 established

that the cue-duration effect can be obtained with central cues, challenging the view that the cue-duration effect reflects processes of solely exogenous attention. Results are discussed in terms of conjoint processes of endogenous and exogenous attention.

31 Strategic influences on the time course of exogenous attentional orienting effects

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In exogenous attentional orienting tasks, the time to respond to a target following an abrupt onset peripheral cue is measured. Response times to targets following shortly after the cue are typically faster at the cued than at the uncued location, while at longer cue-target intervals the opposite result occurs. Although exogenous cueing effects have been documented in a range of performance tasks, variability in the time course of cueing effects as a function of task has not been studied in detail. We report results from a series of studies which show that the time course of cueing effects does vary depending on task, and that this variability is the product of strategies used to avoid costs that occur when spatial orienting of attention is determined by automatic integrative processes.

32 The influence of non-visual attentional tasks upon the visual motion aftereffect

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The motion aftereffect (MAE) is a well-known visual illusion in which, following the continuous observation of drifting contours, subsequently presented static contours appear to drift in the opposite direction. Chaudhuri (1990) showed that if observers are engaged in a separate foveal discrimination task superimposed on a moving textured background, the total duration of the MAE is considerably reduced. This finding was explained in terms of the spatial division of attention.

We have investigated whether suitably demanding non-visual attentional tasks (mental backward counting and auditory vigilance tasks) could also lead to a reduction in the duration of the MAE. Both forms of task were found to reliably decrease the duration of the MAE under specific circumstances; spatial factors were important in determining the level of disruption caused by the auditory vigilance task. These findings can be explained in terms of multimodal representations of attentional objects in space and attentional capacity.

33 Crossmodal attention and the perceptual load hypothesis

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Lavie's (1995; JEP:HPP) 'perceptual load' hypothesis of selective attention was tested in both an auditory and crossmodal setting, using an auditory motion after-effect. Left- or rightward moving tones were presented over headphones for 60 seconds, after which participants had to make a 2-alternative-forced-choice response regarding the direction of apparent motion of a static tone. In Experiment 1, participants simultaneously had to discriminate either the case (low attentional-load) or number of syllables (high attentional-load) of a rapid series of visually-presented words. Varying the visual load had no effect on the auditory after-effect, although it was shown to modulate the duration of the visual motion after-effect (Experiment 2; as reported previously by Rees et al., 1997; Science). However, when the words were presented auditorily (Experiment 3), auditory after-effects were shown to be stronger in the low-load condition (judging the loudness of the words) than in the high-load condition (bisyllabic or not). These results support the view that there are separable resources available for the processing of auditory and visual stimuli, at least under certain conditions.

34 Allocation of spare capacity: Opposite effects of search load and perceptual load

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Lavie and Cox (1997) combined a letter search task with a flanker task to test Lavie's (1995) theory that spare attentional capacity is involuntarily allocated to the processing of irrelevant stimuli. In accord with this hypothesis, they found that increasing task load (i.e., search set size) actually decreased interference from foils. To refine the concept of task load, we differentiated perceptual load from search load. Perceptual load was manipulated by varying the number of letters presented; search load was manipulated by varying the number of search locations, as indicated by precues. Consistent with Lavie and Cox, increases in perceptual load produced decreases in interference. However, increases in search load produced increases in interference. These results suggest that task load is not a unitary construct, and that Lavie's theory regarding the allocation of spare capacity is applicable to manipulations of perceptual load but not to manipulations of search load.

35 Is semantic activation in visual word recognition capacity free?

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Neely and Kahan (1999) assert that, "[semantic activation] from a foveally presented task-irrelevant word should occur full-blown even when attention should be fully allocated to other task-relevant events in the display and this should be so regardless of the type of

processing (linguistic or otherwise) that must be performed on those task-relevant events." We report data from two lexical decision experiments that falsify this claim.

Neely, J. H., & Kahan, T. (1999). Is semantic activation automatic? A critical re-evaluation. In Roediger, H.L., Nairne, J.S., Neath, I., & Surprenant, A.M. (Eds.) *The nature of remembering: Essays in honor of Robert G. Crowder*. Washington, D.C.: American Psychological Association. (in press).

36 The fate of unattended auditory information

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The extent to which unattended information is processed has been the focus of considerable debate since the 1950s. In this paper we argue that recent methodological and theoretical developments serve to inform this debate. The irrelevant sound paradigm involves exposing participants to auditory inputs while they are performing a demanding short-term recall task. The key findings are that unattended information impinges on the processing of attended information, not on the basis of similarity in content between the two sources, but rather on the basis of similarity in process. Results indicate that basic temporal characteristics relating to order information within the unattended channel are processed and that auditory scene analysis may take place outside the focus of attention. Results are also suggestive that semantic processing takes place within the unattended sound

37 Switch costs without task-switching?

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A change in task results in detriments to performance. These switch costs have been commonly attributed to the reconfiguration of task set by way of executive control processes. Herein we report the results of an experiment where the task instruction is stable. Responses were based entirely on the non-spatial identity of targets, and spatial location was completely irrelevant to the correct execution of the task. The Simon effect (better performance with spatial correspondence between target and response) was observed. Spatially corresponding and non-corresponding stimulus-response ensembles alternated in a series of eight trials. Although there were no changes in task, we observed robust switch costs at two relatively long response-stimulus intervals. The results call into question the general idea that switch costs must be the result of a reconfiguration of task set.

38 Dual task performance in older adults

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Previous research has revealed a mixed pattern with regards dual task performance in older adults. Whilst all studies agree that older adults are impaired at dual tasks, only some studies reveal a deficit greater than one would predict from the age-change in single task performance. Kieley (1991) argues that older adults show disproportionate costs of dual tasking when memory is involved. In the present work we examine whether this disproportionate age deficit in dual tasks is found for both semantic and episodic memory. We used a dual task in which participants were required to generate category members or paired associate responses to cues that had just been presented (no load) or to cues that had been presented on previous trials (load). In line with Kieley's expectation there was a disproportionate effect of load for the older adults on the episodic task. A semantic version of this task is underway, and will be presented at the conference.

39 Conscious awareness of stimulus and response in a Posner task.

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Conscious awareness of cued location/target location compatibility effects was considered in a Posner (1978) based paradigm. Participants made a speeded simple response to a visual target. They then judged either the time of the stimulus onset or their movement onset, using a methodology devised by Libet (1983). As expected, participants made fastest responses to visual stimuli at a validly cued location. However, judgements of light onset time indicate that the cue/target compatibility effect is not due to any change in conscious stimulus detection. In addition, participants were just as efficient at judging their movement onset across cue conditions. That is, our participants were aware that their responses were delayed on incompatible trials, but did not detect the stimulus any later on incompatible trials.

The locus of the delay is therefore placed between the conscious detection of the stimulus and conscious awareness of response initiation. This is problematic for traditional accounts that place the locus of the compatibility effect at or prior to stimulus detection. A response locus of compatibility effects remains consistent with our data.

40 Effects of a mildly intoxicating dose of alcohol on various components of attention

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Previous research suggests that alcohol can have adverse effects on attention, depending upon a host of variables including task characteristics (Streufert & Pogash, 1988). The purpose of this study was to investigate the effects of a mildly intoxicating dose of alcohol on various aspects of attentional function. Forty participants were randomly assigned to one of two beverage conditions: alcohol (vodka + orange juice) or control (orange juice). Following beverage consumption/absorption, participants completed a brief battery of attentional tasks based on well-understood paradigms within cognitive psychology (Blackburn et al., 1999). Beverage condition effects were observed on the Stop Signal, Simon, and Rapid Serial Visual Presentation tasks. The pattern of results suggests that alcohol impairs attentional alertness and possibly attentional filtering, while leaving speed of processing intact. Although no effect of beverage condition was observed on speed of processing, alcohol effects on this parameter of attention might be obtained at higher doses.

41 The effect of set size and task on error patterns in immediate memory performance

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1. Bolton Institute

2. University of Laval

3. University of Southern Queensland, Australia

Estes (1991) challenged what he called the "trial-unit model" of short-term recall, according to which short-term memory is reset at the start of each experimental trial. As others, he argued that at the point of recall the number of items competing for output is larger than the number of items presented in the current trial. We investigated these questions within an experiment where set size and task were varied. Participants performed immediate serial recall and immediate reconstruction of order in three set-size conditions. The results show that the pattern of intrusions and protrusions and the effect of set size are different in recall and reconstruction. Results are discussed in terms of the search set that is involved in immediate memory tasks.

42 Do phonological short term memory and episodic memory contribute to performance on complex working memory span tests?

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To assess the contribution of phonological short-term memory and episodic memory to complex working memory, three experiments manipulated phonological similarity and level of processing within a listening span test (developed from Daneman and Carpenter, 1980). Phonological similarity was found to impair memory span, regardless of the type of complex span test used (single-word or sentence version) or age group (6 year olds, 8-year olds and adults). In the single word version, the nature of the processing requirement also affected memory. With phonological similar items, span for semantically encoded words was higher than for physically encoded words. The results indicate that complex span tests draw on components of the memory system other than working memory alone, and specifically tap both the phonological loop and episodic memory.

43 Effect of processing temporal or spatial order in short-term memory on concurrent time estimation

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Université Laval, Québec

In this experiment, identification of the temporal or spatial position of a memory probe was performed during a temporal interval production. Memory-set size was manipulated in the temporal and spatial tasks. In a reaction time condition, both tasks produced RT functions with similar slopes, RT increasing markedly with set size. When the memory task was executed during time production however, increasing set size significantly lengthened produced intervals when the memory set was searched for the temporal position of the probe, but not when its spatial position was identified. These results show, with two memory tasks of equivalent difficulty, that the effect from nontemporal processing on concurrent time estimation is dependent on the specific resources involved in the nontemporal tasks. Furthermore, by showing distinct patterns of interference on a concurrent task with identification of temporal and spatial position, they contribute to distinguish memory for temporal order from memory for spatial order.

44 Aging and the ranschburg effect: No evidence of reduced response suppression in old age.

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We report two experiments designed to test one aspect of Hasher and Zacks's (1988) reduced inhibition hypothesis, namely, that old age impairs the ability to suppress information in working memory that is no longer relevant. In Experiment 1, young and older adults were presented with lists of six letters and were asked to recall each list immediately in the correct order. Half of the lists contained repeated items (e.g., BDGDVP) while half were control lists (e.g., VTBGPD). The recall of non-adjacent repeated items was worse than

that of control items (repetition inhibition; the Ranschburg effect). There was evidence of a larger Ranschburg effect (i.e., greater response suppression) in older than in young adults. In Experiment 2, young and older adults were required either to recall the list or to report if there was a repeated item in the list. The task for each list (serial recall or repetition detection) was signalled by a post-list cue. Repetition detection performance was high and similar in the two age groups. There was also no age difference in repetition inhibition. When age differences in overall performance were taken into account, however, there was evidence of increased repetition inhibition with age in both experiments. It is concluded that, contrary to Hasher and Zacks's reduced inhibition hypothesis, response suppression involved in serial recall from short-term memory is not reduced by normal aging.

Hasher, L. & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), *The psychology of learning and motivation* (Vol. 22, pp. 193-225). New York: Academic Press.

45 Is inhibition induced by the retrieval-practice paradigm?

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3. Bolton Institute

Many studies have illustrated that prior retrieval episodes can make subsequent retrieval of related information more difficult. Recently, Anderson, Bjork and Bjork (1994) proposed a new paradigm where the retrieval process itself induces forgetting. Our aim was to replicate the basic effect of this paradigm with young and older adults. Sixty-four French speaking participants, 32 young and 32 older adults studied a series of category-exemplar pairs (e.g. Fruit-Banana). In a second phase, they practised retrieval of half members of half categories through a category-plus-stem cued-recall test (e.g. Fruit Ba_____). After a retention interval, they executed a final retrieval test where output interference was controlled by a category-plus-stem cued-recall (e.g. Fruit B_____). Results show that the inhibition effect is rather weak in young adults, varies according to the moment of retrieval of 'inhibited category members' and is not observed in older adults.

46 Robust false memory effects under conditions of paired-associate learning

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Substantial levels of false recall and recognition occur for lists of words semantically related to an unrepresented word (Deese, 1959; Roediger & McDermott, 1995). Manipulations that attenuate this "false memory effect" have reduced the probability of the presented words being linked semantically. We employed a paired-associate learning procedure to de-emphasize the relation between items and to make individual items more distinctive. Subjects items either (a) as 12 individual words (standard condition), (b) as 12 words, each paired with a number (number-noun condition), or (c) as 6 two-word pairs (noun-noun condition). If pairing words with numbers minimizes semantic analysis of each item and reduces the probability of forming links between items, the false memory effect should be reduced. However, the results indicated increased false memory in the number-noun condition, relative to the standard and noun-noun conditions, which did not differ. Correlational analyses were used to explore the causes of the false memory effect.

47 Effects of interference in an AB-AC paradigm: Event-related potentials of associative recall

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In event-related potential (ERP) studies of episodic retrieval, a parietal positivity has been attributed to recollection, and a frontal positivity, to monitoring. However, in ERP studies of associative recall that used a recognize-then-recall paradigm, the frontal effect was not found and the parietal effect was not attenuated by interference. To investigate these issues, we recorded ERPs during direct cued recall and manipulated interference using an AB-AC paradigm. Participants studied two lists of word-pairs, with half of the pairs in the interference (AB-AC) and half in the control (AB-CD) condition. Following the study phase, subjects recalled either the first or the second list. Preliminary analyses yielded two results. First, the parietal ERP effect was attenuated in the interference condition. Second, ERPs for recalled items, as compared with non-recalled items, were associated with a bilateral frontal positivity. These results are consistent with recollection and monitoring interpretations and extend the ERP literature to include associative recall.

48 Five years later: Children's memory for stressful experiences

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Long-term memory for medical emergencies was assessed in children who were between 2 and 13 years of age at the time of injury. The children's injuries included broken bones, lacerations requiring suturing, burns and dog bites-i.e., highly salient, often extremely distressing, unique experiences. Children had been recruited from a hospital Emergency Room at the time of injury and relevant witnesses interviewed shortly afterwards, so the accuracy of the children's recall of both injury and hospital treatment details could be

determined. Previous interviews showed that up to 2 years after suffering their injuries, children had forgotten almost nothing of their experiences. The current study tracked down these same children three years after their last interview (and 5 years after their injury), and re-interviewed them about what they recalled. Although most research involving such long-term memory has found children to recall relatively little, the children in this study had extremely good recall in spite of the passage of 5 years between original injury and final recall. Implications for children's eyewitness testimony are discussed.

49 Aging and goal pursuit: The effects of implementation intentions on prospective memory in older adults.

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Recent work on goal completion has found that people achieve their goals more successfully when they form implementation intentions, which are intentions associated with specific situational cues (Gollwitzer, 1999). Gollwitzer (1999) has argued that implementation intentions rely on automatic processes, which suggests that older adults might benefit from forming implementation intentions because automatic processes in memory are relatively age-invariant (Jacoby, Jennings, & Hay, 1996). The purpose of the present study was to determine whether forming implementation intentions would help older adults with tasks requiring event-based prospective memory. All of the older participants completed two types of prospective memory tasks. One task was a background pattern (BP) task in which they had to remember to press a key whenever a specific background pattern appeared on the computer screen. The other was a day of the week (DOW) task in which they had to remember to write the day of the week in the upper right corner of any sheet of paper they received. Older participants were randomly assigned to one of three conditions: (1) form an implementation intention for the BP task, (2) form an implementation intention for the DOW task, or (3) form no intentions for either task (control). No effects were found for the BP task, but an implementation intention effect was found for the DOW task. Participants who formed implementation intentions for the DOW task remembered to write the day of the week much more often than participants who did not form intentions for the DOW task. These results suggest that forming implementation intentions does improve older adults' prospective memory for some tasks.

50 Retrospective revaluation in humans.

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The phenomenon of retrospective revaluation has been a challenge to many associative learning theories as it involves a change in the

associative strength of a cue on trials on which that cue is absent. Most current theories of retrospective revaluation explain it in terms of new learning about the absent cue on trials in which that cue is absent but expected (e.g. Dickinson & Burke's (1996) modified SOP model; van Hamme & Wasserman's (1994) modified Rescorla-Wagner rule). We instead propose a more memory-based explanation of retrospective revaluation, which we suggest results from changes in the retrievability of previously learnt information as a result of subsequent experience. The present series of experiments attempts to distinguish between learning-based and memory-based theories of retrospective revaluation, focussing on Dickinson & Burke's (1996) modified SOP model, and a version of McLaren's (1993) APECS network.

Dickinson, A., & Burke, J. (1996). Within-compound associations mediate the retrospective revaluation of causality judgements. *Quarterly Journal of Experimental Psychology*, 49B, 60-80.

McLaren, I. P. L. (1993). APECS: A solution to the sequential learning problem. *Proceedings of the XVth Annual Convention of the Cognitive Science Society*.

van Hamme, L. J., & Wasserman, E. A. (1994). Cue competition in causality judgments: The role of nonrepresentation of compound stimulus elements. *Learning and Motivation*, 25, 127-151.

51 Mechanisms of predictive and diagnostic causal inferences

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In predictive causal inference people reason from causes to effects while in diagnostic inference they reason from effects to causes. Independently of the causal structure of the events, the temporal structure of the information provided to a reasoner may vary, e.g., multiple events followed by a single event versus a single event followed by multiple events. Here we report 2 experiments in which the causal structure and the temporal information were varied independently. The results reveal that inferences were influenced by the temporal but not by the causal structure of the task. The results are relevant to the evaluation of two current accounts of causal induction, the Rescorla-Wagner (Rescorla & Wagner, 1972) and Causal Model theories (e.g., Waldmann & Holyoak, 1992).

52 A developmental study of contingency perception and its relation to negative affect

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2. Acadia University

The present study investigated age and gender differences in contingency perception and its relation to negative mood. The study combined a mixed prospective and cross-sectional design that allowed assessment of students' affective responses to both experimentally-induced and naturally-occurring stressors. A total of 335 students completed a Judgement-of-Control Task in which the contingency parameters of sufficiency and necessity had been manipulated, an Induced Failure Task, and measures of negative affect and stress. Results provided support for the view that illusory contingency declines with age. Sensitivity to response probability (sufficiency) and random outcomes (necessity) increased with age. Males displayed greater sensitivity to the probability of random outcomes than females. Results indicated that illusory contingency confers some protection from the negative effect of stress but that its role differs between males and females. No support was found for either a moderational or mediational role for contingency perception in the development of negative affect.

53 Human sequence learning: Evidence for an underlying associative and/or cognitive process

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A three-choice serial reaction time task (SRT) was used to investigate human sequence learning. After the task, interviews were carried out to see whether subjects have become cognitively aware of the underlying rules. There is evidence that people's reaction times become significantly faster on rule-consistent stimuli when compared to rule-inconsistent ones. This also holds when people generalise to novel sequences. However, the interviews generally showed that most people were only able to verbalise a part of the underlying rule. The simple recurrent network (SRN) as introduced by Elman (1990) provides the opportunity to model sequence learning in a simple associative fashion. Therefore, the SRN was trained on the same sequences as our human subjects. While the SRN could learn the sequences, it was never able to generalise to the rule-consistent novel sequences. It needs to be said that this is not due to a particular deficit of the SRN. Simulation experiments in our laboratory have shown that, all other factors being equal, the SRN is able to generalise to rule consistent sequences in other sequential tasks. In our case, we have a task that can entirely be solved by humans, but not by the SRN. As a result, we may need to think about a more complex associative process. At the moment, other experiments are carried out in order to shed light on the learning process in question. The results and conclusions of those experiments will also be discussed at the conference.

Elman, J.L. (1990). Finding structure in time. *Cognitive Science*, 14, 179-211.

54 A qualitative dissociation in sequence learning.

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There is controversy as to whether implicit learning phenomena are due to the operation of a dissociable unconscious learning process. This is largely as a result of the lack of consensus over how we should measure awareness. However, recent research has tended to concentrate less on the question of awareness and more on other characteristics of implicit learning (cf Buchner & Frensch, 1997). The experiments reported here continue in this vein. To be more precise, we sought to determine whether the same sequences could be learnt in a qualitative different manner if they were presented under different training conditions; a result that might provide some support for the existence of dissociable learning processes. The experiments employed a two choice RT task in which the order of stimulus presentation was determined by concatenating the following sequences: RRR, LLR, LRL, RLL (R=right, L=left). If the subjects were asked to look for a pattern and given a marker to indicate the beginning of each triplet of trials, then they typically found RRR the most salient sequence and the easiest to learn (as indexed by the greatest RT difference in comparison to a group that controlled for sequential effects). However, if they were not informed about the sequences and no markers were provided, then a different pattern of learning resulted, with RRR being learnt least. Possible explanations of this dissociation are that: (1) it reflects the operation of two different learning mechanisms; (2) it arises because subjects chunk the sequence differently in the two cases. The relative merits of these possibilities are discussed.

Buchner, A., & Frensch, P.A. (1997). Sequence learning: Phenomena and models. *Psychological Research*, 60, 1-3.

55 Category creation - association or competition?

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In the past, much time and effort has been devoted to the study of category learning in humans, and this in turn has generated models of categorisation which have tended to be associative in nature. The question of category formation as opposed to category acquisition has received relatively little attention, and this has been the main focus of this research, based on the work of Wills and McLaren (1998). We now know that people are able to extract category structure without explicit instruction, and we have a paradigm (free classification) for studying this process. The differences between free classification and categorisation-with-feedback have been

investigated by training or pre-exposing to one set of stimuli and then testing generalisation to novel stimuli drawn from that set.

Results so far show that, remarkably, free classification may, under some circumstances, be a better method of training. Although response performance on test does not vary with training, the reaction time data indicates that using a free classification paradigm may decrease the time taken to reach a decision on the generalisation test. The inverted U-shape of the reaction time curve for generalisation, displayed by groups trained with feedback, is greatly reduced in curvature and absolute response time for the free classification group.

The results generated from the experiments have been compared with two different neural network architectures, error correcting and competitive, to discover how category learning in humans might proceed.

Wills, A.J., and McLaren, I.P.L. 1998. Perceptual learning and categorisation: From ignorance to consistent classification without explicit instruction. *Quarterly Journal of Experimental Psychology*, 51B

56 What's in a fingerprint? A PCA approach to fingerprint identification and categorisation

Jason M Tangen, John R Vokey and Lorraine G Allan

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Eigenvectors of an autoassociative memory matrix, derived via singular value decomposition of a set of pixel-maps of fingerprints, contain information that is useful for predicting various traits of the individuals from whom the patterns were obtained. When the projections of the fingerprints onto the eigenvectors were used as input, the model was able to identify each of the patterns it was trained with, as well as generalising its learning to novel prints not presented in the training set. Eigenvectors are ordered by the amount of variance they explain, and reflect the visually based categorical structure of the fingerprint patterns they represent. Thus, it is the individual patterns as a whole and not the specific aspects of their content that are discriminated into discrete categories. The results are discussed in terms of the advantages of this approach to characterising both perceptual/conceptual learning and the stimuli used to investigate it.

57 The effect of phonotactics and neighbourhood density on spoken word recognition in preschoolers

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Vitevitch and Luce (1999) provided evidence that phonotactics and neighbourhood density make independent contributions to spoken

word recognition in adults. This finding has implications for spoken word recognition in children. The limited size of children's lexicons suggests that neighbourhood effects may be more limited and phonotactic effects more prevalent in children as compared to adults. In the present investigation we evaluated the contribution of neighbourhood density and phonotactics in a word recognition task. Stimuli consisted of 56 spoken words varying in neighbourhood density and phonotactic probability selected from a child-based lexicon. 2-, 3-, and 4-year-old children were asked to identify the spoken word by pointing to the word's referent in a 4-picture display. The 2-year-old's recognized words with high probability phoneme sequences more accurately than low probability sequences. In contrast, the effects of neighbourhood density begin to manifest themselves later during childhood as additional words are added to the lexicon.

58 Pseudohomophone base-word frequency and lexicality effects

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The effect of base-word frequency on pseudohomophone (PH) naming latency has produced equivocal results. For example, the studies of McCann and Besner (1987), Marmurek and Kwantes (1996), and Herdman, LeFevre, and Greenham (1996) reported no frequency effect, a negative frequency effect, and a positive frequency effect, respectively. However, different ratios of lexical to non-lexical stimuli were used in these studies, and the validity of the PH stimuli was not examined. A new set of PHs, validated separately for each participant, was tested in pure and mixed stimulus blocks. A PH advantage over nonword naming latency was found only in the mixed block condition, and a frequency effect was observed only in the pure block condition. Comparisons were also made to other PH stimuli sets. The importance of list structure, naming instructions, and PH validation are discussed along with implications of PH naming for models of lexical access.

59 Basic processes in reading: Semantics affects speeded naming of high frequency words in an alphabetic script

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Previous work on single word naming in university level readers has shown that semantics affect the naming of low frequency words in both an alphabetic script like English, and a syllabic script in which the spelling-sound correspondences are consistent (Japanese Kana). The present experiment shows that a semantic factor (imageability) affects naming time to both low and high frequency words in an alphabetic script (Persian) when the word is opaque but not when it is transparent. The characteristics of opaque words that promote

the use of semantics are discussed. At least in some orthographies, semantics play a larger role in single word naming than previously thought.

60 When parallel processing in visual word recognition is not enough: new evidence from naming

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University of Waterloo

Low frequency exception words are named more slowly and are more error prone than are low frequency regular words (the regularity effect). Rastle and Coltheart (1999) reported that this irregularity disadvantage is modulated by the position in the word at which the irregularity occurs such that words with early irregularities are named more slowly than words with late irregularities. They argued that these data implicate serial processing, and provided a successful simulation with the DRC model of reading aloud (a model which has a serial component). However, Zorzi (in press) also simulated these data with a model that operates solely in parallel (Zorzi, Houghton, & Butterworth, 1998). Thus it is not clear that Rastle and Coltheart's (1999) findings implicate serial processing. New data are presented that adjudicate between these models. An interaction between regularity and serial position of irregularity is reported for human readers. This interaction is simulated by DRC but not by the Zorzi et al., (1998) model. These results are discussed in terms of the different properties of the stimuli used in Rastle and Coltheart (1999) versus those used in the current study.

Rastle, K. & Coltheart, M. (1999). Serial and Strategic Effects in Reading Aloud. *Journal of Experimental Psychology: Human Perception and Performance*, 25, 482-503.

61 Prime validity modulates masked priming

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If a masked prime automatically preactivates its lexical representation, then masked priming should not be affected by the proportion of different types of primes in the stimulus list. Contrary to this claim, we report that masked repetition priming in the lexical decision task with 45-ms and 60-ms primes is typically greater when the proportion of repetition prime trials is .8 rather than .2. Moreover, contrary to the notion that consciously-deployed strategies such as expectancy drive proportion effects observed with clearly visible associative primes, we found that masked associative priming with 45-ms primes occurred only when a set of filler trials had repetition rather than unrelated primes. We suggest that masked priming reflects the retrieval of the prime's episodic memory trace, and that this retrieval is modulated in a non-conscious way by the list-wide validity of the priming stimuli.

62 Negative priming for homophone and pseudohomophone pairs: Further support for a retrieval-based account of negative priming.

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2. McMaster University

We tested negative priming for homophones and pseudohomophones. In Experiment 1, we compared negative priming for homophones in a standard negative priming task, where distractors are encoded shallowly, with negative priming in a modified task, where distractors are encoded deeply. We observed negative priming for homophones in the shallow encoding task only. In Experiments 2 and 3 negative priming occurred for lexically related word pairs and lexically similar word-pseudohomophone pairs but not for lexically dissimilar word-pseudohomophone pairs. Negative priming arises for homophones and pseudohomophones in the shallow encoding task because the perceptual similarity between the prime distractor and probe target causes a reinterpretation of the prime item (Kahneman, Treisman, & Gibb, 1992; Loftus & Loftus, 1974) and not because the associated responses are the same. These findings support a retrieval-based explanation of negative priming, placing greater emphasis on probe processing than traditionally has been ascribed.

63 Do "bilingual" infants use fine phonetic detail in word learning tasks?

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Fourteen-month-old monolinguals confuse phonetically similar words in a word-object association task (Stager & Werker, 1997); however, older, more proficient word-learning infants do not (in prep). It has been hypothesised that 14-month-olds fail because linking words to objects is difficult at the beginning stages of word learning, leaving infants with insufficient attentional resources to listen closely to the words. Extending this hypothesis to bilinguals raises two possibilities: elimination of the listening strategy because more phonetic detail is needed to discriminate words in two languages, or retention of the strategy because of the increased cognitive load of learning two languages. Bilinguals of 14 months were tested in the word-object association task. Bilingual exposure was assessed with a structured parental interview. Analogous to the monolinguals, the 14-month bilinguals confuse similar sounding words. Research with 17- and 20-month bilinguals is now underway to clarify if the monolingual pattern remains consistent or diverges with development.

64 Preschoolers' and adults' interpretations of familiar and novel adjectives

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In Experiment 1, we examined preschoolers' and adults' understanding of the referential scope of familiar adjectives. On each trial, we labeled a target animal with one of three different types of adjectives: a transient emotional state term, a transient physiological state term, or a stable trait term. Participants were asked whether these terms could apply to a subordinate match, a basic match, a superordinate match, or an inanimate object. Results indicated that 4-year-olds and adults extended the stable trait terms, but not the emotional or physiological terms, to the subordinate and basic matches. In Experiment 2, we presented 4-year-olds and adults with novel adjectives in one of two syntactic frames ("This X is daxy" vs. "This X feels daxy"). Participants were more likely to extend the novel adjective to subordinate matches, if they were in the "is" condition than if they were in the "feels" condition. We will discuss these findings in terms of implications for children's acquisition of differing types of adjectives.

65 Poor comprehenders can integrate and retain semantic information from heard text

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Three experiments compared seven- and eight-year-old poor comprehenders with normal readers and poor decoders on an immediate and delayed sentence recognition task. Internal reference to integrative semantic representations was indexed by the inflated recognition errors of foil sentences that were semantically congruent with original story information. Poor comprehenders did not differ from skilled comprehenders either in the degree to which they integrated information, as estimated by immediate recognition of single-story information. Furthermore, the groups were not differentially affected by memory demand in their retention of story information. Possible explanations for these findings include underestimation of comprehension ability in selection, and the short simple materials of these experiments being within the ability of poor comprehenders.

Daneman, M., & Carpenter, P. A. (1980). Individual Differences in Working Memory and Reading Comprehension. *Journal of Verbal Learning and Verbal Behavior*, 19, 450-466.

67 Case studies in dyslexia

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Individual case studies are reported of dyslexic students aged 9 to 16 whose reading achievement has been monitored for up to five years. Increases in reading achievement are compared for control periods, during which students received no special help outside of

school, and for experimental periods during which they received individualized tutoring using a rime-based method of teaching word identification (Glass Analysis). The glass analysis word identification and spelling drills consist of rehearsing the associations between orthographic patterns and pronunciation for rimes or complete syllables embedded in words. Students also did oral reading of text passages containing the words that had been drilled. Reading achievement, as measured by standardized tests, improved more during experimental periods than during control periods, and some benefit was obtained for spelling as well. Although comprehension was not explicitly taught, reading comprehension frequently improved as word identification improved.

68 Dissociating performance in written and oral calculation: Evidence from right hemisphere developmental learning disability

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Spatial acalculia, the inability to properly arrange numbers during computation but preserved calculation principles, is reported frequently following right brain damage. We report on the case of a 9.8 year old child, C.G., who was diagnosed with right hemisphere developmental learning disability prior to testing. He demonstrated his intact arithmetic skills by correctly answering questions concerning number comprehension, number facts, and sign recognition. He could also correctly process verbal addition and subtraction questions. However, C.G. showed no appreciation for the spatial arrangements of numbers. The striking dichotomy of his performance was that he could produce the correct answer to difficult arithmetic questions, while he was unable to perform simple written questions. This case study supports Hecaen et al.'s (1961) claim that the right hemisphere contributes spatial knowledge to arithmetic. Developmental defects in spatial processing can result in spatial acalculia, while allowing normal acquisition of other aspects of calculation.

69 Electrophysiology of emotional memory: Evidence for the valence hypothesis

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We investigated two event-related potentials (ERPs) phenomena: (1) ERPs tend to be more positive for emotional pictures than for neutral pictures (emotion effect); (2) ERPs to be more positive for subsequently remembered than for subsequently forgotten items (Dm effect). We recorded ERPs while subjects rated the pleasantness of pleasant, unpleasant, and neutral pictures, and later, we tested their recall for information in the pictures. Preliminary analyses yielded two main results. First, the emotion effect on frontal electrodes

was left-lateralized for pleasant pictures but right-lateralized for unpleasant pictures. This dissociation is consistent with the valence hypothesis of hemispheric lateralization of emotion. Second, the Dm effect occurred earlier for emotional (400-600 ms) than for neutral pictures (after 600 ms). This earlier Dm effect could account for recall performance, which was better for emotional than for neutral pictures. The results established a link between two seemingly unrelated ERP phenomena: the emotion effect and the Dm effect.

70 Priming the meaning of homographs in children with autism

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Several theories have arisen to account for the core deficit underlying autism. The research reported here was designed to provide a specific test of two of these theories Weak Central Coherence theory and Executive Dysfunction theory. In this research we investigated how meaning is accessed in a reading task in both normally developing children and children with autism. In support of the Weak Central coherence view, previous research has found that children with autism fail to take account of context to guide pronunciation of homographs embedded in sentences (Happé, 1997). The embedded sentences task, however, also makes significant executive demands on the reader. In this research we sought to reduce executive demands by testing the use of meaning in a priming task. Participants were first presented with a word prime that was associated with either the dominant or subordinate pronunciation of the subsequent target homograph (e.g. RIP-TEAR). Participants were asked to pronounce both words and responses were scored for correct pronunciation and reaction time. The results will be discussed in relation to the two competing theories.

71 Multiple neuroanatomical features of high functioning autism: A structural MRI study.

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High resolution MRI scans were acquired for ten adult males with autism and ten healthy control subjects matched for age, sex and verbal IQ. Unbiased estimates were obtained for right and left hemispheric volumes of the medial temporal lobe (MTL: amygdala, hippocampus, parahippocampal gyrus¹) and subfields of the prefrontal cortex (PFC: dorsal and orbital) using the Cavalieri method of modern design stereology. Intra-cranial volume (ICV) was also measured. Multivariate anovas were performed separately for MTL and PFC using Diagnosis (Autism/Control) as a grouping factor and Region as a repeated measure. In MTL, Diagnosis interacted with

Region ($F=7.52$, d.f. 2,34, $p<.01$). Post-hoc t-tests showed this was due to larger amygdala volumes ($p<.05$) and smaller hippocampal/parahippocampal volumes ($p's<.10$) in patients compared to controls². In PFC, Diagnosis interacted with Hemisphere ($F=4.68$, d.f. 1,18, $p<.05$) and Hemisphere x Region ($F=3.62$, d.f. 1,18, $p<.10$). Right dorsal PFC was larger than the left in controls ($p<.05$) but not patients with autism. ICV was larger in patients than controls ($F=4.48$, d.f. 1,18, $p<.05$), but sporadic correlations with regional brain measures did not support systematic use of this factor as a covariate. Results provided support for a neuroanatomic profile in patients characterised by: (a) autism-specific effects in the MTL; and (b) PFC asymmetry similar to that observed in other neurodevelopmental disorders.

(1) Note: one patient with autism had missing parahippocampal data and was deleted from all MTL analyses. (2) Howard, M.A., Cowell, P.E., Boucher, J., Broks, P., Mayes, A. and Roberts, N.A structural magnetic resonance imaging (MRI) study of adults with Asperger's syndrome. Proceedings of the Annual Human Brain Mapping Meeting, submitted.

72 Stability of frontal electroencephalogram (EEG) measures and cognitive and affective development in children

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Although the pattern of resting ongoing frontal brain electrical activity (EEG) has been consistently linked to individual differences in cognitive and affective processes in infants, children, and adults, few studies have examined the temporal stability of electrocortical measures in pediatric populations in relation to developmental outcome. In the present study, we examined 1) the stability of regional EEG power and asymmetry measures in a group of 6 year-old children prior to and upon entry into grade school, and 2) the relations of these measures to cognitive and affective development. We found excellent test-retest stability in regional EEG power measures and high stability in regional EEG asymmetry measures across time in frontal EEG power and asymmetry measures. We are currently examining children whose pattern of resting frontal brain electrical activity remains stable in predicting their cognitive abilities and socio-emotional development during the early school age years. Findings are discussed in terms of the utility of regional EEG measures, which are relatively noninvasive, in understanding individual differences in cognitive and emotional development.

73 Differences in reported test anxiety of native vs. non-native english speakers

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Using 966 university students, the present study examined the effects of gender and first-language (as an indication of culture) on test

anxiety using the Spielberger Test Anxiety Inventory (TAI). There was a main effect for gender (women reported more test anxiety than men did), a main effect for first-language (non-native English speakers reported more test anxiety than native English speakers did), with no interaction between gender and first-language. Neither gender nor first-language, however, affected the factor structure of the TAI. Confirmatory factor analyses indicated that a two-factor correlated model, comprising cognitive aspects of anxiety (worry) and bodily arousal (emotionality), best fit all groups. The two factors, nonetheless, were highly correlated (.80), arguing for a one-factor model. Examining participants' correlations between worry and emotionality scores and results in Introductory Psychology and Raven's Advanced Progressive Matrices failed to demonstrate a consistent pattern from which to choose between the one-factor and two-factor models.

74 Temporolimbic functions: Anxiety, depression and cognitive flexibility in university students

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University students completed the Limbic System Checklist (LSCL-33) prior to an assessment of anxiety measures. The upper quartile LSCL-33 participants had higher scores on both trait and state anxiety. Participants who were first administered cognitive/behavioral tasks exhibited greater startle responses. In a second study, the upper quartile LSCL-33 participants had higher scores on the Beck Depression Inventory (BDI-2), and they also used indirect solutions more frequently in solving the so-called Luchins Water Jar Problem. The findings support the hypothesis that LSCL-33 scores are related to measures of anxiety, depression, and cognitive flexibility.

75 Raven's advanced progressive matrices test is a measure of 'G': Evidence in support of a single factor model

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The Raven's Advanced Progressive Matrices test (APM) was originally designed as a nonverbal measure of Spearman's g (general intelligence). Much disagreement exists, however, over the cognitive components responsible for performance on this task. While Spearman believed g represented a single factor, many have argued that the items of the APM are multidimensional in nature. Recently, DeShon et al. (1997) argued that most of the items can be classified as either analytical or spatial in nature. The purpose of the current study was to further examine the dimensionality of the APM and to test DeShon et al.'s factorial structure. Five hundred and six first-year university students completed the APM using standard timing and instructions. A confirmatory factor analysis revealed that a one-factor solution was a better fit than the orthogonal two-factor solution. Furthermore, the two-factor correlated model was no better

of a fit than the one-factor model.

76 Motor priming and the cross modality problem

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In 1962, George Ettliger and later Noble, carried out experiments with rhesus monkeys designed to elucidate that an intolerance of ambiguity plays a role in determining natural dyslexia. Subsequently Ettliger went on, in a series of experiments with both animals and humans, to delineate some of the difficulties that a bilateral but hierarchical system has in intersystem communication.

Recently, with the aid of a domestic computer, we have carried out a number of experiments which simulate in man some of the procedures developed by Ettliger. These experiments, which examine an individual's preferences within a range of mirror figure matching procedures, are described and some results presented in detail, together with alternative statistical analyses.

In experiments undertaken with adults and children, the results are interpreted in relation to the development of reading skills. In three adult subjects, the procedures have been used to reveal some drug-sensitive changes in cross-modal communication (confusion ?) which appear to determine periods of intense mental dysfunction.

We relate these results to a biological basis for personality differences described by Sheldon and Galton and to individually variable procedures which subjects adopt in seeking to match patterns (letters). These individual differences in behaviour are related to theories of brain structure developed by Galton and Sheldon. and to more detailed modern theories involving such concepts as those underlying "feature analysis" and the rotation of "internal images".

Sheldon in his consensual tripartite physiology of personality describes evolutionary infrastructures which could underpin Galton's more psychological concept of sensory types. Galton's thinking may be perhaps, in turn, reinterpreted as representing phenotypes as genetic clusters within the human genome.

At a more tentative level, it is suggested that the body of Ettliger's work, together with the present results, define intersystem relationships which cannot be transformed into the algebra of language. The results are therefore held to support the theories of Herder and other members of the Enlightenment- eg Boule that language is an algebra which damages rather than supports pure thought.

